Package 'mlr3pipelines'

September 5, 2026

Title Preprocessing Operators and Pipelines for 'mlr3'

Version 0.12.0

Description Dataflow programming toolkit that enriches 'mlr3' with a diverse set of pipelining operators ('PipeOps') that can be composed into graphs. Operations exist for data preprocessing, model fitting, and ensemble learning. Graphs can themselves be treated as 'mlr3' 'Learners' and can therefore be resampled, benchmarked, and tuned.

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URL https://mlr3pipelines.mlr-org.com, https://github.com/mlr-org/mlr3pipelines

BugReports https://github.com/mlr-org/mlr3pipelines/issues

Depends R (>= 3.3.0)

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'LearnerAvg.R' 'NO_OP.R' 'PipeOpTaskPreproc.R' 'PipeOpADAS.R'
'PipeOpBLSmote.R' 'PipeOpBoxCox.R' 'PipeOpBranch.R'
'PipeOpChunk.R' 'PipeOpClassBalancing.R' 'PipeOpClassWeights.R'
'PipeOpClassWeightsEx.R' 'PipeOpClassifAvg.R'
'PipeOpColApply.R' 'PipeOpColRoles.R' 'PipeOpCollapseFactors.R'
'PipeOpCopy.R' 'PipeOpDateFeatures.R' 'PipeOpDecode.R'
'PipeOpEncode.R' 'PipeOpEncodeImpact.R' 'PipeOpEncodeLmer.R'
'PipeOpEncodePL.R' 'PipeOpFeatureUnion.R' 'PipeOpFilter.R'
'PipeOpFixFactors.R' 'PipeOpHistBin.R' 'PipeOpICA.R'
'PipeOpImpute.R' 'PipeOpImputeConstant.R' 'PipeOpImputeHist.R'
'PipeOpImputeLearner.R' 'PipeOpImputeMean.R'
'PipeOpImputeMedian.R' 'PipeOpImputeMode.R' 'PipeOpImputeOOR.R'
'PipeOpImputeSample.R' 'PipeOpInfo.R' 'PipeOpIsomap.R'
'PipeOpKernelPCA.R' 'PipeOpLearner.R' 'PipeOpLearnerCV.R'
'PipeOpLearnerPICVPlus.R' 'PipeOpLearnerQuantiles.R'
'PipeOpMaterialize.R' 'PipeOpMissingIndicators.R'
'PipeOpModelMatrix.R' 'PipeOpMultiplicity.R' 'PipeOpMutate.R'
'PipeOpNMF.R' 'PipeOpNOP.R' 'PipeOpNearmiss.R' 'PipeOpOVR.R'
'PipeOpPCA.R' 'PipeOpProxy.R' 'PipeOpQuantileBin.R'
'PipeOpRandomProjection.R' 'PipeOpRandomResponse.R'
'PipeOpRegrAvg.R' 'PipeOpRemoveConstants.R'
'PipeOpRenameColumns.R' 'PipeOpRowApply.R' 'PipeOpScale.R'
'PipeOpScaleMaxAbs.R' 'PipeOpScaleRange.R' 'PipeOpSelect.R'
'PipeOpSmote.R' 'PipeOpSmoteNC.R' 'PipeOpSpatialSign.R'
'PipeOpSplines.R' 'PipeOpSubsample.R' 'PipeOpTextVectorizer.R'
'PipeOpThreshold.R' 'PipeOpTomek.R' 'PipeOpTrafo.R'
'PipeOpTuneThreshold.R' 'PipeOpUnbranch.R' 'PipeOpVtreat.R'
'PipeOpYeoJohnson.R' 'Selector.R' 'TaskRegr_boston_housing.R'
'assert_graph.R' 'bibentries.R' 'gunion.R' 'mlr_graphs.R'
'operators.R' 'pipeline_bagging.R' 'pipeline_branch.R'
'pipeline_convert_types.R' 'pipeline_greplicate.R'
'pipeline_ovr.R' 'pipeline_robustify.R' 'pipeline_stacking.R'
'pipeline_targettrafo.R' 'po.R' 'ppl.R' 'preproc.R'
'reexports.R' 'typecheck.R' 'zzz.R'

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`mlr3pipelines-package` *mlr3pipelines: Preprocessing Operators and Pipelines for 'mlr3'*

Description

Dataflow programming toolkit that enriches 'mlr3' with a diverse set of pipelining operators ('PipeOps') that can be composed into graphs. Operations exist for data preprocessing, model fitting, and ensemble learning. Graphs can themselves be treated as 'mlr3' 'Learners' and can therefore be resampled, benchmarked, and tuned.

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See Also

Useful links:

- https://mlr3pipelines.mlr-org.com
- https://github.com/mlr-org/mlr3pipelines
- Report bugs at https://github.com/mlr-org/mlr3pipelines/issues

add_class_hierarchy_cache *Add a Class Hierarchy to the Cache*

Description

Add a class hierarchy to the class hierarchy cache. This is necessary whenever an S3 class's class hierarchy is important when inferring compatibility between types.

Usage

```
add_class_hierarchy_cache(hierarchy)
```

Arguments

`hierarchy`	`character` the class hierarchy to add; should correspond to the `class()` of the lowest object in the hierarchy.

Value

`NULL`

See Also

Other class hierarchy operations: `register_autoconvert_function()`, `reset_autoconvert_register()`, `reset_class_hierarchy_cache()`

Examples

```
# This lets mlr3pipelines handle "data.table" as "data.frame".
# This is an example and not necessary, because mlr3pipelines adds it by default.

add_class_hierarchy_cache(c("data.table", "data.frame"))
```

as.Multiplicity *Convert an object to a Multiplicity*

Description

Convert an object to a `Multiplicity`.

Usage

```
as.Multiplicity(x)
```

Arguments

x	(any) Object to convert.

Value

Multiplicity

---

assert_graph *Assertion for mlr3pipelines Graph*

Description

Function that checks that a given object is a Graph and throws an error if not.

Usage

```
assert_graph(x)
```

Arguments

x	(any) Object to check.

Value

Graph invisible(x)

See Also

Other Graph operators: %>>%, as_graph(), as_pipeop(), assert_pipeop(), chain_graphs(), gunion(), mlr_graphs_greplicate

---

assert_pipeop *Assertion for mlr3pipelines PipeOp*

Description

Function that checks that a given object is a PipeOp and throws an error if not.

Usage

```
assert_pipeop(x)
```

Arguments

x	(any) Object to check.

Value

PipeOp invisible(x)

See Also

Other Graph operators: %>>%, as_graph(), as_pipeop(), assert_graph(), chain_graphs(), gunion(), mlr_graphs_greplicate

---

as_graph *Conversion to mlr3pipelines Graph*

Description

The argument is turned into a Graph if possible. If clone is TRUE, a deep copy is made if the incoming object is a Graph to ensure the resulting object is a different reference from the incoming object.

as_graph() is an S3 method and can therefore be implemented by other packages that may add objects that can naturally be converted to Graphs.

By default, as_graph() tries to

- apply gunion() to x if it is a list, which recursively applies as_graph() to all list elements first
- create a Graph with only one element if x is a PipeOp or can be converted to one using as_pipeop().

Usage

```
as_graph(x, clone = FALSE)
```

Arguments

x	(any) Object to convert.
clone	(logical(1)) Whether to return a (deep copied) clone if x is a Graph.

Value

Graph x or a deep clone of it.

See Also

Other Graph operators: %>>%, as_pipeop(), assert_graph(), assert_pipeop(), chain_graphs(), gunion(), mlr_graphs_greplicate

---

as_pipeop *Conversion to mlr3pipelines PipeOp*

Description

The argument is turned into a PipeOp if possible. If clone is TRUE, a deep copy is made if the incoming object is a PipeOp to ensure the resulting object is a different reference from the incoming object.

as_pipeop() is an S3 method and can therefore be implemented by other packages that may add objects that can naturally be converted to PipeOps. Objects that can be converted are for example Learner (using PipeOpLearner) or Filter (using PipeOpFilter).

Usage

```
as_pipeop(x, clone = FALSE)
```

Arguments

x	(any) Object to convert.
clone	(logical(1)) Whether to return a (deep copied) clone if x is a PipeOp.

Value

PipeOp x or a deep clone of it.

See Also

Other Graph operators: %>>%, as_graph(), assert_graph(), assert_pipeop(), chain_graphs(), gunion(), mlr_graphs_greplicate

chain_graphs *Chain a Series of Graphs*

Description

Takes an arbitrary amount of Graphs or PipeOps (or objects that can be automatically converted into Graphs or PipeOps, see as_graph() and as_pipeop()) as inputs and joins them in a serial Graph, as if connecting them using %>>%.

Care is taken to avoid unnecessarily cloning of components. A call of chain_graphs(list(g1, g2, g3, g4, ...), in_place = FALSE) is equivalent to g1 %>>% g2 %>>!% g3 %>>!% g4 %>>!% .... A call of chain_graphs(list(g1, g2, g3, g4, ...), in_place = FALSE) is equivalent to g1 %>>!% g2 %>>!% g3 %>>!% g4 %>>!% ... (differing in the first operator being %>>!% as well).

Usage

```
chain_graphs(graphs, in_place = FALSE)
```

Arguments

graphs	list of (Graph | PipeOp | NULL | ...) List of elements which are the Graphs to be joined. Elements must be convertible to Graph or PipeOp using as_graph() and as_pipeop(). NULL is the neutral element of %>>% and skipped.
in_place	(logical(1)) Whether to try to avoid cloning the first element of graphs, similar to the difference of %>>!% over %>>%. This can only be avoided if graphs[[1]] is already a Graph. Beware that, if chain_graphs() fails because of id collisions, then graphs[[1]] will possibly be in an incompletely modified state when in_place is TRUE.

Value

Graph the resulting Graph, or NULL if there are no non-null values in graphs.

See Also

Other Graph operators: %>>%, as_graph(), as_pipeop(), assert_graph(), assert_pipeop(), gunion(), mlr_graphs_greplicate

filter_noop *Remove NO_OPs from a List*

Description

Remove all NO_OP elements from a list.

Usage

```
filter_noop(x)
```

Arguments

x	list List to filter.

Value

list: The input list, with all NO_OP elements removed.

See Also

Other Path Branching: NO_OP, is_noop(), mlr_pipeops_branch, mlr_pipeops_unbranch

Graph *Graph Base Class*

Description

A Graph is a representation of a machine learning pipeline graph. It can be *trained*, and subsequently used for *prediction*.

A Graph is most useful when used together with Learner objects encapsulated as PipeOpLearner. In this case, the Graph produces Prediction data during its $predict() phase and can be used as a Learner itself (using the GraphLearner wrapper). However, the Graph can also be used without Learner objects to simply perform preprocessing of data, and, in principle, does not even need to handle data at all but can be used for general processes with dependency structure (although the PipeOps for this would need to be written).

Format

R6Class.

Construction

Graph$new()

Internals

A Graph is made up of a list of PipeOps, and a data.table of edges. Both for training and prediction, the Graph performs topological sorting of the PipeOps and executes their respective $train() or $predict() functions in order, moving the PipeOp results along the edges as input to other PipeOps.

Fields

- pipeops :: named list of PipeOp
  Contains all PipeOps in the Graph, named by the PipeOp's $ids.
- edges :: data.table with columns src_id (character), src_channel (character), dst_id (character), dst_channel (character)
  Table of connections between the PipeOps. A data.table. src_id and dst_id are $ids of PipeOps that must be present in the $pipeops list. src_channel and dst_channel must respectively be $output and $input channel names of the respective PipeOps.
- is_trained :: logical(1)
  Is the Graph, i.e. are all of its PipeOps, trained, and can the Graph be used for prediction?
- lhs :: character
  Ids of the 'left-hand-side' PipeOps that have some unconnected input channels and therefore act as Graph input layer.
- rhs :: character
  Ids of the 'right-hand-side' PipeOps that have some unconnected output channels and therefore act as Graph output layer.
- input :: data.table with columns name (character), train (character), predict (character), op.id (character), channel.name (character)
  Input channels of the Graph. For each channel lists the name, input type during training, input type during prediction, PipeOp $id of the PipeOp the channel pertains to, and channel name as the PipeOp knows it.
- output :: data.table with columns name (character), train (character), predict (character), op.id (character), channel.name (character)
  Output channels of the Graph. For each channel lists the name, output type during training, output type during prediction, PipeOp $id of the PipeOp the channel pertains to, and channel name as the PipeOp knows it.
- packages :: character
  Set of all required packages for the various methods in the Graph, a set union of all required packages of all contained PipeOp objects.
- state :: named list
  Get / Set the $state of each of the members of PipeOp.
- param_set :: ParamSet
  Parameters and parameter constraints. Parameter values are in $param_set$values. These are the union of $param_sets of all PipeOps in the Graph. Parameter names as seen by the Graph have the naming scheme <PipeOp$id>.<PipeOp original parameter name>. Changing $param_set$values also propagates the changes directly to the contained PipeOps and is an alternative to changing a PipeOps $param_set$values directly.

- hash :: character(1)
  Stores a checksum calculated on the Graph configuration, which includes all PipeOp hashes (and therefore their $param_set$values) and a hash of $edges.
- phash :: character(1)
  Stores a checksum calculated on the Graph configuration, which includes all PipeOp hashes *except* their $param_set$values, and a hash of $edges.
- keep_results :: logical(1)
  Whether to store intermediate results in the PipeOp's $.result slot, mostly for debugging purposes. Default FALSE.
- man :: character(1)
  Identifying string of the help page that shows with help().

Methods

- ids(sorted = FALSE)
  (logical(1)) -> character
  Get IDs of all PipeOps. This is in order that PipeOps were added if sorted is FALSE, and topologically sorted if sorted is TRUE.
- add_pipeop(op, clone = TRUE)
  (PipeOp | Learner | Filter | ..., logical(1)) -> self
  Mutates Graph by adding a PipeOp to the Graph. This does not add any edges, so the new PipeOp will not be connected within the Graph at first.
  Instead of supplying a PipeOp directly, an object that can naturally be converted to a PipeOp can also be supplied, e.g. a Learner or a Filter; see as_pipeop(). The argument given as op is cloned if clone is TRUE (default); to access a Graph's PipeOps by-reference, use $pipeops.
  Note that $add_pipeop() is a relatively low-level operation, it is recommended to build graphs using %>>%.
- add_edge(src_id, dst_id, src_channel = NULL, dst_channel = NULL)
  (character(1), character(1), character(1) | numeric(1) | NULL, character(1) | numeric(1) | NULL) -> self
  Add an edge from PipeOp src_id, and its channel src_channel (identified by its name or number as listed in the PipeOp's $output), to PipeOp dst_id's channel dst_channel (identified by its name or number as listed in the PipeOp's $input). If source or destination PipeOp have only one input / output channel and src_channel / dst_channel are therefore unambiguous, they can be omitted (i.e. left as NULL).
- chain(gs, clone = TRUE)
  (list of Graphs, logical(1)) -> self
  Takes a list of Graphs or PipeOps (or objects that can be automatically converted into Graphs or PipeOps, see as_graph() and as_pipeop()) as inputs and joins them in a serial Graph coming after self, as if connecting them using %>>%.
- plot(html = FALSE, horizontal = FALSE)
  (logical(1), logical(1)) -> NULL
  Plot the Graph, using either the **igraph** package (for html = FALSE, default) or the visNetwork package for html = TRUE producing a htmlWidget. The htmlWidget can be rescaled using visOptions. For html = FALSE, the orientation of the plotted graph can be controlled through horizontal.

- `print(dot = FALSE, dotname = "dot", fontsize = 24L)`
  `(logical(1), character(1), integer(1)) -> NULL`
  Print a representation of the Graph on the console. If `dot` is `FALSE`, output is a table with one row for each contained PipeOp and columns `ID` (`$id` of PipeOp), `State` (short representation of `$state` of PipeOp), `sccssors` (PipeOps that take their input directly from the PipeOp on this line), and `prdcssors` (the PipeOps that produce the data that is read as input by the PipeOp on this line). If `dot` is `TRUE`, print a DOT representation of the Graph on the console. The DOT output can be named via the argument `dotname` and the `fontsize` can also be specified.
- `set_names(old, new)`
  `(character, character) -> self`
  Rename PipeOps: Change ID of each PipeOp as identified by `old` to the corresponding item in `new`. This should be used instead of changing a PipeOp's `$id` value directly!
- `update_ids(prefix = "", postfix = "")`
  `(character, character) -> self`
  Pre- or postfix PipeOp's existing ids. Both `prefix` and `postfix` default to `""`, i.e. no changes.
- `train(input, single_input = TRUE)`
  `(any, logical(1)) -> named list`
  Train Graph by traversing the Graphs' edges and calling all the PipeOp's `$train` methods in turn. Return a named `list` of outputs for each unconnected PipeOp out-channel, named according to the Graph's `$output` `name` column. During training, the `$state` member of each PipeOps will be set and the `$is_trained` slot of the Graph (and each individual PipeOp) will consequently be set to `TRUE`.
  If `single_input` is `TRUE`, the `input` value will be sent to each unconnected PipeOp's input channel (as listed in the Graph's `$input`). Typically, `input` should be a Task, although this is dependent on the PipeOps in the Graph. If `single_input` is `FALSE`, then `input` should be a `list` with the same length as the Graph's `$input` table has rows; each list item will be sent to a corresponding input channel of the Graph. If `input` is a named `list`, names must correspond to input channel names (`$input$name`) and inputs will be sent to the channels by name; otherwise they will be sent to the channels in order in which they are listed in `$input`.
- `predict(input, single_input = TRUE)`
  `(any, logical(1)) -> list of any`
  Predict with the Graph by calling all the PipeOp's `$train` methods. Input and output, as well as the function of the `single_input` argument, are analogous to `$train()`.
- `help(help_type)`
  `(character(1)) -> help file`
  Displays the help file of the concrete PipeOp instance. `help_type` is one of `"text"`, `"html"`, `"pdf"` and behaves as the `help_type` argument of R's `help()`.

See Also

Other mlr3pipelines backend related: PipeOp, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_graphs, mlr_pipeops, mlr_pipeops_materialize, mlr_pipeops_updatetarget

Examples

```
library("mlr3")

g = Graph$new()$
```

```
  add_pipeop(PipeOpScale$new(id = "scale"))$
  add_pipeop(PipeOpPCA$new(id = "pca"))$
  add_edge("scale", "pca")
g$input
g$output

task = tsk("iris")
trained = g$train(task)
trained[[1]]$data()

task$filter(1:10)
predicted = g$predict(task)
predicted[[1]]$data()
```

---

gunion *Disjoint Union of Graphs*

Description

Takes an arbitrary amount of Graphs or PipeOps (or objects that can be automatically converted into Graphs or PipeOps, see as_graph() and as_pipeop()) as inputs and joins them in a new Graph.

The PipeOps of the input Graphs are not joined with new edges across Graphs, so if length(graphs) > 1, the resulting Graph will be disconnected.

This operation always creates deep copies of its input arguments, so they cannot be modified by reference afterwards. To access individual PipeOps after composition, use the resulting Graph's $pipeops list.

Usage

```
gunion(graphs, in_place = FALSE)
```

Arguments

graphs	list of (Graph | PipeOp | NULL | ...) List of elements which are the Graphs to be joined. Elements must be convertible to Graph or PipeOp using as_graph() and as_pipeop(). NULL values automatically get converted to PipeOpNOP with a random ID of the format nop_********. The list can be named, in which case the IDs of the elements are prefixed with the names, separated by a dot (.).
in_place	(logical(1) | logical) Whether to try to avoid cloning the first element of graphs, similar to the difference of %>>!% over %>>%. This can only be avoided if graphs[[1]] is already a Graph. Unlike chain_graphs(), gunion() does all checks *before* mutating graphs[[1]], so it will not leave graphs[[1]] in an incompletely modified state when it fails. in_place may also be of length graph, in which case it determines for each element of graphs whether it is cloned. This is for internal usage and is not recommended.

Value

Graph the resulting Graph.

See Also

Other Graph operators: %>>%, as_graph(), as_pipeop(), assert_graph(), assert_pipeop(), chain_graphs(), mlr_graphs_greplicate

---

is.Multiplicity *Check if an object is a Multiplicity*

Description

Check if an object is a Multiplicity.

Usage

```
is.Multiplicity(x)
```

Arguments

x	(any) Object to check.

Value

logical(1)

---

is_noop *Test for NO_OP*

Description

Test whether a given object is a NO_OP.

Usage

```
is_noop(x)
```

Arguments

x	any Object to test.

Value

logical(1): Whether x is a NO_OP.

See Also

Other Path Branching: NO_OP, filter_noop(), mlr_pipeops_branch, mlr_pipeops_unbranch

---

mlr_filters_ensemble *Filter Ensemble*

Description

FilterEnsemble aggregates several Filters by averaging their scores (or ranks) with user-defined weights. Each wrapped filter is evaluated on the supplied task, and the resulting feature scores are combined feature-wise by a convex combination determined through the weights parameter. This allows leveraging complementary inductive biases of multiple filters without committing to a single criterion. The concept was introduced by Binder et al. (2020). This implementation follows the idea but leaves the exact choice of weights to the user.

Format

R6Class object inheriting from Filter.

Construction

```
FilterEnsemble$new(filters)
```

- filters :: list of Filter
  Filters that are evaluated and aggregated. Each filter must be cloneable and support the task type and feature types of the ensemble. The ensemble identifier defaults to the wrapped filter ids concatenated by ".".

Parameters

- weights :: numeric()
  Required non-negative weights, one for each wrapped filter, with at least one strictly positive value. Values are used as given when calculating the weighted mean. If named, names must match the wrapped filter ids.
- rank_transform :: logical(1)
  If TRUE, ranks of individual filter scores are used instead of the raw scores. Initialized to FALSE.
- filter_score_transform :: function
  Function to be applied to the vector of individual filter scores after they were potentially transformed by rank_transform but before weighting and aggregation. Initialized to identity.
- aggregator :: function
  Function to aggregate the (potentially transformed) and weighted filter scores across filters. Must take arguments w for weights and na.rm, the latter of which is always set to TRUE. Defaults to stats::weighted.mean.

- result_score_transform :: function
  Function to be applied to the vector of aggregated scores after they were potentially transformed by rank_transform and/or filter_score_transform. Initialized to identity.

Parameters of wrapped filters are available via $param_set and can be referenced using the wrapped filter id followed by ".", e.g. "variance.na.rm".

Fields

- $wrapped :: named list of Filter
  Read-only access to the wrapped filters.

Methods

- get_weights_search_space(weights_param_name = "weights", normalize_weights = "uniform", prefix = "w")
  (character(1), character(1), character(1)) -> ParamSet
  Construct a ParamSet describing a weight search space.
- get_weights_tunetoken(normalize_weights = "uniform")
  (character(1)) -> TuneToken
  Shortcut returning a TuneToken for tuning the weights.
- set_weights_to_tune(normalize_weights = "uniform")
  (character(1)) -> self
  Convenience wrapper that stores the TuneToken returned by get_weights_tunetoken() in $param_set$values$weights.

Internals

All wrapped filters are called with nfeat equal to the number of features to ensure that complete score vectors are available for aggregation. Scores are combined per feature by computing a weighted aggregation of transformed (default: identity) scores or ranks. Additionally, the final scores may also be transformed (default: identity).

The order of transformations is as follows:

1. $calculate the filter's scores for all features;
2. If rank_transform is TRUE, convert filter scores to ranks;
3. Apply filter_score_transform to the scores / ranks;
4. Calculate the weighted aggregation across all filters using aggregator;
5. Potentially apply result_score_transform to the vector of scores for each feature aggreagted across filters.

References

Binder M, Moosbauer J, Thomas J, Bischl B (2020). "Multi-objective hyperparameter tuning and feature selection using filter ensembles." In *Proceedings of the 2020 Genetic and Evolutionary Computation Conference*, 471–479. doi:10.1145/3377930.3389815.

Examples

```
library("mlr3")
library("mlr3filters")

task = tsk("sonar")

filter = flt("ensemble",
  filters = list(FilterVariance$new(), FilterAUC$new()))
filter$param_set$values$weights = c(variance = 0.5, auc = 0.5)
filter$calculate(task)
head(as.data.table(filter))

# Weighted median as aggregator
filter$param_set$set_values(aggregator = function(x, w, na.rm) {
  if (na.rm) x <- x[!is.na(x)]
  o <- order(x)
  x <- x[o]
  w <- w[o]
  x[match(TRUE, which(cumsum(w) >= sum(w) / 2))]
})
filter$calculate(task)
head(as.data.table(filter))

# Aggregate reciprocal ranking
filter$param_set$set_values(rank_transform = TRUE,
  filter_score_transform = function(x) 1 / x,
  result_score_transform = function(x) rank(1 / x, ties.method = "average"))
filter$calculate(task)
head(as.data.table(filter))
```

---

mlr_graphs *Dictionary of (sub-)graphs*

Description

A simple Dictionary storing objects of class Graph. The dictionary contains a collection of often-used graph structures, and it's aim is solely to make often-used functions more accessible. Each Graph has an associated help page, which can be accessed via ?mlr_graphs_<key>, i.e. ?mlr_graphs_bagging.

Format

R6Class object inheriting from mlr3misc::Dictionary.

Methods

Methods inherited from Dictionary.

S3 methods

- as.data.table(dict)
  Dictionary -> data.table::data.table
  Returns a data.table with column key (character).

See Also

Other mlr3pipelines backend related: Graph, PipeOp, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_materialize, mlr_pipeops_updatetarget

Other Dictionaries: mlr_pipeops

Examples

```
library(mlr3)
lrn = lrn("regr.rpart")
task = mlr_tasks$get("boston_housing")

# Robustify the learner for the task.
gr = pipeline_robustify(task, lrn) %>>% po("learner", lrn)
# or equivalently
gr = mlr_graphs$get("robustify", task = task, learner = lrn) %>>% po(lrn)
# or equivalently
gr = ppl("robustify", task, lrn) %>>% po("learner", lrn)

# all Graphs currently in the dictionary:
as.data.table(mlr_graphs)
```

---

mlr_graphs_bagging *Create a bagging learner*

Description

Creates a Graph that performs bagging for a supplied graph. This is done as follows:

- Subsample the data in each step using PipeOpSubsample, afterwards apply graph
- Replicate this step iterations times (in parallel via multiplicities)
- Average outputs of replicated graphs predictions using the averager (note that setting collect_multipliciy = TRUE is required)

All input arguments are cloned and have no references in common with the returned Graph.

Usage

```
pipeline_bagging(
  graph,
  iterations = 10,
  frac = 0.7,
  averager = NULL,
  replace = FALSE
)
```

Arguments

graph	PipeOp	Graph A PipeOpLearner or Graph to create a robustifying pipeline for. Outputs from the replicated graphs are connected with the averager.
iterations	integer(1) Number of bagging iterations. Defaults to 10.
frac	numeric(1) Percentage of rows to keep during subsampling. See PipeOpSubsample for more information. Defaults to 0.7.
averager	PipeOp	Graph A PipeOp or Graph that averages the predictions from the replicated and subsampled graph's. In the simplest case, po("classifavg") and po("regravg") can be used in order to perform simple averaging of classification and regression predictions respectively. If NULL (default), no averager is added to the end of the graph. Note that setting collect_multipliciy = TRUE during construction of the averager is required.
replace	logical(1) Whether to sample with replacement. Default FALSE.

Value

Graph

Examples

```
library(mlr3)
lrn_po = po("learner", lrn("regr.rpart"))
task = mlr_tasks$get("boston_housing")
gr = pipeline_bagging(lrn_po, 3, averager = po("regravg", collect_multiplicity = TRUE))
resample(task, GraphLearner$new(gr), rsmp("holdout"))$aggregate()

# The original bagging method uses boosting by sampling with replacement.
gr = ppl("bagging", lrn_po, frac = 1, replace = TRUE,
  averager = po("regravg", collect_multiplicity = TRUE))
resample(task, GraphLearner$new(gr), rsmp("holdout"))$aggregate()
```

`mlr_graphs_branch` *Branch Between Alternative Paths*

Description

Create a multiplexed graph.

All input arguments are cloned and have no references in common with the returned `Graph`.

Usage

```
pipeline_branch(graphs, prefix_branchops = "", prefix_paths = FALSE)
```

Arguments

`graphs`	`list` of `Graph` Multiple graphs, possibly named. They all must have exactly one output. If any of the arguments are named, then all must have unique names.
`prefix_branchops`	`character(1)` Optional id prefix to prepend to `PipeOpBranch` and `PipeOpUnbranch` id. Their resulting IDs will be `"[prefix_branchops]branch"` and `"[prefix_branchops]unbranch"`. Default is `""`.
`prefix_paths`	`logical(1)` | `character(1)` Whether to add prefixes to graph IDs when performing gunion. Can be helpful to avoid ID clashes in resulting graph. Default `FALSE`. If this is `TRUE`, the prefixes are taken from the names of the input arguments if present or `"poX"` where X counts up. If this is a `character(1)`, it is a prefix that is added to the `PipeOp` IDs *additionally* to the input argument list.

Value

`Graph`

Examples

```
library("mlr3")

po_pca = po("pca")
po_nop = po("nop")

branches = pipeline_branch(list(pca = po_pca, nothing = po_nop))
# gives the same as
branches = c("pca", "nothing")
po("branch", branches) %>>%
  gunion(list(po_pca, po_nop)) %>>%
  po("unbranch", branches)

pipeline_branch(list(pca = po_pca, nothing = po_nop),
```

```
  prefix_branchops = "br_", prefix_paths = "xy_")
# gives the same as
po("branch", branches, id = "br_branch") %>>%
  gunion(list(xy_pca = po_pca, xy_nothing = po_nop)) %>>%
  po("unbranch", branches, id = "br_unbranch")
```

`mlr_graphs_convert_types` *Convert Column Types*

Description

Converts all columns of type `type_from` to `type_to`, using the corresponding R function (e.g. `as.numeric()`, `as.factor()`). It is possible to further subset the columns that should be affected using the `affect_columns` argument. The resulting `Graph` contains a `PipeOpColApply`, followed, if appropriate, by a `PipeOpFixFactors`.

Unlike R's `as.factor()` function, `ppl("convert_types")` will convert `ordered` types into (unordered) `factor` vectors.

Usage

```
pipeline_convert_types(
  type_from,
  type_to,
  affect_columns = NULL,
  id = NULL,
  fixfactors = NULL,
  more_args = list()
)
```

Arguments

`type_from`	`character` Which column types to convert. May be any combination of `"logical"`, `"integer"`, `"numeric"`, `"factor"`, `"ordered"`, `"character"`, or `"POSIXct"`.
`type_to`	`character(1)` Which type to convert to. Must be a scalar value, exactly one of the types allowed in `type_from`.
`affect_columns`	`function` | `Selector` | `NULL` Which columns to affect. This argument can further restrict the columns being converted, beyond the `type_from` argument. Must be a `Selector`-like function, which takes a `Task` as argument and returns a `character` of features to use.
`id`	`character(1)` | `NULL` ID to give to the constructed `PipeOp`s. Defaults to an ID built automatically from `type_from` and `type_to`. If a `PipeOpFixFactors` is appended, its ID will be `paste0(id, "_ff")`.

fixfactors — logical(1) | NULL
Whether to append a PipeOpFixFactors. Defaults to TRUE if and only if type_to is "factor" or "ordered".

more_args — list
Additional arguments to give to the conversion function. This could e.g. be used to pass the timezone to as.POSIXct.

Value

Graph

Examples

```
library("mlr3")

data_chr = data.table::data.table(
  x = factor(letters[1:3]),
  y = letters[1:3],
  z = letters[1:3]
)
task_chr = TaskClassif$new("task_chr", data_chr, "x")
str(task_chr$data())

graph = ppl("convert_types", "character", "factor")
str(graph$train(task_chr)[[1]]$data())

graph_z = ppl("convert_types", "character", "factor",
  affect_columns = selector_name("z"))
graph_z$train(task_chr)[[1]]$data()

# `affect_columns` and `type_from` are both applied. The following
# looks for a 'numeric' column with name 'z', which is not present;
# the task is therefore unchanged.
graph_z = ppl("convert_types", "numeric", "factor",
  affect_columns = selector_name("z"))
graph_z$train(task_chr)[[1]]$data()
```

---

mlr_graphs_greplicate *Create Disjoint Graph Union of Copies of a Graph*

Description

Create a new Graph containing n copies of the input Graph / PipeOp. To avoid ID collisions, PipeOp IDs are suffixed with _i where i ranges from 1 to n.

All input arguments are cloned and have no references in common with the returned Graph.

Usage

```
pipeline_greplicate(graph, n)
```

Arguments

graph	Graph Graph to replicate.
n	integer(1) Number of copies to create.

Value

Graph containing n copies of input graph.

See Also

Other Graph operators: %>>%, as_graph(), as_pipeop(), assert_graph(), assert_pipeop(), chain_graphs(), gunion()

Examples

```
library("mlr3")

po_pca = po("pca")
ppl("greplicate", po_pca, n = 2)
```

---

mlr_graphs_ovr *Create A Graph to Perform "One vs. Rest" classification.*

Description

Create a new Graph for a classification Task to perform "One vs. Rest" classification.

All input arguments are cloned and have no references in common with the returned Graph.

Usage

```
pipeline_ovr(graph)
```

Arguments

graph	Graph Graph being wrapped between PipeOpOVRSplit and PipeOpOVRUnite. The Graph should return NULL during training and a classification Prediction during prediction.

Value

Graph

Examples

```
library("mlr3")

task = tsk("wine")

learner = lrn("classif.rpart")
learner$predict_type = "prob"

# Simple OVR
g1 = pipeline_ovr(learner)
g1$train(task)
g1$predict(task)

# Bagged Learners
gr = po("replicate", reps = 3) %>>%
  po("subsample") %>>%
  learner %>>%
  po("classifavg", collect_multiplicity = TRUE)
g2 = pipeline_ovr(gr)
g2$train(task)
g2$predict(task)

# Bagging outside OVR
g3 = po("replicate", reps = 3) %>>%
  pipeline_ovr(po("subsample") %>>% learner) %>>%
  po("classifavg", collect_multiplicity = TRUE)
g3$train(task)
g3$predict(task)
```

---

mlr_graphs_robustify *Robustify a learner*

Description

Creates a Graph that can be used to robustify any subsequent learner. Performs the following steps:

- Drops empty factor levels using PipeOpFixFactors
- Imputes numeric features using PipeOpImputeHist and PipeOpMissInd
- Imputes factor features using PipeOpImputeOOR
- Encodes factors using one-hot-encoding. Factors with a cardinality > max_cardinality are collapsed using PipeOpCollapseFactors

The graph is built conservatively, i.e. the function always tries to assure everything works. If a learner is provided, some steps can be left out, i.e. if the learner can deal with factor variables, no encoding is performed.

All input arguments are cloned and have no references in common with the returned Graph.

Usage

```
pipeline_robustify(
  task = NULL,
  learner = NULL,
  impute_missings = NULL,
  factors_to_numeric = NULL,
  max_cardinality = 1000,
  ordered_action = "factor",
  character_action = "factor",
  POSIXct_action = "numeric"
)
```

Arguments

task	Task A Task to create a robustifying pipeline for. Optional, if omitted, the "worst possible" Task is assumed and the full pipeline is created.
learner	Learner A learner to create a robustifying pipeline for. Optional, if omitted, the "worst possible" Learner is assumed and a more conservative pipeline is built.
impute_missings	logical(1) | NULL Should missing values be imputed? Defaults to NULL: imputes if the task has missing values (or factors that are not encoded to numerics) and the learner can not handle them.
factors_to_numeric	logical(1) | NULL Should (ordered and unordered) factors be encoded? Defaults to NULL: encodes if the task has factors (or character columns that get converted to factor) and the learner can not handle factors.
max_cardinality	integer(1) Maximum number of factor levels allowed. See above. Default: 1000.
ordered_action	character(1) How to handle ordered columns: "factor" (default) or "factor!": convert to factor columns; "numeric" or "numeric!": convert to numeric columns; "integer" or "integer!": convert to integer columns; "ignore" or "ignore!": ignore. When task is given and has no ordered columns, or when learner is given and can handle ordered, then "factor", "numeric" and "integer" are treated like "ignore". This means it is necessary to add the exclamation point to override Task or Learner properties when given. "ignore" and "ignore!" therefore behave completely identically, "ignore!" is only present for consistency. When ordered features are converted to factor, then they are treated like factor features further down in the pipeline, and are possibly eventually converted to numerics, but in a different way: factors get one-hot encoded, ordered_action = "numeric" converts ordered using as.numeric to their integer-valued rank.

character_action
: character(1)
How to handle character columns: "factor" (default) or "factor!": convert to factor columns; "matrix" or "matrix!": Use PipeOpTextVectorizer. "ignore" or "ignore!": ignore. When task is given and has no character columns, or when learner is given and can handle character, then "factor" and "matrix" are treated like "ignore". This means it is necessary to add the exclamation point to override Task or Learner properties when given. "ignore" and "ignore!" therefore behave completely identically, "ignore!" is only present for consistency.
When character columns are converted to factor, then they are treated like factor further down in the pipeline, and are possibly eventually converted to numerics, using one-hot encoding.

POSIXct_action
: character(1)
How to handle POSIXct columns: "numeric" (default) or "numeric!": convert to numeric columns; "datefeatures" or "datefeatures!": Use PipeOpDateFeatures. "ignore" or "ignore!": ignore. When task is given and has no POSIXct columns, or when learner is given and can handle POSIXct, then "numeric" and "datefeatures" are treated like "ignore". This means it is necessary to add the exclamation point to override Task or Learner properties when given. "ignore" and "ignore!" therefore behave completely identically, "ignore!" is only present for consistency.

Value

Graph

Examples

```
library(mlr3)
lrn = lrn("regr.rpart")
task = mlr_tasks$get("boston_housing")
gr = pipeline_robustify(task, lrn) %>>% po("learner", lrn)
resample(task, GraphLearner$new(gr), rsmp("holdout"))
```

---

mlr_graphs_stacking *Create A Graph to Perform Stacking.*

Description

Create a new Graph for stacking. A stacked learner uses predictions of several base learners and fits a super learner using these predictions as features in order to predict the outcome.

All input arguments are cloned and have no references in common with the returned Graph.

Usage

```
pipeline_stacking(
  base_learners,
  super_learner,
  method = "cv",
  folds = 3,
  use_features = TRUE
)
```

Arguments

base_learners	list of Learner A list of base learners.
super_learner	Learner The super learner that makes the final prediction based on the base learners.
method	character(1) "cv" (default) for building a super learner using cross-validated predictions of the base learners or "insample" for building a super learner using the predictions of the base learners trained on all training data.
folds	integer(1) Number of cross-validation folds. Only used for method = "cv". Default 3.
use_features	logical(1) Whether the original features should also be passed to the super learner. Default TRUE.

Value

Graph

Examples

```
library(mlr3)
library(mlr3learners)

base_learners = list(
  lrn("classif.rpart", predict_type = "prob"),
  lrn("classif.nnet", predict_type = "prob")
)
super_learner = lrn("classif.log_reg")

graph_stack = pipeline_stacking(base_learners, super_learner)
graph_learner = as_learner(graph_stack)
graph_learner$train(tsk("german_credit"))
```

`mlr_graphs_targettrafo` *Transform and Re-Transform the Target Variable*

Description

Wraps a `Graph` that transforms a target during training and inverts the transformation during prediction. This is done as follows:

- Specify a transformation and inversion function using any subclass of `PipeOpTargetTrafo`, defaults to `PipeOpTargetMutate`, afterwards apply `graph`.
- At the very end, during prediction the transformation is inverted using `PipeOpTargetInvert`.
- To set a transformation and inversion function for `PipeOpTargetMutate` see the parameters `trafo` and `inverter` of the `param_set` of the resulting `Graph`.
- Note that the input `graph` is not explicitly checked to actually return a `Prediction` during prediction.

All input arguments are cloned and have no references in common with the returned `Graph`.

Usage

```
pipeline_targettrafo(
  graph,
  trafo_pipeop = PipeOpTargetMutate$new(),
  id_prefix = ""
)
```

Arguments

`graph`	`PipeOpLearner` | `Graph` A `PipeOpLearner` or `Graph` to wrap between a transformation and re-transformation of the target variable.
`trafo_pipeop`	`PipeOp` A `PipeOp` that is a subclass of `PipeOpTargetTrafo`. Default is `PipeOpTargetMutate`.
`id_prefix`	`character(1)` Optional id prefix to prepend to `PipeOpTargetInvert` ID. The resulting ID will be `"[id_prefix]targetinvert"`. Default is `""`.

Value

`Graph`

Examples

```
library("mlr3")

tt = pipeline_targettrafo(PipeOpLearner$new(LearnerRegrRpart$new()))
tt$param_set$values$targetmutate.trafo = function(x) log(x, base = 2)
tt$param_set$values$targetmutate.inverter = function(x) list(response = 2 ^ x$response)

# gives the same as
g = Graph$new()
g$add_pipeop(PipeOpTargetMutate$new(param_vals = list(
  trafo = function(x) log(x, base = 2),
  inverter = function(x) list(response = 2 ^ x$response))
  )
)
g$add_pipeop(LearnerRegrRpart$new())
g$add_pipeop(PipeOpTargetInvert$new())
g$add_edge(src_id = "targetmutate", dst_id = "targetinvert",
  src_channel = 1, dst_channel = 1)
g$add_edge(src_id = "targetmutate", dst_id = "regr.rpart",
  src_channel = 2, dst_channel = 1)
g$add_edge(src_id = "regr.rpart", dst_id = "targetinvert",
  src_channel = 1, dst_channel = 2)
```

---

mlr_learners_avg *Optimized Weighted Average of Features for Classification and Regression*

Description

Computes a weighted average of inputs. Used in the context of computing weighted averages of predictions.

Predictions are averaged using `weights` (in order of appearance in the data) which are optimized using nonlinear optimization from the package **nloptr** for a measure provided in `measure`. (defaults to `classif.ce` for `LearnerClassifAvg` and `regr.mse` for `LearnerRegrAvg`). Learned weights can be obtained from `$model`. This Learner implements and generalizes an approach proposed in LeDell (2015) that uses non-linear optimization in order to learn base-learner weights that optimize a given performance metric (e.g `AUC`). The approach is similar but not exactly the same as the one implemented as `AUC` in the **SuperLearner** R package (when `metric` is `"classif.auc"`). For a more detailed analysis and the general idea, the reader is referred to LeDell (2015).

Note, that weights always sum to 1 by division by `sum(weights)` before weighting incoming features.

Usage

```
mlr_learners_classif.avg

mlr_learners_regr.avg
```

Format

R6Class object inheriting from mlr3::LearnerClassif/mlr3::Learner.

Parameters

The parameters are the parameters inherited from LearnerClassif, as well as:

- measure :: Measure | character
  Measure to optimize for. Will be converted to a Measure in case it is character. Initialized to "classif.ce", i.e. misclassification error for classification and "regr.mse", i.e. mean squared error for regression.
- optimizer :: Optimizer | character(1)
  Optimizer used to find optimal thresholds. If character, converts to Optimizer via opt. Initialized to OptimizerNLoptr. Nloptr hyperparameters are initialized to xtol_rel = 1e-8, algorithm = "NLOPT_LN_COBYLA" and equal initial weights for each learner. For more fine-grained control, it is recommended to supply a instantiated Optimizer.
- log_level :: character(1) | integer(1)
  Set a temporary log-level for lgr::get_logger("mlr3/bbotk"). Initialized to: "warn".

Methods

- LearnerClassifAvg$new(), id = "classif.avg")
  (chr) -> self
  Constructor.
- LearnerRegrAvg$new(), id = "regr.avg")
  (chr) -> self
  Constructor.

References

LeDell, Erin (2015). *Scalable Ensemble Learning and Computationally Efficient Variance Estimation*. Ph.D. thesis, UC Berkeley.

See Also

Other Learners: mlr_learners_graph

Other Ensembles: PipeOpEnsemble, mlr_pipeops_classifavg, mlr_pipeops_ovrunite, mlr_pipeops_regravg

---

mlr_learners_graph *Encapsulate a Graph as a Learner*

Description

A Learner that encapsulates a Graph to be used in mlr3 resampling and benchmarks.

The Graph must return a single Prediction on its $predict() call. The result of the $train() call is discarded, only the internal state changes during training are used.

The predict_type of a GraphLearner can be obtained or set via it's predict_type active binding. Setting a new predict type will try to set the predict_type in all relevant PipeOp / Learner encapsulated within the Graph. Similarly, the predict_type of a Graph will always be the smallest denominator in the Graph.

A GraphLearner is always constructed in an untrained state. When the graph argument has a non-NULL $state, it is ignored.

Format

R6Class object inheriting from mlr3::Learner.

Construction

```
GraphLearner$new(graph, id = NULL, param_vals = list(), task_type = NULL, predict_type = NULL)
```

- graph :: Graph | PipeOp
  Graph to wrap. Can be a PipeOp, which is automatically converted to a Graph. This argument is usually cloned, unless clone_graph is FALSE; to access the Graph inside GraphLearner by-reference, use $graph.

- id :: character(1) Identifier of the resulting Learner.
- param_vals :: named list
  List of hyperparameter settings, overwriting the hyperparameter settings . Default list().
- task_type :: character(1)
  What task_type the GraphLearner should have; usually automatically inferred for Graphs that are simple enough.
- predict_type :: character(1)
  What predict_type the GraphLearner should have; usually automatically inferred for Graphs that are simple enough.
- clone_graph :: logical(1)
  Whether to clone graph upon construction. Unintentionally changing graph by reference can lead to unexpected behaviour, so TRUE (default) is recommended. In particular, note that the $state of $graph is set to NULL by reference on construction of GraphLearner, during $train(), and during $predict() when clone_graph is FALSE.

Fields

Fields inherited from Learner, as well as:

- graph :: Graph
  Graph that is being wrapped. This field contains the prototype of the Graph that is being trained, but does *not* contain the model. Use graph_model to access the trained Graph after $train(). Read-only.

- graph_model :: Learner
  Graph that is being wrapped. This Graph contains a trained state after $train(). Read-only.
- pipeops :: named list of PipeOp
  Contains all PipeOps in the underlying Graph, named by the PipeOp's $ids. Shortcut for $graph_model$pipeops. See Graph for details.
- edges :: data.table with columns src_id (character), src_channel (character), dst_id (character), dst_channel (character)
  Table of connections between the PipeOps in the underlying Graph. Shortcut for $graph$edges. See Graph for details.
- param_set :: ParamSet
  Parameters of the underlying Graph. Shortcut for $graph$param_set. See Graph for details.
- pipeops_param_set :: named list()
  Named list containing the ParamSets of all PipeOps in the Graph. See there for details.
- pipeops_param_set_values :: named list()
  Named list containing the set parameter values of all PipeOps in the Graph. See there for details.
- internal_tuned_values :: named list() or NULL
  The internal tuned parameter values collected from all PipeOps. NULL is returned if the learner is not trained or none of the wrapped learners supports internal tuning.
- internal_valid_scores :: named list() or NULL
  The internal validation scores as retrieved from the PipeOps. The names are prefixed with the respective IDs of the PipeOps. NULL is returned if the learner is not trained or none of the wrapped learners supports internal validation.
- best_valid_scores :: named list() or NULL
  The best internal validation scores as retrieved from the PipeOps, i.e. the best scores that were observed during training instead of those of the final model. The names are prefixed with the respective IDs of the PipeOps. NULL is returned if the learner is not trained or none of the wrapped learners tracks them.
- validate :: numeric(1), "predefined", "test" or NULL
  How to construct the validation data. This also has to be configured for the individual PipeOps such as PipeOpLearner, see set_validate.GraphLearner. For more details on the possible values, see mlr3::Learner.
- marshaled :: logical(1)
  Whether the learner is marshaled.
- impute_selected_features :: logical(1)
  Whether to heuristically determine $selected_features() as all $selected_features() of all "base learner" Learners, even if they do not have the "selected_features" property / do not implement $selected_features(). If impute_selected_features is TRUE and the base learners do not implement $selected_features(), the GraphLearner's $selected_features() method will return all features seen by the base learners. This is useful in cases where feature selection is performed inside the Graph: The $selected_features() will then be the set of features that were selected by the Graph. If impute_selected_features is FALSE, the $selected_features() method will throw an error if $selected_features() is not implemented by the base learners.
  This is a heuristic and may report more features than actually used by the base learners, in cases where the base learners do not implement $selected_features(). The default is FALSE.

Methods

Methods inherited from Learner, as well as:

- ids(sorted = FALSE)
  (logical(1)) -> character
  Get IDs of all PipeOps. This is in order that PipeOps were added if sorted is FALSE, and topologically sorted if sorted is TRUE.
- plot(html = FALSE, horizontal = FALSE)
  (logical(1), logical(1)) -> NULL
  Plot the Graph, using either the **igraph** package (for html = FALSE, default) or the visNetwork package for html = TRUE producing a htmlWidget. The htmlWidget can be rescaled using visOptions. For html = FALSE, the orientation of the plotted graph can be controlled through horizontal.
- marshal
  (any) -> self
  Marshal the model.
- unmarshal
  (any) -> self
  Unmarshal the model.
- base_learner(recursive = Inf, return_po = FALSE, return_all = FALSE, resolve_branching = TRUE)
  (numeric(1), logical(1), logical(1), character(1)) -> Learner | PipeOp | list of Learner | list of PipeOp
  Return the base learner of the GraphLearner. If recursive is 0, the GraphLearner itself is returned. Otherwise, the Graph is traversed backwards to find the first PipeOp containing a $learner_model field. If recursive is 1, that $learner_model (or containing PipeOp, if return_po is TRUE) is returned. If recursive is greater than 1, the discovered base learner's base_learner() method is called with recursive - 1. recursive must be set to 1 if return_po is TRUE, and must be set to at most 1 if return_all is TRUE.
  If return_po is TRUE, the container-PipeOp is returned instead of the Learner. This will typically be a PipeOpLearner or a PipeOpLearnerCV.
  If return_all is TRUE, a list of Learners or PipeOps is returned. If return_po is FALSE, this list may contain Multiplicity objects, which are not unwrapped. If return_all is FALSE and there are multiple possible base learners, an error is thrown. This may also happen if only a single PipeOpLearner is present that was trained with a Multiplicity.
  If resolve_branching is TRUE, and when a PipeOpUnbranch is encountered, the corresponding PipeOpBranch is searched, and its hyperparameter configuration is used to select the base learner. There may be multiple corresponding PipeOpBranchs, which are all considered. If resolve_branching is FALSE, PipeOpUnbranch is treated as any other PipeOp with multiple inputs; all possible branch paths are considered equally.
- predict_newdata_fast(newdata, task = NULL)
  (data.frame, Task | NULL) -> Prediction
  Predicts outcomes for new data in newdata using the model fitted during $train().
  For the moment, this is merely a thin wrapper around Learner$predict_newdata() to ensure compatibility, meaning that *no speedup* is currently achieved. In the future, this method may be optimized to be faster than $predict_newdata().

Unlike $predict_newdata(), this method does not return a Prediction object. Instead, it returns a list with elements depending on $task_type and $predict_type:

- for task_type = "classif": response and prob, or quantiles (if predict_type = "quantiles")
- for task_type = "regr": response and se

The following standard extractors as defined by the Learner class are available. Note that these typically only extract information from the $base_learner(). This works well for simple Graphs that do not modify features too much, but may give unexpected results for Graphs that add new features or move information between features.

As an example, consider a feature A with missing values, and a feature B that is used for imputation, using a po("imputelearner"). In a case where the following Learner performs embedded feature selection and only selects feature A, the selected_features() method could return only feature A, and $importance() may even report 0 for feature B. This would not be entirely accurate when considering the entire GraphLearner, as feature B is used for imputation and would therefore have an impact on predictions. The following should therefore only be used if the Graph is known to not have an impact on the relevant properties.

- importance()
  () -> numeric
  The $importance() returned by the base learner, if it has the "importance property. Throws an error otherwise.
- selected_features()
  () -> character
  The $selected_features() returned by the base learner, if it has the "selected_features property. If the base learner does not have the "selected_features" property and impute_selected_features is TRUE, all features seen by the base learners are returned. Throws an error otherwise.
- oob_error()
  () -> numeric(1)
  The $oob_error() returned by the base learner, if it has the "oob_error property. Throws an error otherwise.
- loglik()
  () -> numeric(1)
  The $loglik() returned by the base learner, if it has the "loglik property. Throws an error otherwise.

Internals

as_graph() is called on the graph argument, so it can technically also be a list of things, which is automatically converted to a Graph via gunion(); however, this will usually not result in a valid Graph that can work as a Learner. graph can furthermore be a Learner, which is then automatically wrapped in a Graph, which is then again wrapped in a GraphLearner object; this usually only adds overhead and is not recommended.

See Also

Other Learners: mlr_learners_avg

Examples

```
library("mlr3")

graph = po("pca") %>>% lrn("classif.rpart")

lr = GraphLearner$new(graph)
lr = as_learner(graph)  # equivalent

lr$train(tsk("iris"))

lr$graph$state  # untrained version!
# The following is therefore NULL:
lr$graph$pipeops$classif.rpart$learner_model$model

# To access the trained model from the PipeOpLearner's Learner, use:
lr$graph_model$pipeops$classif.rpart$learner_model$model

# Feature importance (of principal components):
lr$graph_model$pipeops$classif.rpart$learner_model$importance()
```

---

mlr_pipeops *Dictionary of PipeOps*

Description

A simple Dictionary storing objects of class PipeOp. Each PipeOp has an associated help page, see mlr_pipeops_[id].

Format

R6Class object inheriting from mlr3misc::Dictionary.

Fields

Fields inherited from Dictionary, as well as:

- metainf :: environment
  Environment that stores the metainf argument of the $add() method. Only for internal use.

Methods

Methods inherited from Dictionary, as well as:

- add(key, value, metainf = NULL)
  (character(1), R6ClassGenerator, NULL | list)
  Adds constructor value to the dictionary with key key, potentially overwriting a previously stored item. If metainf is not NULL (the default), it must be a list of arguments that will be given to the value constructor (i.e. value$new()) when it needs to be constructed for as.data.table PipeOp listing.

S3 methods

- as.data.table(dict)
  Dictionary -> data.table::data.table
  Returns a data.table with the following columns:
  - key :: (character)
    Key with which the PipeOp was registered to the Dictionary using the $add() method.
  - label :: (character)
    Description of the PipeOp's functionality.
  - packages :: (character)
    Set of all required packages for the PipeOp's train and predict methods.
  - tags :: (character)
    A set of tags associated with the PipeOp describing its purpose.
  - feature_types :: (character)
    Feature types the PipeOp operates on. Is NA for PipeOps that do not directly operate on a Task.
  - input.num, output.num :: (integer)
    Number of the PipeOp's input and output channels. Is NA for PipeOps which accept a varying number of input and/or output channels depending a construction argument. See input and output fields of PipeOp.
  - input.type.train, input.type.predict, output.type.train, output.type.predict :: (character)
    Types that are allowed as input to or returned as output of the PipeOp's $train() and $predict() methods.
    A value of NULL means that a null object, e.g. no data, is taken as input or being returned as output. A value of "*" means that any type is possible.
    If both input.type.train and output.type.train or both input.type.predict and output.type.predict contain values enclosed by square brackets ("[", "]"), then the respective input or channel is Multiplicity-aware. For more information, see Multiplicity.

See Also

Other mlr3pipelines backend related: Graph, PipeOp, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_graphs, mlr_pipeops_materialize, mlr_pipeops_updatetarget

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputecons
mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantiles, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite,

mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Other Dictionaries: mlr_graphs

Examples

```
library("mlr3")

mlr_pipeops$get("learner", lrn("classif.rpart"))

# equivalent:
po("learner", learner = lrn("classif.rpart"))

# all PipeOps currently in the dictionary:
as.data.table(mlr_pipeops)[, c("key", "input.num", "output.num", "packages")]
```

---

mlr_pipeops_adas *ADAS Balancing*

Description

Generates a more balanced data set by creating synthetic instances of the minority classes using the ADASYN algorithm.

The algorithm generates for each minority instance new data points based on its K nearest neighbors and the difficulty of learning for that data point. It can only be applied to tasks with numeric features that have no missing values.

See smotefamily::ADAS for details.

Format

R6Class object inheriting from PipeOpTaskPreproc/PipeOp.

Construction

```
PipeOpADAS$new(id = "adas", param_vals = list())
```

- id :: character(1)
  Identifier of resulting object, default "adas".
- param_vals :: named list
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default list().

Input and Output Channels

Input and output channels are inherited from PipeOpTaskPreproc. Instead of a Task, a TaskClassif is used as input and output during training and prediction.

The output during training is the input Task with added synthetic rows for the minority class. The output during prediction is the unchanged input.

State

The $state is a named list with the $state elements inherited from PipeOpTaskPreproc.

Parameters

The parameters are the parameters inherited from PipeOpTaskPreproc, as well as:

- K :: numeric(1)
  The number of nearest neighbors used for sampling new values. Default is 5. See ADAS().

Internals

If a target level is unobserved during training, no synthetic data points will be generated for that class. No error is raised; the unobserved class is simply ignored.

Fields

Only fields inherited from PipeOp.

Methods

Only methods inherited from PipeOpTaskPreproc/PipeOp.

References

He H, Bai Y, Garcia, A. E, Li S (2008). "ADASYN: Adaptive synthetic sampling approach for imbalanced learning." In *2008 IEEE International Joint Conference on Neural Networks (IEEE World Congress on Computational Intelligence)*, 1322-1328. doi:10.1109/IJCNN.2008.4633969.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputeconstant, mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap,

mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantile
mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply,
mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf,
mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy,
mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse,
mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns, mlr_pipeops_replicate,
mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange,
mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign,
mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate,
mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold,
mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget,
mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Examples

```
library("mlr3")

# Create example task
data = data.frame(
  target = factor(sample(c("c1", "c2"), size = 300, replace = TRUE, prob = c(0.1, 0.9))),
  x1 = rnorm(300),
  x2 = rnorm(300)
)
task = TaskClassif$new(id = "example", backend = data, target = "target")
task$head()
table(task$data(cols = "target"))

# Generate synthetic data for minority class
pop = po("adas")
adas_result = pop$train(list(task))[[1]]$data()
nrow(adas_result)
table(adas_result$target)
```

---

mlr_pipeops_blsmote *BLSMOTE Balancing*

Description

Adds new data points by generating synthetic instances for the minority class using the Borderline-SMOTE algorithm. This can only be applied to classification tasks with numeric features that have no missing values. See `smotefamily::BLSMOTE` for details.

Format

`R6Class` object inheriting from `PipeOpTaskPreproc`/`PipeOp`.

Construction

```
PipeOpBLSmote$new(id = "blsmote", param_vals = list())
```

- `id` :: `character(1)`
  Identifier of resulting object, default `"smote"`.
- `param_vals` :: named `list`
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from `PipeOpTaskPreproc`. Instead of a `Task`, a `TaskClassif` is used as input and output during training and prediction.

The output during training is the input `Task` with added synthetic rows for the minority class. The output during prediction is the unchanged input.

State

The `$state` is a named `list` with the `$state` elements inherited from `PipeOpTaskPreproc`.

Parameters

The parameters are the parameters inherited from `PipeOpTaskPreproc`, as well as:

- `K` :: `numeric(1)`
  The number of nearest neighbors used for sampling from the minority class. Default is `5`. See `BLSMOTE()`.
- `C` :: `numeric(1)`
  The number of nearest neighbors used for classifying sample points as SAFE/DANGER/NOISE. Default is `5`. See `BLSMOTE()`.
- `dup_size` :: `numeric(1)`
  Desired times of synthetic minority instances over the original number of majority instances. `0` leads to balancing minority and majority class. Default is `0`. See `BLSMOTE()`.
- `method` :: `character(1)`
  The type of Borderline-SMOTE algorithm to use. Default is `"type1"`. See `BLSMOTE()`.
- `quiet` :: `logical(1)`
  Whether to suppress printing status during training. Initialized to `TRUE`.

Internals

If a target level is unobserved during training, no synthetic data points will be generated for that class. No error is raised; the unobserved class is simply ignored.

Fields

Only fields inherited from `PipeOp`.

Methods

Only methods inherited from PipeOpTaskPreproc/PipeOp.

References

Han H, Wang W, Mao B (2005). "Borderline-SMOTE: A New Over-Sampling Method in Imbalanced Data Sets Learning." In Huang D, Zhang X, Huang G (eds.), *Advances in Intelligent Computing*, 878–887. ISBN 978-3-540-31902-3. doi:10.1007/11538059_91.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputeconstant, mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantile, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Examples

```
library("mlr3")

# Create example task
data = smotefamily::sample_generator(500, 0.8)
data$result = factor(data$result)
task = TaskClassif$new(id = "example", backend = data, target = "result")
task$head()
table(task$data(cols = "result"))

# Generate synthetic data for minority class
pop = po("blsmote")
bls_result = pop$train(list(task))[[1]]$data()
```

```
nrow(bls_result)
table(bls_result$result)
```

`mlr_pipeops_boxcox` *Box-Cox Transformation of Numeric Features*

Description

Conducts a Box-Cox transformation on numeric features. The lambda parameter of the transformation is estimated during training and used for both training and prediction transformation. See `bestNormalize::boxcox()` for details.

Format

`R6Class` object inheriting from `PipeOpTaskPreproc`/`PipeOp`.

Construction

```
PipeOpBoxCox$new(id = "boxcox", param_vals = list())
```

- `id` :: `character(1)`
  Identifier of resulting object, default `"boxcox"`.
- `param_vals` :: named `list`
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from `PipeOpTaskPreproc`.

The output is the input `Task` with all affected numeric features replaced by their transformed versions.

State

The `$state` is a named `list` with the `$state` elements inherited from `PipeOpTaskPreproc`, as well as a list of class `boxcox` for each column, which is transformed.

Parameters

The parameters are the parameters inherited from `PipeOpTaskPreproc`, as well as:

- `standardize` :: `logical(1)`
  Whether to center and scale the transformed values to attempt a standard normal distribution. For details see `boxcox()`.
- `eps` :: `numeric(1)`
  Tolerance parameter to identify if lambda parameter is equal to zero. For details see `boxcox()`.

- `lower` :: `numeric(1)`
  Lower value for estimation of lambda parameter. For details see `boxcox()`.
- `upper` :: `numeric(1)`
  Upper value for estimation of lambda parameter. For details see `boxcox()`.

Internals

Uses the `bestNormalize::boxcox` function.

Fields

Only fields inherited from `PipeOp`.

Methods

Only methods inherited from `PipeOpTaskPreproc`/`PipeOp`.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: `PipeOp`, `PipeOpEncodePL`, `PipeOpEnsemble`, `PipeOpImpute`, `PipeOpTargetTrafo`, `PipeOpTaskPreproc`, `PipeOpTaskPreprocSimple`, `mlr_pipeops`, `mlr_pipeops_adas`, `mlr_pipeops_blsmote`, `mlr_pipeops_branch`, `mlr_pipeops_chunk`, `mlr_pipeops_classbalancing`, `mlr_pipeops_classifavg`, `mlr_pipeops_classweights`, `mlr_pipeops_classweightsex`, `mlr_pipeops_colapply`, `mlr_pipeops_collapsefactors`, `mlr_pipeops_colroles`, `mlr_pipeops_copy`, `mlr_pipeops_datefeatures`, `mlr_pipeops_decode`, `mlr_pipeops_encode`, `mlr_pipeops_encodeimpact`, `mlr_pipeops_encodelmer`, `mlr_pipeops_encodeplquantiles`, `mlr_pipeops_encodepltree`, `mlr_pipeops_featureunion`, `mlr_pipeops_filter`, `mlr_pipeops_fixfactors`, `mlr_pipeops_histbin`, `mlr_pipeops_ica`, `mlr_pipeops_imputeconstant`, `mlr_pipeops_imputehist`, `mlr_pipeops_imputelearner`, `mlr_pipeops_imputemean`, `mlr_pipeops_imputemedian`, `mlr_pipeops_imputemode`, `mlr_pipeops_imputeoor`, `mlr_pipeops_imputesample`, `mlr_pipeops_info`, `mlr_pipeops_isomap`, `mlr_pipeops_kernelpca`, `mlr_pipeops_learner`, `mlr_pipeops_learner_pi_cvplus`, `mlr_pipeops_learner_quantile`, `mlr_pipeops_materialize`, `mlr_pipeops_missind`, `mlr_pipeops_modelmatrix`, `mlr_pipeops_multiplicityexply`, `mlr_pipeops_multiplicityimply`, `mlr_pipeops_mutate`, `mlr_pipeops_nearmiss`, `mlr_pipeops_nmf`, `mlr_pipeops_nop`, `mlr_pipeops_ovrsplit`, `mlr_pipeops_ovrunite`, `mlr_pipeops_pca`, `mlr_pipeops_proxy`, `mlr_pipeops_quantilebin`, `mlr_pipeops_randomprojection`, `mlr_pipeops_randomresponse`, `mlr_pipeops_regravg`, `mlr_pipeops_removeconstants`, `mlr_pipeops_renamecolumns`, `mlr_pipeops_replicate`, `mlr_pipeops_rowapply`, `mlr_pipeops_scale`, `mlr_pipeops_scalemaxabs`, `mlr_pipeops_scalerange`, `mlr_pipeops_select`, `mlr_pipeops_smote`, `mlr_pipeops_smotenc`, `mlr_pipeops_spatialsign`, `mlr_pipeops_splines`, `mlr_pipeops_subsample`, `mlr_pipeops_targetinvert`, `mlr_pipeops_targetmutate`, `mlr_pipeops_targettrafoscalerange`, `mlr_pipeops_textvectorizer`, `mlr_pipeops_threshold`, `mlr_pipeops_tomek`, `mlr_pipeops_tunethreshold`, `mlr_pipeops_unbranch`, `mlr_pipeops_updatetarget`, `mlr_pipeops_vtreat`, `mlr_pipeops_yeojohnson`

Examples

```
library("mlr3")

task = tsk("iris")
pop = po("boxcox")
```

```
task$data()
pop$train(list(task))[[1]]$data()

pop$state
```

`mlr_pipeops_branch` *Path Branching*

Description

Perform alternative path branching: `PipeOpBranch` has multiple output channels that connect to different paths in a `Graph`. At any time, only one of these paths will be taken for execution. At the end of the different paths, the `PipeOpUnbranch` `PipeOp` must be used to indicate the end of alternative paths.

Not to be confused with `PipeOpCopy`, the naming scheme is a bit unfortunate.

Format

`R6Class` object inheriting from `PipeOp`.

Construction

```
PipeOpBranch$new(options, id = "branch", param_vals = list())
```

- `options` :: `numeric(1)` | `character`
  If `options` is an integer number, it determines the number of output channels / options that are created, named `output1`...`output<n>`. The `$selection` parameter will then be an integer. If `options` is a `character`, it determines the names of channels directly. The `$selection` parameter will then be factorial.
- `id` :: `character(1)`
  Identifier of resulting object, default `"branch"`.
- `param_vals` :: named `list`
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

`PipeOpBranch` has one input channel named `"input"`, taking any input (`"*"`) both during training and prediction.

`PipeOpBranch` has multiple output channels depending on the `options` construction argument, named `"output1"`, `"output2"`, ... if `options` is `numeric`, and named after each `options` value if `options` is a `character`. All output channels produce the object given as input (`"*"`) or `NO_OP`, both during training and prediction.

State

The $state is left empty (list()).

Parameters

- selection :: numeric(1) | character(1)
  Selection of branching path to take. Is a ParamInt if the options parameter during construction was a numeric(1), and ranges from 1 to options. Is a ParamFct if the options parameter was a character and its possible values are the options values. Initialized to either 1 (if the options construction argument is numeric(1)) or the first element of options (if it is character).

Internals

Alternative path branching is handled by the PipeOp backend. To indicate that a path should not be taken, PipeOpBranch returns the NO_OP object on its output channel. The PipeOp handles each NO_OP input by automatically returning a NO_OP output without calling private$.train() or private$.predict(), until PipeOpUnbranch is reached. PipeOpUnbranch will then take multiple inputs, all except one of which must be a NO_OP, and forward the only non-NO_OP object on its output.

Fields

Only fields inherited from PipeOp.

Methods

Only methods inherited from PipeOp.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputeconstant, mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantile, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange,

mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Other Path Branching: NO_OP, filter_noop(), is_noop(), mlr_pipeops_unbranch

Examples

```
library("mlr3")

pca = po("pca")
nop = po("nop")
choices = c("pca", "nothing")
gr = po("branch", choices) %>>%
  gunion(list(pca, nop)) %>>%
  po("unbranch", choices)

gr$param_set$values$branch.selection = "pca"
gr$train(tsk("iris"))

gr$param_set$values$branch.selection = "nothing"
gr$train(tsk("iris"))
```

---

mlr_pipeops_chunk *Chunk Input into Multiple Outputs*

Description

Chunks its input into `outnum` chunks. Creates `outnum` Tasks during training, and simply passes on the input during `outnum` times during prediction.

Format

R6Class object inheriting from PipeOp.

Construction

```
PipeOpChunk$new(outnum, id = "chunk", param_vals = list())
```

- `outnum` :: `numeric(1)`
  Number of output channels, and therefore number of chunks created.
- `id` :: `character(1)`
  Identifier of resulting object, default `"chunk"`.
- `param_vals` :: named `list`
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output

PipeOpChunk has one input channel named "input", taking a Task both during training and prediction.

PipeOpChunk has multiple output channels depending on the options construction argument, named "output1", "output2", ... All output channels produce (respectively disjoint, random) subsets of the input Task during training, and pass on the original Task during prediction.

State

The $state is left empty (list()).

Parameters

- shuffle :: logical(1)
  Should the data be shuffled before chunking? Initialized to TRUE.

Internals

Uses the mlr3misc::chunk_vector() function.

Fields

Only fields inherited from PipeOp.

Methods

Only methods inherited from PipeOp.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputeconstant, mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantile, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign,

mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Examples

```
library("mlr3")

task = tsk("wine")
opc = mlr_pipeops$get("chunk", 2)

# watch the row number: 89 during training (task is chunked)...
opc$train(list(task))

# ... 178 during predict (task is copied)
opc$predict(list(task))
```

---

mlr_pipeops_classbalancing

Class Balancing

Description

Both undersamples a Task to keep only a fraction of the rows of the majority class, as well as oversamples (repeats data points) rows of the minority class.

Sampling happens only during training phase. Class-balancing a Task by sampling may be beneficial for classification with imbalanced training data.

Format

R6Class object inheriting from PipeOpTaskPreproc/PipeOp.

Construction

```
PipeOpClassBalancing$new(id = "classbalancing", param_vals = list())
```

- id :: character(1) Identifier of the resulting object, default "classbalancing"
- param_vals :: named list
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default list().

Input and Output Channels

Input and output channels are inherited from PipeOpTaskPreproc. Instead of a Task, a TaskClassif is used as input and output during training and prediction.

The output during training is the input Task with added or removed rows to balance target classes. The output during prediction is the unchanged input.

State

The $state is a named list with the $state elements inherited from PipeOpTaskPreproc.

Parameters

The parameters are the parameters inherited from PipeOpTaskPreproc; however, the affect_columns parameter is *not* present. Further parameters are:

- ratio :: numeric(1)
  Ratio of number of rows of classes to keep, relative to the $reference value. Initialized to 1.
- reference :: numeric(1)
  What the $ratio value is measured against. Can be "all" (mean instance count of all classes), "major" (instance count of class with most instances), "minor" (instance count of class with fewest instances), "nonmajor" (average instance count of all classes except the major one), "nonminor" (average instance count of all classes except the minor one), and "one" ($ratio determines the number of instances to have, per class). Initialized to "all".
- adjust :: numeric(1)
  Which classes to up / downsample. Can be "all" (up and downsample all to match required instance count), "major", "minor", "nonmajor", "nonminor" (see respective values for $reference), "upsample" (only upsample), and "downsample". Initialized to "all".
- shuffle :: logical(1)
  Whether to shuffle the rows of the resulting task. In case the data is upsampled and shuffle = FALSE, the resulting task will have the original rows (which were not removed in downsampling) in the original order, followed by all newly added rows ordered by target class. Initialized to TRUE.

Internals

Up / downsampling happens as follows: At first, a "target class count" is calculated, by taking the mean class count of all classes indicated by the reference parameter (e.g. if reference is "nonmajor": the mean class count of all classes that are not the "major" class, i.e. the class with the most samples) and multiplying this with the value of the ratio parameter. If reference is "one", then the "target class count" is just the value of ratio (i.e. 1 * ratio).

Then for each class that is referenced by the adjust parameter (e.g. if adjust is "nonminor": each class that is not the class with the fewest samples), PipeOpClassBalancing either throws out samples (downsampling), or adds additional rows that are equal to randomly chosen samples (upsampling), until the number of samples for these classes equals the "target class count". No upsampling is performed for classes that were not observed during training (i.e. empty factor levels in the target column).

Uses task$filter() to remove rows. When identical rows are added during upsampling, then the taskrow_rolesuse can *not* be used to duplicate rows because of [inaudible]; instead the task$rbind() function is used, and a new data.table is attached that contains all rows that are being duplicated exactly as many times as they are being added.

Fields

Only fields inherited from PipeOp.

Methods

Only methods inherited from PipeOpTaskPreproc/PipeOp.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputeconstant, mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantile, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Examples

```
library("mlr3")

task = tsk("spam")
opb = po("classbalancing")

# target class counts
table(task$truth())

# double the instances in the minority class (spam)
opb$param_set$values = list(ratio = 2, reference = "minor",
  adjust = "minor", shuffle = FALSE)
result = opb$train(list(task))[[1L]]
table(result$truth())

# up or downsample all classes until exactly 20 per class remain
opb$param_set$values = list(ratio = 20, reference = "one",
  adjust = "all", shuffle = FALSE)
result = opb$train(list(task))[[1]]
table(result$truth())
```

`mlr_pipeops_classifavg` *Majority Vote Prediction*

Description

Perform (weighted) majority vote prediction from classification `Predictions` by connecting `PipeOpClassifAvg` to multiple `PipeOpLearner` outputs.

Always returns a `"prob"` prediction, regardless of the incoming `Learner`'s `$predict_type`. The label of the class with the highest predicted probability is selected as the `"response"` prediction. If the `Learner`'s `$predict_type` is set to `"prob"`, the probability aggregation is controlled by `prob_aggr` (see below). If `$predict_type = "response"`, predictions are internally converted to one-hot probability vectors (point mass on the predicted class) before aggregation.

`"prob"` **aggregation::**

- `prob_aggr = "mean"` – *Linear opinion pool (arithmetic mean of probabilities; default).* **Interpretation.** Mixture semantics: choose a base model with probability `w[i]`, then draw from its class distribution. Decision-theoretically, this is the minimizer of `sum(w[i] * KL(p[i] || p))` over probability vectors `p`, where `KL(x || y)` is the Kullback-Leibler divergence. **Typical behavior.** Conservative / better calibrated and robust to near-zero probabilities (never assigns zero unless all do). This is the standard choice for probability averaging in ensembles and stacking.
- `prob_aggr = "log"` – *Log opinion pool / product of experts (geometric mean in probability space)*: Average per-model logs (or equivalently, logits) and apply softmax. **Interpretation.** Product semantics: `p_ens ~ prod_i p_i^{w[i]}`; minimizes `sum(w[i] * KL(p || p[i]))`. **Typical behavior.** Sharper / lower entropy (emphasizes consensus regions), but can be **overconfident** and is sensitive to zeros; use `prob_aggr_eps` to clip small probabilities for numerical stability. Often beneficial with strong, similarly calibrated members (e.g., neural networks), less so when calibration is the priority.

All incoming `Learner`'s `$predict_type` must agree.

Weights can be set as a parameter; if none are provided, defaults to equal weights for each prediction. Defaults to equal weights for each model.

Format

`R6Class` inheriting from `PipeOpEnsemble`/`PipeOp`.

Construction

```
PipeOpClassifAvg$new(innum = 0, collect_multiplicity = FALSE, id = "classifavg", param_vals = list())
```

- `innum` :: `numeric(1)`
  Determines the number of input channels. If `innum` is 0 (default), a vararg input channel is created that can take an arbitrary number of inputs.

- collect_multiplicity :: logical(1)
  If TRUE, the input is a Multiplicity collecting channel. This means, a Multiplicity input, instead of multiple normal inputs, is accepted and the members are aggregated. This requires innum to be 0. Default is FALSE.
- id :: character(1) Identifier of the resulting object, default "classifavg".
- param_vals :: named list
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default list().

Input and Output Channels

Input and output channels are inherited from PipeOpEnsemble. Instead of a Prediction, a PredictionClassif is used as input and output during prediction.

State

The $state is left empty (list()).

Parameters

The parameters are the parameters inherited from the PipeOpEnsemble, as well as:

- prob_aggr :: character(1)
  Controls how incoming class probabilities are aggregated. One of "mean" (linear opinion pool; default) or "log" (log opinion pool / product of experts). See the description above for definitions and interpretation. Only has an effect if the incoming predictions have "prob" values.
- prob_aggr_eps :: numeric(1)
  Small positive constant used only for prob_aggr = "log" to clamp probabilities before taking logs, improving numerical stability and avoiding -Inf. Ignored for prob_aggr = "mean". Default is 1e-12.

Internals

Inherits from PipeOpEnsemble by implementing the private$weighted_avg_predictions() method.

Fields

Only fields inherited from PipeOp.

Methods

Only methods inherited from PipeOpEnsemble/PipeOp.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputeconstant, mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantile, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Other Multiplicity PipeOps: Multiplicity(), PipeOpEnsemble, mlr_pipeops_featureunion, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_regravg, mlr_pipeops_replicate

Other Ensembles: PipeOpEnsemble, mlr_learners_avg, mlr_pipeops_ovrunite, mlr_pipeops_regravg

Examples

```
library("mlr3")

# Simple Bagging
gr = ppl("greplicate",
  po("subsample") %>>%
  po("learner", lrn("classif.rpart")),
  n = 3
) %>>%
  po("classifavg")

resample(tsk("iris"), GraphLearner$new(gr), rsmp("holdout"))
```

`mlr_pipeops_classweights` *Class Weights for Sample Weighting*

Description

Adds a class-dependent sample weights column to a `Task`, allowing `Learner`s and `Measure`s to weight observations differently during training and evaluation.

Weights are assigned per observation based on the target class and can be written to the `"weights_learner"` column, the `"weights_measure"` column, both, or neither.

Only binary classification tasks (`TaskClassif`) are supported.

Note: By default, all weights are set to `1`. To obtain a meaningful effect, the `minor_weight` parameter must be adjusted.

See `PipeOpClassWeightsEx` for an extended version of this `PipeOp` which can handle multiclass classification tasks and offers several methods for automatically determining weights.

Format

`R6Class` object inheriting from `PipeOpTaskPreproc`/`PipeOp`.

Construction

```
PipeOpClassWeights$new(id = "classweights", param_vals = list())
```

- `id` :: `character(1)`
  Identifier of the resulting object, default `"classweights"`
- `param_vals` :: named `list`
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from `PipeOpTaskPreproc`. Instead of a `Task`, a `TaskClassif` is used as input and output during training and prediction.

The output during training is the input `Task` with an added weights column according to the target class. The output during prediction is the unchanged input.

State

The `$state` is a named `list` with the `$state` elements inherited from `PipeOpTaskPreproc`.

Parameters

The parameters are the parameters inherited from PipeOpTaskPreproc; however, the affect_columns parameter is *not* present. Further parameters are:

- minor_weight :: numeric(1)
  Weight given to samples of the minor class. Major class samples have weight 1. Initialized to 1.
- weights_learner :: logical(1)
  Whether the created weights should be stored as a weights_learner column or not. Initialized to TRUE.
- weights_measure :: logical(1)
  Whether the created weights should be stored as a weights_measure column or not. Initialized to FALSE.

Internals

Adds a .WEIGHTS column to the Task, which is removed from the feature role and mapped to the requested weight roles. There will be a naming conflict if this column already exists and is *not* a weight column already. For potentially pre-existing weight columns, the weight column role gets dropped, but they remain in the DataBackend of the Task. The Learner must support weights for this PipeOp to have an effect.

Fields

Only fields inherited from PipeOp.

Methods

Only methods inherited from PipeOpTaskPreproc/PipeOp.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputeconstant, mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantile, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse,

mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Examples

```
library("mlr3")

task = tsk("spam")
opb = po("classweights")

# task weights
if ("weights_learner" %in% names(task)) {
  task$weights_learner  # recent mlr3-versions
} else {
  task$weights  # old mlr3-versions
}

# double the instances in the minority class (spam)
opb$param_set$values$minor_weight = 2
result = opb$train(list(task))[[1L]]
if ("weights_learner" %in% names(result)) {
  result$weights_learner  # recent mlr3-versions
} else {
  result$weights  # old mlr3-versions
}
```

---

mlr_pipeops_classweightsex

Class Weights for Sample Weighting - Extended

Description

Adds a class-dependent sample weights column to a Task, allowing Learners and Measures to weight observations differently during training and evaluation.

Weights are assigned per observation based on the target class and can be written to the "weights_learner" column, the "weights_measure" column, both, or neither.

Binary as well as multiclass classification tasks (TaskClassif) are supported.

Format

R6Class object inheriting from PipeOpTaskPreproc/PipeOp.

Construction

```
PipeOpClassWeightsEx$new(id = "classweightsex", param_vals = list())
```

- `id` :: `character(1)`
  Identifier of the resulting object, default `"classweightsex"`
- `param_vals` :: named `list`
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from `PipeOpTaskPreproc`. Instead of a `Task`, a `TaskClassif` is used as input and output during training and prediction.

The output during training is the input `Task` with an added weights column according to the target class. The output during prediction is the unchanged input.

State

The `$state` is a named `list` with the `$state` elements inherited from `PipeOpTaskPreproc`.

Parameters

The parameters are the parameters inherited from `PipeOpTaskPreproc`; however, the `affect_columns` parameter is *not* present. Further parameters are:

- `weights_learner` :: `logical(1)`
  Whether the created weights should be stored as a `weights_learner` column or not. Initialized to `TRUE`.
- `weights_measure` :: `logical(1)`
  Whether the created weights should be stored as a `weights_measure` column or not. Initialized to `FALSE`.
- `weight_method` :: `character(1)`
  The method that is chosen to determine the weights of the samples. Methods encompass `"inverse_class_frequency"`, `"inverse_square_root_of_frequency"`, `"median_frequency_balancing"` and `"explicit"`. In case of `"explicit"`, the `mapping` hyperparameter must be use. Initialized to `"explicit"`.
- `mapping` :: named `numeric`
  A named numeric vector that specifies a finite weight for each target class in the task. This only has an effect if `weight_method` is `explicit`.

Internals

Adds a `.WEIGHTS` column to the `Task`, which is removed from the feature role and mapped to the requested weight roles. There will be a naming conflict if this column already exists and is *not* a weight column already. For potentially pre-existing weight columns, the weight column role gets dropped, but they remain in the `DataBackend` of the `Task`.
When `weight_method = "explicit"`, the mapping must cover every class present in the training data and may not contain additional classes.
The `Learner` must support weights for this `PipeOp` to have an effect.

Fields

Only fields inherited from PipeOp.

Methods

Only methods inherited from PipeOpTaskPreproc/PipeOp.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputeconstant, mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantile, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Examples

```
library("mlr3")

task = tsk("spam")

poicf = po("classweightsex", param_vals = list(weights_learner = TRUE, weights_measure = TRUE,
  weight_method = "inverse_class_frequency"))
result = poicf$train(list(task))[[1L]]

if ("weights_learner" %in% names(result)) {
  result$weights_learner  # recent mlr3-versions
} else {
  result$weights  # old mlr3-versions
}
```

```
if ("weights_measure" %in% names(result)) {
  result$weights_measure  # recent mlr3-versions
} else {
  result$weights  # old mlr3-versions
}
```

`mlr_pipeops_colapply` *Apply a Function to each Column of a Task*

Description

Applies a function to each column of a task. Use the `affect_columns` parameter inherited from `PipeOpTaskPreprocSimple` to limit the columns this function should be applied to. This can be used for simple parameter transformations or type conversions (e.g. `as.numeric`).

The same function is applied during training and prediction. One important relationship for machine learning preprocessing is that during the prediction phase, the preprocessing on each data row should be independent of other rows. Therefore, the `applicator` function should always return a vector / list where each result component only depends on the corresponding input component and not on other components. As a rule of thumb, if the function `f` generates output different from `Vectorize(f)`, it is not a function that should be used for `applicator`.

Format

`R6Class` object inheriting from `PipeOpTaskPreprocSimple`/`PipeOpTaskPreproc`/`PipeOp`.

Construction

```
PipeOpColApply$new(id = "colapply", param_vals = list())
```

- `id` :: `character(1)`
  Identifier of resulting object, default `"colapply"`.
- `param_vals` :: named `list`
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from `PipeOpTaskPreproc`.

The output is the input `Task` with features changed according to the `applicator` parameter.

State

The `$state` is a named `list` with the `$state` elements inherited from `PipeOpTaskPreproc`.

Parameters

The parameters are the parameters inherited from PipeOpTaskPreproc, as well as:

- applicator :: function
  Function to apply to each column of the task. The return value should be a vector of the same length as the input, i.e., the function vectorizes over the input. A typical example would be as.numeric.
  The return value can also be a matrix, data.frame, or data.table. In this case, the length of the input must match the number of returned rows. The names of the resulting features of the output Task is based on the (column) name(s) of the return value of the applicator function, prefixed with the original feature name separated by a dot (.). Use Vectorize to create a vectorizing function from any function that ordinarily only takes one element input.

Internals

Calls map on the data, using the value of applicator as f. and coerces the output via as.data.table.

Fields

Only fields inherited from PipeOp.

Methods

Only methods inherited from PipeOpTaskPreprocSimple/PipeOpTaskPreproc/PipeOp.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_collapsefacto mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputeconstant, mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantile mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold,

mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Examples

```
library("mlr3")

task = tsk("iris")
poca = po("colapply", applicator = as.character)
poca$train(list(task))[[1]]  # types are converted

# function that does not vectorize
f1 = function(x) {
  # we could use `ifelse` here, but that is not the point
  if (x > 1) {
    "a"
  } else {
    "b"
  }
}
poca$param_set$values$applicator = Vectorize(f1)
poca$train(list(task))[[1]]$data()

# only affect Petal.* columns
poca$param_set$values$affect_columns = selector_grep("^Petal")
poca$train(list(task))[[1]]$data()

# function returning multiple columns
f2 = function(x) {
  cbind(floor = floor(x), ceiling = ceiling(x))
}
poca$param_set$values$applicator = f2
poca$param_set$values$affect_columns = selector_all()
poca$train(list(task))[[1]]$data()
```

---

mlr_pipeops_collapsefactors

Collapse Factors

Description

Collapses factors of type `factor`, `ordered`: Collapses the rarest factors in the training samples, until `target_level_count` levels remain. Levels that have prevalence strictly above `no_collapse_above_prevalence` or absolute count strictly above `no_collapse_above_absolute` are retained, however. For `factor` variables, these are collapsed to the next larger level, for `ordered` variables, rare variables are collapsed to the neighbouring class, whichever has fewer samples. In case both `no_collapse_above_prevalence` and `no_collapse_above_absolute` are given, the less strict threshold of the two will be used, i.e. if `no_collapse_above_prevalence` is 1 and `no_collapse_above_absolute` is 10 for a task with 100 samples, levels that are seen more than 10 times will not be collapsed.

Levels not seen during training are not touched during prediction; Therefore it is useful to combine this with the PipeOpFixFactors.

Format

R6Class object inheriting from PipeOpTaskPreprocSimple/PipeOpTaskPreproc/PipeOp.

Construction

```
PipeOpCollapseFactors$new(id = "collapsefactors", param_vals = list())
```

- id :: character(1)
  Identifier of resulting object, default "collapsefactors".
- param_vals :: named list
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default list().

Input and Output Channels

Input and output channels are inherited from PipeOpTaskPreproc.

The output is the input Task with rare affected factor and ordered feature levels collapsed.

State

The $state is a named list with the $state elements inherited from PipeOpTaskPreproc, as well as:

- collapse_map :: named list of named list of character
  List of factor level maps. For each factor, collapse_map contains a named list that indicates what levels of the input task get mapped to what levels of the output task. If collapse_map has an entry feat_1 with an entry a = c("x", "y"), it means that levels "x" and "y" get collapsed to level "a" in feature "feat_1".

Parameters

The parameters are the parameters inherited from PipeOpTaskPreproc, as well as:

- no_collapse_above_prevalence :: numeric(1)
  Fraction of samples below which factor levels get collapsed. Default is 1, which causes all levels to be collapsed until target_level_count remain.
- no_collapse_above_absolute :: integer(1)
  Number of samples below which factor levels get collapsed. Default is Inf, which causes all levels to be collapsed until target_level_count remain.
- target_level_count :: integer(1)
  Number of levels to retain. Default is 2.

Internals

Makes use of the fact that levels(fact_var) = list(target1 = c("source1", "source2"), target2 = "source2") causes renaming of level "source1" and "source2" both to "target1", and also "source2" to "target2".

Fields

Only fields inherited from PipeOp.

Methods

Only methods inherited from PipeOpTaskPreprocSimple/PipeOpTaskPreproc/PipeOp.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputeconstant, mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantile, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Examples

```
library("mlr3")
op = PipeOpCollapseFactors$new()

# Create example training task
df = data.frame(
  target = runif(100),
  fct = factor(rep(LETTERS[1:6], times = c(25, 30, 5, 15, 5, 20))),
  ord = factor(rep(1:6, times = c(20, 25, 30, 5, 5, 15)), ordered = TRUE)
)
task = TaskRegr$new(df, target = "target", id = "example_train")

# Training
train_task_collapsed = op$train(list(task))[[1]]
train_task_collapsed$levels(c("fct", "ord"))
```

```
# Create example prediction task
df_pred = data.frame(
  target = runif(7),
  fct = factor(LETTERS[1:7]),
  ord = factor(1:7, ordered = TRUE)
)
pred_task = TaskRegr$new(df_pred, target = "target", id = "example_pred")

# Prediction
pred_task_collapsed = op$predict(list(pred_task))[[1]]
pred_task_collapsed$levels(c("fct", "ord"))
```

`mlr_pipeops_colroles` *Change Column Roles of a Task*

Description

Changes the column roles of the input `Task` according to `new_role` or its inverse `new_role_direct`.

Setting a new target variable or changing the role of an existing target variable is not supported.

Format

`R6Class` object inheriting from `PipeOpTaskPreprocSimple`/`PipeOpTaskPreproc`/`PipeOp`.

Construction

```
PipeOpColRoles$new(id = "colroles", param_vals = list())
```

- `id` :: `character(1)`
  Identifier of resulting object, default `"colroles"`.
- `param_vals` :: named `list`
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from `PipeOpTaskPreproc`.

The output is the input `Task` with transformed column roles according to `new_role` or its inverse `new_role_direct`.

State

The `$state` is a named `list` with the `$state` elements inherited from `PipeOpTaskPreproc`.

Parameters

The parameters are the parameters inherited from PipeOpTaskPreproc, as well as:

- new_role :: named list
  Named list of new column roles by column. The names must match the column names of the input task that will later be trained/predicted on. Each entry of the list must contain a character vector with possible values of mlr_reflections$task_col_roles. If the value is given as character() or NULL, the column will be dropped from the input task. Changing the role of a column results in this column loosing its previous role(s).
- new_role_direct :: named list
  # Named list of new column roles by role. The names must match the possible column roles, i.e. values of mlr_reflections$task_col_roles. Each entry of the list must contain a character vector with column names of the input task that will later be trained/predicted on. If the value is given as character() or NULL, all columns will be dropped from the role given in the element name. The value given for a role overwrites the previous entry in task$col_roles for that role, completely.

Fields

Only fields inherited from PipeOp.

Methods

Only methods inherited from PipeOpTaskPreprocSimple/PipeOpTaskPreproc/PipeOp.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputeconstant, mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantile, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold,

mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Examples

```
library("mlr3")

task = tsk("penguins")
pop = po("colroles", param_vals = list(
  new_role = list(body_mass = c("order", "feature"))
))

train_out1 = pop$train(list(task))[[1L]]
train_out1$col_roles

pop$param_set$set_values(
 new_role = NULL,
 new_role_direct = list(order = character(), group = "island")
)

train_out2 = pop$train(list(train_out1))
train_out2$col_roles
```

---

mlr_pipeops_copy *Copy Input Multiple Times*

Description

Copies its input `outnum` times. This `PipeOp` usually not needed, because copying happens automatically when one `PipeOp` is followed by multiple different `PipeOp`s. However, when constructing big Graphs using the `%>>%`-operator, `PipeOpCopy` can be helpful to specify which `PipeOp` gets connected to which.

Format

`R6Class` object inheriting from `PipeOp`.

Construction

```
PipeOpCopy$new(outnum, id = "copy", param_vals = list())
```

- `outnum` :: `numeric(1)`
  Number of output channels, and therefore number of copies being made.
- `id` :: `character(1)`
  Identifier of resulting object, default `"copy"`.
- `param_vals` :: named `list`
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

PipeOpCopy has one input channel named "input", taking any input ("*") both during training and prediction.

PipeOpCopy has multiple output channels depending on the outnum construction argument, named "output1", "output2", ... All output channels produce the object given as input ("*").

State

The $state is left empty (list()).

Parameters

PipeOpCopy has no parameters.

Internals

Note that copies are not clones, but only reference copies. This affects R6-objects: If R6 objects are copied using PipeOpCopy, they must be cloned beforehand.

Fields

Only fields inherited from PipeOp.

Methods

Only methods inherited from PipeOp.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputeconstant, mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantile, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate,

mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Other Placeholder Pipeops: mlr_pipeops_nop

Examples

```
# The following copies the output of 'scale' automatically to both
# 'pca' and 'nop'
po("scale") %>>%
  gunion(list(
    po("pca"),
    po("nop")
  ))

# The following would not work: the '%>>%'-operator does not know
# which output to connect to which input
# > gunion(list(
# >   po("scale"),
# >   po("select")
# > )) %>>%
# >   gunion(list(
# >     po("pca"),
# >     po("nop"),
# >     po("imputemean")
# >   ))
# Instead, the 'copy' operator makes clear which output gets copied.
gunion(list(
  po("scale") %>>% po("copy", outnum = 2),
  po("select")
)) %>>%
  gunion(list(
    po("pca"),
    po("nop"),
    po("imputemean")
  ))
```

---

mlr_pipeops_datefeatures

Preprocess Date Features

Description

Based on `POSIXct`/`Date` columns of the data, a set of date related features is computed and added to the feature set of the output task. If no `POSIXct` or `Date` column is found, the original task is returned unaltered. This functionality is based on the `add_datepart()` and `add_cyclic_datepart()` functions from the **fastai** package. If operation on only particular `POSIXct`/`Date` columns is requested, use the `affect_columns` parameter inherited from PipeOpTaskPreprocSimple.

For `Date` columns, the features `"hour"`, `"minute"`, `"second"`, and `"is_day"` are skipped.

If cyclic = TRUE, cyclic features are computed for the features "month", "week_of_year", "day_of_year", "day_of_month", "day_of_week", "hour", "minute" and "second". This means that for each feature x, two additional features are computed, namely the sine and cosine transformation of 2 * pi * x / max_x (here max_x is the largest possible value the feature could take on + 1, assuming the lowest possible value is given by 0, e.g., for hours from 0 to 23, this is 24). This is useful to respect the cyclical nature of features such as seconds, i.e., second 21 and second 22 are one second apart, but so are second 60 and second 1 of the next minute.

Format

R6Class object inheriting from PipeOpTaskPreprocSimple/PipeOpTaskPreproc/PipeOp.

Construction

```
PipeOpDateFeatures$new(id = "datefeatures", param_vals = list())
```

- id :: character(1)
  Identifier of resulting object, default "datefeatures".
- param_vals :: named list
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default list().

Input and Output Channels

Input and output channels are inherited from PipeOpTaskPreproc.

The output is the input Task with date-related features computed and added to the feature set of the output task and the POSIXct columns of the data removed from the feature set (depending on the value of keep_date_var).

State

The $state is a named list with the $state elements inherited from PipeOpTaskPreproc.

Parameters

The parameters are the parameters inherited from PipeOpTaskPreproc, as well as:

- keep_date_var :: logical(1)
  Whether POSIXct columns should be kept as features. Initialized to FALSE.
- cyclic :: logical(1)
  Whether cyclic features should be computed. See Internals. Initialized to FALSE.
- year :: logical(1)
  Whether the year should be extracted as a feature. Initialized to TRUE.
- quarter :: logical(1)
  Whether the quarter should be extracted as a feature. Initialized to TRUE.
- month :: logical(1)
  Whether the month should be extracted as a feature. Initialized to TRUE.

- `week_of_year` :: `logical(1)`
  Whether the week of the year should be extracted as a feature. Initialized to `TRUE`.
- `day_of_year` :: `logical(1)`
  Whether the day of the year should be extracted as a feature. Initialized to `TRUE`.
- `day_of_month` :: `logical(1)`
  Whether the day of the month should be extracted as a feature. Initialized to `TRUE`.
- `day_of_week` :: `logical(1)`
  Whether the day of the week (ISO 8601) should be extracted as a feature. Initialized to `TRUE`.
- `hour` :: `logical(1)`
  Whether the hour should be extracted as a feature. Initialized to `TRUE`.
- `minute` :: `logical(1)`
  Whether the minute should be extracted as a feature. Initialized to `TRUE`.
- `second` :: `logical(1)`
  Whether the second should be extracted as a feature. Initialized to `TRUE`.
- `is_day` :: `logical(1)`
  Whether a feature indicating day time (06:00am - 08:00pm) should be extracted. Initialized to `TRUE`.
- `is_month_start` :: `logical(1)`
  Whether a feature indicating the first day of the month should be extracted. Initialized to `FALSE`.
- `is_month_end` :: `logical(1)`
  Whether a feature indicating the last day of the month should be extracted. Initialized to `FALSE`.
- `is_quarter_start` :: `logical(1)`
  Whether a feature indicating the first day of the quarter should be extracted. Initialized to `FALSE`.
- `is_quarter_end` :: `logical(1)`
  Whether a feature indicating the last day of the quarter should be extracted. Initialized to `FALSE`.
- `is_year_start` :: `logical(1)`
  Whether a feature indicating the first day of the year should be extracted. Initialized to `FALSE`.
- `is_year_end` :: `logical(1)`
  Whether a feature indicating the last day of the year should be extracted. Initialized to `FALSE`.
- `is_leap_year` :: `logical(1)`
  Whether a feature indicating a leap year should be extracted. Initialized to `FALSE`.

Internals

The cyclic feature transformation always assumes that values range from 0, so some values (e.g. day of the month) are shifted before sine/cosine transform.

Fields

Only fields inherited from `PipeOp`.

Methods

Only methods inherited from PipeOpTaskPreprocSimple/PipeOpTaskPreproc/PipeOp.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputeconstant, mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantile, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Examples

```
library("mlr3")
dat = iris
set.seed(1)
dat$date = sample(
  seq(as.POSIXct("2020-02-01"), to = as.POSIXct("2020-02-29"), by = "hour"), size = 150L
)
task = TaskClassif$new("iris_date", backend = dat, target = "Species")
pop = po("datefeatures", param_vals = list(cyclic = FALSE, minute = FALSE, second = FALSE))
pop$train(list(task))
pop$state
```

---

mlr_pipeops_decode *Reverse Factor Encoding*

Description

Reverses one-hot or treatment encoding of columns. It collapses multiple `numeric` or `integer` columns into one `factor` column based on a pre-specified grouping pattern of column names.

May be applied to multiple groups of columns, grouped by matching a common naming pattern. The grouping pattern is extracted to form the name of the newly derived `factor` column, and levels are constructed from the previous column names, with parts matching the grouping pattern removed (see examples). The level per row of the new factor column is generally determined as the name of the column with the maximum value in the group.

Format

`R6Class` object inheriting from `PipeOpTaskPreprocSimple`/`PipeOpTaskPreproc`/`PipeOp`.

Construction

```
PipeOpEncode$new(id = "decode", param_vals = list())
```

- `id` :: `character(1)`
  Identifier of resulting object, default `"decode"`.
- `param_vals` :: named `list`
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from `PipeOpTaskPreproc`.

The output is the input `Task` with encoding columns collapsed into new decoded columns.

State

The `$state` is a named `list` with the `$state` elements inherited from `PipeOpTaskPreproc`, as well as:

- `colmaps` :: named `list`
  Named list of named character vectors. Each element is named according to the new column name extracted by `group_pattern`. Each vector contains the level names for the new factor column that should be created, named by the corresponding old column name. If `treatment_encoding` is `TRUE`, then each vector also contains `ref_name` as the reference class with an empty string as name.
- `treatment_encoding` :: `logical(1)`
  Value of `treatment_encoding` hyperparameter.
- `cutoff` :: `numeric(1)`
  Value of `treatment_encoding` hyperparameter, or `0` if that is not given.
- `ties_method` :: `character(1)`
  Value of `ties_method` hyperparameter.

Parameters

The parameters are the parameters inherited from PipeOpTaskPreproc, as well as:

- group_pattern :: character(1)
  A regular expression to be applied to column names. Should contain a capturing group for the new column name, and match everything that should not be interpreted as the new factor levels (which are constructed as the difference between column names and what group_pattern matches). If set to "", all columns matching the group_pattern are collapsed into one factor column called pipeop.decoded. Use PipeOpRenameColumns to rename this column. Initialized to "^([^.]+)\\.", which would extract everything up to the first dot as the new column name and construct new levels as everything after the first dot.
- treatment_encoding :: logical(1)
  If TRUE, treatment encoding is assumed instead of one-hot encoding. Initialized to FALSE.
- treatment_cutoff :: numeric(1)
  If treatment_encoding is TRUE, specifies a cutoff value for identifying the reference level. The reference level is set to ref_name in rows where the value is less than or equal to a specified cutoff value (e.g., 0) in all columns in that group. Default is 0.
- ref_name :: character(1)
  If treatment_encoding is TRUE, specifies the name for reference levels. Default is "ref".
- ties_method :: character(1)
  Method for resolving ties if multiple columns have the same value. Specifies the value from which of the columns with the same value is to be picked. Options are "first", "last", or "random". Initialized to "random".

Fields

Only fields inherited from PipeOp.

Methods

Only methods inherited from PipeOpTaskPreprocSimple/PipeOpTaskPreproc/PipeOp.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputeconstant, mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantile, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply,

mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Examples

```
library("mlr3")

# Reverse one-hot encoding
df = data.frame(
  target = runif(4),
  x.1 = rep(c(1, 0), 2),
  x.2 = rep(c(0, 1), 2),
  y.1 = rep(c(1, 0), 2),
  y.2 = rep(c(0, 1), 2),
  a = runif(4)
)
task_one_hot = TaskRegr$new(id = "example", backend = df, target = "target")

pop = po("decode")

train_out = pop$train(list(task_one_hot))[[1]]
# x.1 and x.2 are collapsed into x, same for y; a is ignored.
train_out$data()

# Reverse treatment encoding from PipeOpEncode
df = data.frame(
  target = runif(6),
  fct = factor(rep(c("a", "b", "c"), 2))
)
task = TaskRegr$new(id = "example", backend = df, target = "target")

po_enc = po("encode", method = "treatment")
task_encoded = po_enc$train(list(task))[[1]]
task_encoded$data()

po_dec = po("decode", treatment_encoding = TRUE)
task_decoded = pop$train(list(task))[[1]]
# x.1 and x.2 are collapsed into x. All rows where all values
# are smaller or equal to 0, the level is set to the reference level.
task_decoded$data()

# Different group_pattern
df = data.frame(
  target = runif(4),
```

```
  x_1 = rep(c(1, 0), 2),
  x_2 = rep(c(0, 1), 2),
  y_1 = rep(c(2, 0), 2),
  y_2 = rep(c(0, 1), 2)
)
task = TaskRegr$new(id = "example", backend = df, target = "target")

# Grouped by first underscore
pop = po("decode", group_pattern = "^([^_]+)\\_")
train_out = pop$train(list(task))[[1]]
# x_1 and x_2 are collapsed into x, same for y
train_out$data()

# Empty string to collapse all matches into one factor column.
pop$param_set$set_values(group_pattern = "")
train_out = pop$train(list(task))[[1]]
# All columns are combined into a single column.
# The level for each row is determined by the column with the largest value in that row.
# By default, ties are resolved randomly.
train_out$data()
```

`mlr_pipeops_encode` *Factor Encoding*

Description

Encodes columns of type `factor` and `ordered`.

Possible encodings are `"one-hot"` encoding, as well as encoding according to `stats::contr.helmert()`, `stats::contr.poly()`, `stats::contr.sum()` and `stats::contr.treatment()`. Newly created columns are named via pattern `[column-name].[x]` where `x` is the respective factor level for `"one-hot"` and `"treatment"` encoding, and an integer sequence otherwise.

Use the `PipeOpTaskPreproc` `$affect_columns` functionality to only encode a subset of columns, or only encode columns of a certain type.

`character`-type features can be encoded by converting them `factor` features first, using `ppl("convert_types", "character", "factor")`.

Format

`R6Class` object inheriting from `PipeOpTaskPreprocSimple`/`PipeOpTaskPreproc`/`PipeOp`.

Construction

```
PipeOpEncode$new(id = "encode", param_vals = list())
```

- `id` :: `character(1)`
  Identifier of resulting object, default `"encode"`.
- `param_vals` :: named `list`
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from PipeOpTaskPreproc.

The output is the input Task with all affected factor and ordered columns encoded according to the method parameter.

State

The $state is a named list with the $state elements inherited from PipeOpTaskPreproc, as well as:

- contrasts :: named list of matrix
  List of contrast matrices, one for each affected discrete feature. The rows of each matrix correspond to (training task) levels, the columns to the new columns that replace the old discrete feature. See stats::contrasts.

Parameters

The parameters are the parameters inherited from PipeOpTaskPreproc, as well as:

- method :: character(1)
  Initialized to "one-hot". One of:
  - "one-hot": create a new column for each factor level.
  - "treatment": create $n-1$ columns leaving out the first factor level of each factor variable (see stats::contr.treatment()).
  - "helmert": create columns according to Helmert contrasts (see stats::contr.helmert()).
  - "poly": create columns with contrasts based on orthogonal polynomials (see stats::contr.poly()).
  - "sum": create columns with contrasts summing to zero, (see stats::contr.sum()).

Internals

Uses the stats::contrasts functions. This is relatively inefficient for features with a large number of levels.

Fields

Only fields inherited from PipeOp.

Methods

Only methods inherited from PipeOpTaskPreprocSimple/PipeOpTaskPreproc/PipeOp.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply,

mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputeconstant, mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantile, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Examples

```
library("mlr3")

data = data.table::data.table(x = factor(letters[1:3]), y = factor(letters[1:3]))
task = TaskClassif$new("task", data, "x")

poe = po("encode")

# poe is initialized with encoding: "one-hot"
poe$train(list(task))[[1]]$data()

# other kinds of encoding:
poe$param_set$values$method = "treatment"
poe$train(list(task))[[1]]$data()

poe$param_set$values$method = "helmert"
poe$train(list(task))[[1]]$data()

poe$param_set$values$method = "poly"
poe$train(list(task))[[1]]$data()

poe$param_set$values$method = "sum"
poe$train(list(task))[[1]]$data()

# converting character-columns
data_chr = data.table::data.table(x = factor(letters[1:3]), y = letters[1:3])
task_chr = TaskClassif$new("task_chr", data_chr, "x")

goe = ppl("convert_types", "character", "factor") %>>% po("encode")

goe$train(task_chr)[[1]]$data()
```

`mlr_pipeops_encodeimpact`

Conditional Target Value Impact Encoding

Description

Encodes columns of type `factor`, `character` and `ordered`.

Impact coding for classification Tasks converts factor levels of each (factorial) column to the difference between each target level's conditional log-likelihood given this level, and the target level's global log-likelihood.

Impact coding for regression Tasks converts factor levels of each (factorial) column to the difference between the target's conditional mean given this level, and the target's global mean.

Treats new levels during prediction like missing values.

Format

`R6Class` object inheriting from `PipeOpTaskPreprocSimple`/`PipeOpTaskPreproc`/`PipeOp`.

Construction

```
PipeOpEncodeImpact$new(id = "encodeimpact", param_vals = list())
```

- `id` :: `character(1)`
  Identifier of resulting object, default `"encodeimpact"`.
- `param_vals` :: named `list`
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from `PipeOpTaskPreproc`. Instead of a `Task`, a `TaskSupervised` is used as input and output during training and prediction.

The output is the input `Task` with all affected `factor`, `character` or `ordered` parameters encoded.

State

The `$state` is a named `list` with the `$state` elements inherited from `PipeOpTaskPreproc`, as well as:

- `impact` :: a named `list`
  A list with an element for each affected feature:
  For regression each element is a single column matrix of impact values for each level of that feature.
  For classification, it is a list with an element for each *feature level*, which is a vector giving the impact of this feature level on each *outcome level*.

Parameters

The parameters are the parameters inherited from PipeOpTaskPreproc, as well as:

- smoothing :: numeric(1)
  A finite positive value used for smoothing. Mostly relevant for classification Tasks if a factor does not coincide with a target factor level (and would otherwise give an infinite logit value). Initialized to 1e-4.
- impute_zero :: logical(1)
  If TRUE, impute missing values as impact 0; otherwise the respective impact is coded as NA. Default FALSE.

Internals

Uses Laplace smoothing, mostly to avoid infinite values for classification Task.

Fields

Only fields inherited from PipeOp.

Methods

Only methods inherited PipeOpTaskPreprocSimple/PipeOpTaskPreproc/PipeOp.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputeconstant, mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantile, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Examples

```
library("mlr3")
poe = po("encodeimpact")

task = TaskClassif$new("task",
  data.table::data.table(
    x = factor(c("a", "a", "a", "b", "b")),
    y = factor(c("a", "a", "b", "b", "b"))),
  "x")

poe$train(list(task))[[1]]$data()

poe$state
```

`mlr_pipeops_encodelmer`

Impact Encoding with Random Intercept Models

Description

Encodes columns of type `factor`, `character` and `ordered`.

`PipeOpEncodeLmer` converts factor levels of each factorial column to the estimated coefficients of a simple random intercept model. Models are fitted with the glmer function of the lme4 package and are of the type `target ~ 1 + (1 | factor)`. If the task is a regression task, the numeric target variable is used as dependent variable and the factor is used for grouping. If the task is a classification task, the target variable is used as dependent variable and the factor is used for grouping. If the target variable is multiclass, for each level of the multiclass target variable, binary "one vs. rest" models are fitted.

For training, multiple models can be estimated in a cross-validation scheme to ensure that the same factor level does not always result in identical values in the converted numerical feature. For prediction, a global model (which was fitted on all observations during training) is used for each factor. New factor levels are converted to the value of the intercept coefficient of the global model for prediction. NAs are ignored by the CPO.

Use the `PipeOpTaskPreproc` `$affect_columns` functionality to only encode a subset of columns, or only encode columns of a certain type.

Format

`R6Class` object inheriting from `PipeOpTaskPreprocSimple`/`PipeOpTaskPreproc`/`PipeOp`.

Construction

```
PipeOpEncodeLmer$new(id = "encodelmer", param_vals = list())
```

- `id` :: `character(1)`
  Identifier of resulting object, default `"encodelmer"`.

- `param_vals` :: named `list`
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from `PipeOpTaskPreproc`. Instead of a `Task`, a `TaskSupervised` is used as input and output during training and prediction.

The output is the input `Task` with all affected `factor`, `character` or `ordered` parameters encoded according to the `method` parameter.

State

The `$state` is a named `list` with the `$state` elements inherited from `PipeOpTaskPreproc`, as well as:

- `target_levels` :: `character`
  Levels of the target columns.
- `control` :: a named `list`
  List of coefficients learned via `glmer`.

Parameters

The parameters are the parameters inherited from `PipeOpTaskPreproc`, as well as:

- `fast_optim` :: `logical(1)`
  If `fast_optim` is `TRUE` (default), a faster (up to 50 percent) optimizer from the `nloptr` package is used when fitting the lmer models. This uses additional stopping criteria which can give suboptimal results. Initialized to `TRUE`.

Internals

Uses the `lme4::glmer`. This is relatively inefficient for features with a large number of levels.

Fields

Only fields inherited from `PipeOp`.

Methods

Only methods inherited `PipeOpTaskPreprocSimple`/`PipeOpTaskPreproc`/`PipeOp`.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: `PipeOp`, `PipeOpEncodePL`, `PipeOpEnsemble`, `PipeOpImpute`, `PipeOpTargetTrafo`, `PipeOpTaskPreproc`, `PipeOpTaskPreprocSimple`, `mlr_pipeops`, `mlr_pipeops_adas`, `mlr_pipeops_blsmote`, `mlr_pipeops_boxcox`, `mlr_pipeops_branch`, `mlr_pipeops_chunk`, `mlr_pipeops_classbalancing`, `mlr_pipeops_classifavg`, `mlr_pipeops_classweights`, `mlr_pipeops_classweightsex`, `mlr_pipeops_colapply`, `mlr_pipeops_collapsefactors`, `mlr_pipeops_colroles`, `mlr_pipeops_copy`, `mlr_pipeops_datefeatures`,

mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputeconstant, mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantile, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Examples

```
library("mlr3")
poe = po("encodelmer")

task = TaskClassif$new("task",
  data.table::data.table(
    x = factor(c("a", "a", "a", "b", "b")),
    y = factor(c("a", "a", "b", "b", "b"))),
  "x")

poe$train(list(task))[[1]]$data()

poe$state
```

---

mlr_pipeops_encodeplquantiles

Piecewise Linear Encoding using Quantiles

Description

Encodes `numeric` and `integer` feature columns using piecewise lienar encoding. For details, see documentation of `PipeOpEncodePL` or Gorishniy et al. (2022).

Bins are constructed by taking the quantiles of the respective feature column as bin boundaries. The first and last boundaries are set to the minimum and maximum value of the feature, respectively. The number of bins can be controlled with the `numsplits` hyperparameter. Affected feature columns may contain `NA`s. These are ignored when calculating quantiles.

Format

R6Class object inheriting from PipeOpEncodePL/PipeOpTaskPreprocSimple/PipeOpTaskPreproc/PipeOp.

Construction

```
PipeOpEncodePLQuantiles$new(id = "encodeplquantiles", param_vals = list())
```

- id :: character(1)
  Identifier of resulting object, default "encodeplquantiles".
- param_vals :: named list
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default list().

Input and Output Channels

Input and output channels are inherited from PipeOpTaskPreproc.

The output is the input Task with all affected numeric and integer columns encoded using piecewise linear encoding with bins being derived from the quantiles of the respective original feature column.

State

The $state is a named list with the $state elements inherited from PipeOpEncodePL/PipeOpTaskPreproc.

Parameters

The parameters are the parameters inherited from PipeOpTaskPreproc, as well as:

- numsplits :: integer(1)
  Number of bins to create. Initialized to 2.
- type :: integer(1)
  Method used to calculate sample quantiles. See help of stats::quantile. Default is 7.

Internals

This overloads the private$.get_bins() method of PipeOpEncodePL and uses the stats::quantile function to derive the bins used for piecewise linear encoding.

Fields

Only fields inherited from PipeOp.

Methods

Only methods inherited from PipeOpEncodePL/PipeOpTaskPreproc/PipeOp.

References

Gorishniy Y, Rubachev I, Babenko A (2022). "On Embeddings for Numerical Features in Tabular Deep Learning." In *Advances in Neural Information Processing Systems*, volume 35, 24991–25004. https://proceedings.neurips.cc/paper_files/paper/2022/hash/9e9f0ffc3d836836ca96cbf8fe14b105-Abstrac html.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputeconstant, mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantile mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Other Piecewise Linear Encoding PipeOps: PipeOpEncodePL, mlr_pipeops_encodepltree

Examples

```
library(mlr3)

task = tsk("iris")$select(c("Petal.Width", "Petal.Length"))
pop = po("encodeplquantiles")

train_out = pop$train(list(task))[[1L]]
# Calculated bin boundaries per feature
pop$state$bins
# Each feature was split into two encoded features using piecewise linear encoding
train_out$head()

# Prediction works the same as training, using the bins learned during training
predict_out = pop$predict(list(task))[[1L]]
predict_out$head()
```

```
# Binning into three bins per feature
# Using the nearest even order statistic for caluclating quantiles
pop$param_set$set_values(numsplits = 4, type = 3)

train_out = pop$train(list(task))[[1L]]
# Calculated bin boundaries per feature
pop$state$bins
# Each feature was split into three encoded features using
# piecewise linear encoding
train_out$head()
```

`mlr_pipeops_encodepltree`

Piecewise Linear Encoding using Decision Trees

Description

Encodes `numeric` and `integer` feature columns using piecewise lienar encoding. For details, see documentation of `PipeOpEncodePL` or Gorishniy et al. (2022).

Bins are constructed by trainig one decision tree `Learner` per feature column, taking the target column into account, and using decision boundaries as bin boundaries.

Format

`R6Class` object inheriting from `PipeOpEncodePL`/`PipeOpTaskPreprocSimple`/`PipeOpTaskPreproc`/`PipeOp`.

Construction

```
PipeOpEncodePLTree$new(task_type, id = "encodepltree", param_vals = list())
```

- `task_type` :: `character(1)`
  The class of `Task` that should be accepted as input, given as a `character(1)`. This is used to construct the appropriate `Learner` to be used for obtaining the bins for piecewise linear encoding. Supported options are `"TaskClassif"`for `LearnerClassifRpart` or `"TaskRegr"`for `LearnerRegrRpart`.
- `id` :: `character(1)`
  Identifier of resulting object, default `"encodeplquantiles"`.
- `param_vals` :: named `list`
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from PipeOpTaskPreproc. Instead of a Task, a TaskClassif or TaskRegr is used as input and output during training and prediction, depending on the task_type construction argument.

The output is the input Task with all affected numeric and integer columns encoded using piecewise linear encoding with bins being derived from a decision tree Learner trained on the respective feature column.

State

The $state is a named list with the $state elements inherited from PipeOpEncodePL/PipeOpTaskPreproc.

Parameters

The parameters are the parameters inherited from PipeOpTaskPreproc, as well as the parameters of the Learner used for obtaining the bins for piecewise linear encoding.

Internals

This overloads the private$.get_bins() method of PipeOpEncodePL. To derive the bins for each feature, the Task is split into smaller Tasks with only the target and respective feature as columns. On these Tasks either a LearnerClassifRpart or LearnerRegrRpart gets trained and the respective splits extracted as bin boundaries used for piecewise linear encodings.

Fields

Only fields inherited from PipeOp.

Methods

Only methods inherited from PipeOpEncodePL/PipeOpTaskPreproc/PipeOp.

References

Gorishniy Y, Rubachev I, Babenko A (2022). "On Embeddings for Numerical Features in Tabular Deep Learning." In *Advances in Neural Information Processing Systems*, volume 35, 24991–25004. https://proceedings.neurips.cc/paper_files/paper/2022/hash/9e9f0ffc3d836836ca96cbf8fe14b105-Abstrac html.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors,

mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputeconstant, mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantile, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Other Piecewise Linear Encoding PipeOps: PipeOpEncodePL, mlr_pipeops_encodeplquantiles

Examples

```
library(mlr3)

# For classification task
task = tsk("iris")$select(c("Petal.Width", "Petal.Length"))
pop = po("encodepltree", task_type = "TaskClassif")
train_out = pop$train(list(task))[[1L]]

# Calculated bin boundaries per feature
pop$state$bins
# Each feature was split into three encoded features using piecewise linear encoding
train_out$head()

# Prediction works the same as training, using the bins learned during training
predict_out = pop$predict(list(task))[[1L]]
predict_out$head()

# Controlling behavior of the tree learner, here: setting minimum number of
# observations per node for a split to be attempted
pop$param_set$set_values(minsplit = 5)

train_out = pop$train(list(task))[[1L]]
# feature "hp" now gets split into five encoded features instead of three
pop$state$bins
train_out$head()

# For regression task
task = tsk("mtcars")$select(c("cyl", "hp"))
pop = po("encodepltree", task_type = "TaskRegr")
train_out = pop$train(list(task))[[1L]]

# Calculated bin boundaries per feature
pop$state$bins
```

```
# First feature was split into three encoded features,
# second into two, using piecewise linear encoding
train_out$head()
```

`mlr_pipeops_featureunion`

Aggregate Features from Multiple Inputs

Description

Aggregates features from all input tasks by `cbind()`ing them together into a single `Task`.

`DataBackend` primary keys and `Task` targets have to be equal across all `Task`s. Only the target column(s) of the first `Task` are kept.

If `assert_targets_equal` is `TRUE` then target column names are compared and an error is thrown if they differ across inputs.

If input tasks share some feature names but these features are not identical an error is thrown. This check is performed by first comparing the features names and if duplicates are found, also the values of these possibly duplicated features. True duplicated features are only added a single time to the output task.

Format

`R6Class` object inheriting from `PipeOp`.

Construction

```
PipeOpFeatureUnion$new(innum = 0, collect_multiplicity = FALSE, id = "featureunion", param_vals = list(
  assert_targets_equal = TRUE)
```

- `innum` :: `numeric(1)` | `character`
  Determines the number of input channels. If `innum` is 0 (default), a vararg input channel is created that can take an arbitrary number of inputs. If `innum` is a `character` vector, the number of input channels is the length of `innum`, and the columns of the result are prefixed with the values.
- `collect_multiplicity` :: `logical(1)`
  If `TRUE`, the input is a `Multiplicity` collecting channel. This means, a `Multiplicity` input, instead of multiple normal inputs, is accepted and the members are aggregated. This requires `innum` to be 0. Default is `FALSE`.
- `id` :: `character(1)`
  Identifier of the resulting object, default `"featureunion"`.
- `param_vals` :: named `list`
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.
- `assert_targets_equal` :: `logical(1)`
  If `assert_targets_equal` is `TRUE` (Default), task target column names are checked for agreement. Disagreeing target column names are usually a bug, so this should often be left at the default.

Input and Output Channels

PipeOpFeatureUnion has multiple input channels depending on the innum construction argument, named "input1", "input2", ... if innum is nonzero; if innum is 0, there is only one *vararg* input channel named "...". All input channels take a Task both during training and prediction.

PipeOpFeatureUnion has one output channel named "output", producing a Task both during training and prediction.

The output is a Task constructed by cbind()ing all features from all input Tasks, both during training and prediction.

State

The $state is left empty (list()).

Parameters

PipeOpFeatureUnion has no Parameters.

Internals

PipeOpFeatureUnion uses the Task $cbind() method to bind the input values beyond the first input to the first Task. This means if the Tasks are database-backed, all of them except the first will be fetched into R memory for this. This behaviour may change in the future.

Fields

Only fields inherited from PipeOp.

Methods

Only methods inherited from PipeOp.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputeconstant, mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantile, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy,

mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Other Multiplicity PipeOps: Multiplicity(), PipeOpEnsemble, mlr_pipeops_classifavg, mlr_pipeops_multiplicity mlr_pipeops_multiplicityimply, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_regravg, mlr_pipeops_replicate

Examples

```
library("mlr3")

task1 = tsk("iris")
gr = gunion(list(
  po("nop"),
  po("pca")
)) %>>% po("featureunion")

gr$train(task1)

task2 = tsk("iris")
task3 = tsk("iris")
po = po("featureunion", innum = c("a", "b"))

po$train(list(task2, task3))
```

---

mlr_pipeops_filter *Feature Filtering*

Description

Feature filtering using a mlr3filters::Filter object, see the **mlr3filters** package.

If a Filter can only operate on a subset of columns based on column type, then only these features are considered and filtered. nfeat and frac will count for the features of the type that the Filter can operate on; this means e.g. that setting nfeat to 0 will only remove features of the type that the Filter can work with.

Format

R6Class object inheriting from PipeOpTaskPreprocSimple/PipeOpTaskPreproc/PipeOp.

Construction

```
PipeOpFilter$new(filter, id = filter$id, param_vals = list())
```

- `filter` :: `Filter`
  `Filter` used for feature filtering. This argument is always cloned; to access the `Filter` inside `PipeOpFilter` by-reference, use `$filter`.

- `id` :: `character(1)`
  Identifier of the resulting object, defaulting to the `id` of the `Filter` being used.
- `param_vals` :: named `list`
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from `PipeOpTaskPreproc`.

The output is the input `Task` with features removed that were filtered out.

State

The `$state` is a named `list` with the `$state` elements inherited from `PipeOpTaskPreproc`, as well as:

- `scores` :: named `numeric`
  Scores calculated for all features of the training `Task` which are being used as cutoff for feature filtering. If `frac` or `nfeat` is given, the underlying `Filter` may choose to not calculate scores for all features that are given. This only includes features on which the `Filter` can operate; e.g. if the `Filter` can only operate on numeric features, then scores for factorial features will not be given.
- `features` :: `character`
  Names of features that are being kept. Features of types that the `Filter` can not operate on are always being kept.

Parameters

The parameters are the parameters inherited from the `PipeOpTaskPreproc`, as well as the parameters of the `Filter` used by this object. Besides, parameters introduced are:

- `filter.nfeat` :: `numeric(1)`
  Number of features to select. Mutually exclusive with `frac`, `cutoff`, and `permuted`.
- `filter.frac` :: `numeric(1)`
  Fraction of features to keep. Mutually exclusive with `nfeat`, `cutoff`, and `permuted`.
- `filter.cutoff` :: `numeric(1)`
  Minimum value of filter heuristic for which to keep features. Mutually exclusive with `nfeat`, `frac`, and `permuted`.

- `filter.permuted` :: `integer(1)`
  If this parameter is set, a random permutation of each feature is added to the task before applying the filter. All features selected before the `permuted`-th permuted features is selected are kept. This is similar to the approach in Wu (2007) and Thomas (2017). Mutually exclusive with `nfeat`, `frac`, and `cutoff`.

Note that at least one of `filter.nfeat`, `filter.frac`, `filter.cutoff`, and `filter.permuted` must be given.

Internals

This does *not* use the `$.select_cols` feature of `PipeOpTaskPreproc` to select only features compatible with the `Filter`; instead the whole `Task` is used by `private$.get_state()` and subset internally.

Fields

Fields inherited from `PipeOp`, as well as:

- `filter` :: `Filter`
  `Filter` that is being used for feature filtering. Do *not* use this slot to get to the feature filtering scores after training; instead, use `$state$scores`. Read-only.

Methods

Methods inherited from `PipeOpTaskPreprocSimple`/`PipeOpTaskPreproc`/`PipeOp`.

References

Wu Y, Boos DD, Stefanski LA (2007). "Controlling Variable Selection by the Addition of Pseudovariables." *Journal of the American Statistical Association*, **102**(477), 235–243. doi:10.1198/016214506000000843.

Thomas J, Hepp T, Mayr A, Bischl B (2017). "Probing for Sparse and Fast Variable Selection with Model-Based Boosting." *Computational and Mathematical Methods in Medicine*, **2017**, 1–8. doi:10.1155/2017/1421409.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: `PipeOp`, `PipeOpEncodePL`, `PipeOpEnsemble`, `PipeOpImpute`, `PipeOpTargetTrafo`, `PipeOpTaskPreproc`, `PipeOpTaskPreprocSimple`, `mlr_pipeops`, `mlr_pipeops_adas`, `mlr_pipeops_blsmote`, `mlr_pipeops_boxcox`, `mlr_pipeops_branch`, `mlr_pipeops_chunk`, `mlr_pipeops_classbalancing`, `mlr_pipeops_classifavg`, `mlr_pipeops_classweights`, `mlr_pipeops_classweightsex`, `mlr_pipeops_colapply`, `mlr_pipeops_collapsefactors`, `mlr_pipeops_colroles`, `mlr_pipeops_copy`, `mlr_pipeops_datefeatures`, `mlr_pipeops_decode`, `mlr_pipeops_encode`, `mlr_pipeops_encodeimpact`, `mlr_pipeops_encodelmer`, `mlr_pipeops_encodeplquantiles`, `mlr_pipeops_encodepltree`, `mlr_pipeops_featureunion`, `mlr_pipeops_fixfactors`, `mlr_pipeops_histbin`, `mlr_pipeops_ica`, `mlr_pipeops_imputeconstant`, `mlr_pipeops_imputehist`, `mlr_pipeops_imputelearner`, `mlr_pipeops_imputemean`, `mlr_pipeops_imputemedian`, `mlr_pipeops_imputemode`, `mlr_pipeops_imputeoor`, `mlr_pipeops_imputesample`, `mlr_pipeops_info`, `mlr_pipeops_isomap`, `mlr_pipeops_kernelpca`, `mlr_pipeops_learner`, `mlr_pipeops_learner_pi_cvplus`,

mlr_pipeops_learner_quantiles, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Examples

```
library("mlr3")
library("mlr3filters")


# setup PipeOpFilter to keep the 5 most important
# features of the spam task w.r.t. their AUC
task = tsk("spam")
filter = flt("auc")
po = po("filter", filter = filter)
po$param_set
po$param_set$values$filter.nfeat = 5

# filter the task
filtered_task = po$train(list(task))[[1]]

# filtered task + extracted AUC scores
filtered_task$feature_names
head(po$state$scores, 10)

# feature selection embedded in a 3-fold cross validation
# keep 30% of features based on their AUC score
task = tsk("spam")
gr = po("filter", filter = flt("auc"), filter.frac = 0.5) %>>%
  po("learner", lrn("classif.rpart"))
learner = GraphLearner$new(gr)
rr = resample(task, learner, rsmp("holdout"), store_models = TRUE)
rr$learners[[1]]$model$auc$scores
```

---

mlr_pipeops_fixfactors

Fix Factor Levels

Description

Fixes factors of type `factor`, `ordered`: Makes sure the factor levels during prediction are the same as during training; possibly dropping empty training factor levels before.

Note this may introduce *missing values* during prediction if unseen factor levels are found.

Format

`R6Class` object inheriting from `PipeOpTaskPreprocSimple`/`PipeOpTaskPreproc`/`PipeOp`.

Construction

```
PipeOpFixFactors$new(id = "fixfactors", param_vals = list())
```

- `id` :: `character(1)`
  Identifier of resulting object, default `"fixfactors"`.
- `param_vals` :: named `list`
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from `PipeOpTaskPreproc`.

The output is the input `Task` with all affected `factor` and `ordered` feature levels fixed.

State

The `$state` is a named `list` with the `$state` elements inherited from `PipeOpTaskPreproc`, as well as:

- `levels` :: named `list` of `character`
  List of factor levels of each affected `factor` or `ordered` feature that will be fixed.

Parameters

The parameters are the parameters inherited from `PipeOpTaskPreproc`, as well as:

- `droplevels` :: `logical(1)`
  Whether to drop empty factor levels of the training task. Default `TRUE`

Internals

Changes factor levels of columns and attaches them with a new `data.table` backend and the virtual `cbind()` backend.

Fields

Only fields inherited from `PipeOp`.

Methods

Only methods inherited from PipeOpTaskPreprocSimple/PipeOpTaskPreproc/PipeOp.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputeconstant, mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantiles, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Examples

```
library("mlr3")

# Reduced task with no entries for the installment_rate < 20 is defined
task = tsk("german_credit")
rows = task$row_ids[task$data()[, installment_rate != "< 20"]]
reduced_task = task$clone(deep = TRUE)$filter(rows)
levels(reduced_task$data()$installment_rate)

# PipeOp is trained on the reduced task
po = po("fixfactors")
processed_task = preproc(reduced_task, po)
levels(processed_task$data()$installment_rate)
summary(processed_task$data()$installment_rate)

predicted_task = preproc(task, po, predict = TRUE)

# Predictions are made on the task without any missing data
levels(predicted_task$data()$installment_rate)
summary(predicted_task$data()$installment_rate)
```

`mlr_pipeops_histbin` *Split Numeric Features into Equally Spaced Bins*

Description

Splits numeric features into equally spaced bins. See `graphics::hist()` for details. Values that fall out of the training data range during prediction are binned with the lowest / highest bin respectively.

Format

`R6Class` object inheriting from `PipeOpTaskPreprocSimple`/`PipeOpTaskPreproc`/`PipeOp`.

Construction

```
PipeOpHistBin$new(id = "histbin", param_vals = list())
```

- `id` :: `character(1)`
  Identifier of resulting object, default `"histbin"`.
- `param_vals` :: named `list`
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from `PipeOpTaskPreproc`.

The output is the input `Task` with all affected numeric features replaced by their binned versions.

State

The `$state` is a named `list` with the `$state` elements inherited from `PipeOpTaskPreproc`, as well as:

- `breaks` :: `list`
  List of intervals representing the bins for each numeric feature.

Parameters

The parameters are the parameters inherited from `PipeOpTaskPreproc`, as well as:

- `breaks` :: `character(1)` | `numeric` | `function`
  Either a `character(1)` string naming an algorithm to compute the number of cells, a `numeric(1)` giving the number of breaks for the histogram, a vector `numeric` giving the breakpoints between the histogram cells, or a `function` to compute the vector of breakpoints or to compute the number of cells. Default is algorithm `"Sturges"` (see `grDevices::nclass.Sturges()`). For details see `hist()`.

Internals

Uses the `graphics::hist` function.

Fields

Only fields inherited from PipeOp.

Methods

Only methods inherited from PipeOpTaskPreprocSimple/PipeOpTaskPreproc/PipeOp.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_ica, mlr_pipeops_imputeconstant, mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantiles, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Examples

```
library("mlr3")

task = tsk("iris")
pop = po("histbin")

task$data()
pop$train(list(task))[[1]]$data()

pop$state
```

`mlr_pipeops_ica` *Independent Component Analysis*

Description

Extracts statistically independent components from data. Only affects numerical features. See fastICA::fastICA for details.

Format

`R6Class` object inheriting from `PipeOpTaskPreproc`/`PipeOp`.

Construction

```
PipeOpICA$new(id = "ica", param_vals = list())
```

- `id` :: `character(1)`
  Identifier of resulting object, default `"ica"`.
- `param_vals` :: named `list`
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from `PipeOpTaskPreproc`.

The output is the input `Task` with all affected numeric parameters replaced by independent components.

State

The `$state` is a named `list` with the `$state` elements inherited from `PipeOpTaskPreproc`, as well as the elements of the function `fastICA::fastICA()`, with the exception of the `$X` and `$S` slots. These are in particular:

- `K` :: `matrix`
  Matrix that projects data onto the first `n.comp` principal components. See `fastICA()`.
- `W` :: `matrix`
  Estimated un-mixing matrix. See `fastICA()`.
- `A` :: `matrix`
  Estimated mixing matrix. See `fastICA()`.
- `center` :: `numeric`
  The mean of each numeric feature during training.

Parameters

The parameters are the parameters inherited from PipeOpTaskPreproc, as well as the following parameters based on fastICA():

- n.comp :: numeric(1)
  Number of components to extract. Default is NULL, which sets it to the number of available numeric columns.
- alg.typ:: character(1)
  Algorithm type. One of "parallel" (default) or "deflation".
- fun :: character(1)
  One of "logcosh" (default) or "exp".
- alpha :: numeric(1)
  In range [1, 2], Used for negentropy calculation when fun is "logcosh". Default is 1.0.
- method :: character(1)
  Internal calculation method. "C" (default) or "R". See fastICA().
- row.norm :: logical(1)
  Logical value indicating whether rows should be standardized beforehand. Default is FALSE.
- maxit :: numeric(1)
  Maximum number of iterations. Default is 200.
- tol :: numeric(1)
  Tolerance for convergence, default is 1e-4.
- verbose logical(1)
  Logical value indicating the level of output during the run of the algorithm. Default is FALSE.
- w.init:: matrix
  Initial un-mixing matrix. See fastICA(). Default is NULL.

Internals

Uses the fastICA() function.

Fields

Only fields inherited from PipeOp.

Methods

Only methods inherited from PipeOpTaskPreproc/PipeOp.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures,

mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_imputeconstant, mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantiles, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Examples

```
library("mlr3")

task = tsk("iris")
pop = po("ica")

task$data()
pop$train(list(task))[[1]]$data()

pop$state
```

`mlr_pipeops_imputeconstant`

Impute Features by a Constant

Description

Impute features by a constant value.

Format

`R6Class` object inheriting from `PipeOpImpute`/`PipeOp`.

Construction

```
PipeOpImputeConstant$new(id = "imputeconstant", param_vals = list())
```

- `id` :: `character(1)`
  Identifier of resulting object, default `"imputeconstant"`.

- `param_vals` :: named `list`
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from `PipeOpImpute`.

The output is the input `Task` with all affected features missing values imputed by the value of the `constant` parameter.

State

The `$state` is a named `list` with the `$state` elements inherited from `PipeOpImpute`.

The `$state$model` contains the value of the `constant` parameter that is used for imputation.

Parameters

The parameters are the parameters inherited from `PipeOpImpute`, as well as:

- `constant` :: `atomic(1)`
  The constant value that should be used for the imputation, atomic vector of length `1`. The atomic mode must match the type of the features that will be selected by the `affect_columns` parameter and this will be checked during imputation. This is a required hyperparameter and needs to be set by the user.
- `check_levels` :: `logical(1)`
  Should be checked whether the `constant` value is a valid level of factorial features (i.e., it already is a level)? Raises an error if unsuccessful. This check is only performed for factorial features (i.e., `factor`, `ordered`; skipped for `character`). Initialized to `TRUE`.
  Note that empty factor levels can be a problem for many `Learners`. Thus, `PipeOpImputeOOR` is the preferred choice for creating new levels, since it is designed to impute out-of-range values and offers a more explicit control for handling potentially problematic behavior.

Internals

The constructor is called with `empty_level_control` set to `"always"`, to allow the creation of a new empty level for `factor` and `ordered` (but not `character`) features during training, if `constant` is not an already existing level and `check_levels` is set to `FALSE`. This has no impact if `check_levels` is `TRUE`, since in that case an error would be raised before imputation.

Fields

Only fields inherited from `PipeOp`.

Methods

Only methods inherited from `PipeOpImpute`/`PipeOp`.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantile, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Other Imputation PipeOps: PipeOpImpute, mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample

Examples

```
library("mlr3")

task = tsk("diabetes")
task$missings()

# impute missing values of the numeric feature "glucose" by the constant value -999
po = po("imputeconstant", param_vals = list(
  constant = -999, affect_columns = selector_name("glucose"))
)
new_task = po$train(list(task = task))[[1]]
new_task$missings()
new_task$data(cols = "glucose")[[1]]
```

---

mlr_pipeops_imputehist

Impute Numeric, Integer, POSIXct or Date Features by Histogram

---

Description

Impute numeric, integer, POSIXct or Date features by histogram.

During training, a histogram is fitted on each column using R's `hist()` function. The fitted histogram is then sampled from for imputation. Sampling happens in a two-step process: First, a bin is sampled from the histogram, then a value is sampled uniformly from the bin. This is an approximation to sampling from the empirical training data distribution (i.e. sampling from training data with replacement), but is much more memory efficient for large datasets, since the `$state` does not need to save the training data.

Format

`R6Class` object inheriting from `PipeOpImpute`/`PipeOp`.

Construction

```
PipeOpImputeHist$new(id = "imputehist", param_vals = list())
```

- `id` :: `character(1)`
  Identifier of resulting object, default `"imputehist"`.
- `param_vals` :: named `list`
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from `PipeOpImpute`.

The output is the input `Task` with all affected numeric, integer, POSIXct or Date features missing values imputed by (column-wise) histogram; see Description for details.

State

The `$state` is a named `list` with the `$state` elements inherited from `PipeOpImpute`.

The `$state$model` is a named `list` of `lists` containing elements `$counts` and `$breaks`.

Parameters

The parameters are the parameters inherited from `PipeOpImpute`.

Internals

Uses the `graphics::hist()` function. Features that are entirely `NA` are imputed as `0`.

Fields

Only fields inherited from `PipeOp`.

Methods

Only methods inherited from `PipeOpImpute`/`PipeOp`.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputecons
mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantile
mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Other Imputation PipeOps: PipeOpImpute, mlr_pipeops_imputeconstant, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample

Examples

```
library("mlr3")

task = tsk("diabetes")
task$missings()

po = po("imputehist")
new_task = po$train(list(task = task))[[1]]
new_task$missings()

po$state$model
```

`mlr_pipeops_imputelearner`

Impute Features by Fitting a Learner

Description

Impute features by fitting a Learner for each feature. Uses the features indicated by the context_columns parameter as features to train the imputation Learner. Note this parameter is part of the PipeOpImpute base class and explained there.

Additionally, only features supported by the learner can be imputed; i.e. learners of type regr can only impute features of type integer, numeric, POSIXct and Date, while classif can impute features of type factor, ordered and logical.

The Learner used for imputation is trained on all context_columns; if these contain missing values, the Learner typically either needs to be able to handle missing values itself, or needs to do its own imputation (see examples).

Format

R6Class object inheriting from PipeOpImpute/PipeOp.

Construction

```
PipeOpImputeLearner$new(learner, id = NULL, param_vals = list())
```

- id :: character(1)
  Identifier of resulting object, default "impute.", followed by the id of the Learner.
- learner :: Learner | character(1) Learner to wrap, or a string identifying a Learner in the mlr3::mlr_learners Dictionary. The Learner usually needs to be able to handle missing values, i.e. have the missings property, unless care is taken that context_columns do not contain missings; see examples.
  This argument is always cloned; to access the Learner inside PipeOpImputeLearner by-reference, use $learner.

- param_vals :: named list
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default list().

Input and Output Channels

Input and output channels are inherited from PipeOpImpute.

The output is the input Task with missing values from all affected features imputed by the trained model.

State

The $state is a named list with the $state elements inherited from PipeOpImpute.

The $state$models is a named list of models created by the Learner's $.train() function for each column. If a column consists of missing values only during training, the model is 0 or the levels of the feature; these are used for sampling during prediction.

This state is given the class "pipeop_impute_learner_state".

Parameters

The parameters are the parameters inherited from PipeOpImpute, in addition to the parameters of the Learner used for imputation.

Internals

Uses the $train and $predict functions of the provided learner. Features that are entirely NA are imputed as 0 or randomly sampled from available (factor / logical) levels.

The Learner does *not* necessarily need to handle missing values in cases where context_columns is chosen well (or there is only one column with missing values present).

Fields

Fields inherited from PipeOpTaskPreproc/PipeOp, as well as:

- learner :: Learner
  Learner that is being wrapped. Read-only.
- learner_models :: list of Learner | NULL
  Learner that is being wrapped. This list is named by features for which a Learner was fitted, and contains the same Learner, but with different respective models for each feature. If this PipeOp is not trained, this is an empty list. For features that were entirely NA during training, the list contains NULL elements.

Methods

Only methods inherited from PipeOpImpute/PipeOp.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputecons
mlr_pipeops_imputehist, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantile
mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign,

mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Other Imputation PipeOps: PipeOpImpute, mlr_pipeops_imputeconstant, mlr_pipeops_imputehist, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample

Examples

```
library("mlr3")

task = tsk("diabetes")
task$missings()

po = po("imputelearner", lrn("regr.rpart"))
new_task = po$train(list(task = task))[[1]]
new_task$missings()

# '$state' of the "regr.rpart" Learner, trained to predict the 'mass' column:
po$state$model$mass

library("mlr3learners")
# To use the "regr.lm" Learner, prefix it with its own imputation method!
# The "imputehist" PipeOp is used to train "regr.lm"; predictions of this
# trained Learner are then used to impute the missing values in the Task.
po = po("imputelearner",
  po("imputehist") %>>% lrn("regr.lm")
)

new_task = po$train(list(task = task))[[1]]
new_task$missings()
```

---

mlr_pipeops_imputemean

Impute Numeric, Integer, POSIXct or Date Features by their Mean

---

Description

Impute numeric, integer, POSIXct or Date features by their mean.

Format

R6Class object inheriting from PipeOpImpute/PipeOp.

Construction

```
PipeOpImputeMean$new(id = "imputemean", param_vals = list())
```

- `id` :: `character(1)`
  Identifier of resulting object, default `"imputemean"`.
- `param_vals` :: named `list`
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from `PipeOpImpute`.

The output is the input `Task` with all affected numeric, integer, POSIXct and Date features missing values imputed by (column-wise) mean.

State

The `$state` is a named `list` with the `$state` elements inherited from `PipeOpImpute`.

The `$state$model` is a named `list` of either `numeric(1)`, `integer(1)`, `POSIXct(1)` or `Date(1)` indicating the mean of the respective feature.

Parameters

The parameters are the parameters inherited from `PipeOpImpute`.

Internals

Uses the `mean()` function. Features that are entirely `NA` are imputed as `0`.

Fields

Only fields inherited from `PipeOp`.

Methods

Only methods inherited from `PipeOpImpute`/`PipeOp`.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: `PipeOp`, `PipeOpEncodePL`, `PipeOpEnsemble`, `PipeOpImpute`, `PipeOpTargetTrafo`, `PipeOpTaskPreproc`, `PipeOpTaskPreprocSimple`, `mlr_pipeops`, `mlr_pipeops_adas`, `mlr_pipeops_blsmote`, `mlr_pipeops_boxcox`, `mlr_pipeops_branch`, `mlr_pipeops_chunk`, `mlr_pipeops_classbalancing`, `mlr_pipeops_classifavg`, `mlr_pipeops_classweights`, `mlr_pipeops_classweightsex`, `mlr_pipeops_colapply`, `mlr_pipeops_collapsefactors`, `mlr_pipeops_colroles`, `mlr_pipeops_copy`, `mlr_pipeops_datefeatures`, `mlr_pipeops_decode`, `mlr_pipeops_encode`, `mlr_pipeops_encodeimpact`, `mlr_pipeops_encodelmer`, `mlr_pipeops_encodeplquantiles`, `mlr_pipeops_encodepltree`, `mlr_pipeops_featureunion`, `mlr_pipeops_filter`, `mlr_pipeops_fixfactors`, `mlr_pipeops_histbin`, `mlr_pipeops_ica`, `mlr_pipeops_imputecons`

mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantile, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Other Imputation PipeOps: PipeOpImpute, mlr_pipeops_imputeconstant, mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample

Examples

```
library("mlr3")

task = tsk("diabetes")
task$missings()

po = po("imputemean")
new_task = po$train(list(task = task))[[1]]
new_task$missings()

po$state$model
```

---

mlr_pipeops_imputemedian

Impute Numeric, Integer, POSIXct or Date Features by their Median

---

Description

Impute numerical, integer, POSIXct or Date features by their median.

Format

R6Class object inheriting from PipeOpImpute/PipeOp.

Construction

```
PipeOpImputeMedian$new(id = "imputemedian", param_vals = list())
```

- id :: character(1)
  Identifier of resulting object, default "imputemedian".

- param_vals :: named list
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default list().

Input and Output Channels

Input and output channels are inherited from PipeOpImpute.

The output is the input Task with all affected numeric, integer, POSIXct and Date features missing values imputed by (column-wise) median.

State

The $state is a named list with the $state elements inherited from PipeOpImpute.

The $state$model is a named list of numeric(1), integer(1), POSIXct(1) or Date(1) indicating the median of the respective feature.

Parameters

The parameters are the parameters inherited from PipeOpImpute.

Internals

Uses the stats::median() function. Features that are entirely NA are imputed as 0.

Fields

Only fields inherited from PipeOp.

Methods

Only methods inherited from PipeOpImpute/PipeOp.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputecons
mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantile
mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy,

mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Other Imputation PipeOps: PipeOpImpute, mlr_pipeops_imputeconstant, mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample

Examples

```
library("mlr3")

task = tsk("diabetes")
task$missings()

po = po("imputemedian")
new_task = po$train(list(task = task))[[1]]
new_task$missings()

po$state$model
```

---

mlr_pipeops_imputemode

Impute Features by their Mode

Description

Impute features by their mode. Supports factors, logical, numerical, POSIXct and Date features. If multiple modes are present then imputed values are sampled randomly from them.

Format

R6Class object inheriting from PipeOpImpute/PipeOp.

Construction

```
PipeOpImputeMode$new(id = "imputemode", param_vals = list())
```

- id :: character(1)
  Identifier of resulting object, default "imputemode".
- param_vals :: named list
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default list().

Input and Output Channels

Input and output channels are inherited from PipeOpImpute.

The output is the input Task with all affected features missing values imputed by (column-wise) mode.

State

The $state is a named list with the $state elements inherited from PipeOpImpute.

The $state$model is a named list of a vector of length one of the type of the feature, indicating the mode of the respective feature.

Parameters

The parameters are the parameters inherited from PipeOpImpute.

Internals

Features that are entirely NA are imputed as the following: For factor or ordered, random levels are sampled uniformly at random. For logicals, TRUE or FALSE are sampled uniformly at random. Numerics and integers are imputed as 0.

Note that every random imputation is drawn independently, so different values may be imputed if multiple values are missing.

Fields

Only fields inherited from PipeOp.

Methods

Only methods inherited from PipeOpImpute/PipeOp.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputecons
mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantile
mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy,

mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Other Imputation PipeOps: PipeOpImpute, mlr_pipeops_imputeconstant, mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputeoor, mlr_pipeops_imputesample

Examples

```
library("mlr3")

task = tsk("diabetes")
task$missings()

po = po("imputemode")
new_task = po$train(list(task = task))[[1]]
new_task$missings()

po$state$model
```

---

mlr_pipeops_imputeoor *Out of Range Imputation*

Description

Impute factorial features by adding a new level ".MISSING".

Impute numeric, integer, POSIXct or Date features by constant values shifted below the minimum or above the maximum by using $min(x) - offset - multiplier * diff(range(x))$ or $max(x) + offset + multiplier * diff(range(x))$.

This type of imputation is especially sensible in the context of tree-based methods, see also Ding & Simonoff (2010).

Learners expect input Tasks to have the same factor (or ordered) levels during training as well as prediction. This PipeOp modifies the levels of factor and ordered features, and since it may occur that a factor or ordered feature contains missing values only during prediction, but not during training, the output Task could also have different levels during the two stages.

To avoid problems with the Learners' expectation, controlling the PipeOps' handling of this edge-case is necessary. For this, use the create_empty_level hyperparameter inherited from PipeOpImpute.
If create_empty_level is set to TRUE, then an unseen level ".MISSING" is added to the feature during training and missing values are imputed as ".MISSING" during prediction. However, empty factor levels during training can be a problem for many Learners.
If create_empty_level is set to FALSE, then no empty level is introduced during training, but

columns that have missing values only during prediction will *not* be imputed. This is why it may still be necessary to use `po("imputesample", affect_columns = selector_type(types = c("factor", "ordered")))` (or another imputation method) after this imputation method. Note that setting `create_empty_level` to `FALSE` is the same as setting it to `TRUE` and using `PipeOpFixFactors` after this `PipeOp`.

Format

`R6Class` object inheriting from `PipeOpImpute`/`PipeOp`.

Construction

```
PipeOpImputeOOR$new(id = "imputeoor", param_vals = list())
```

- `id` :: `character(1)`
  Identifier of resulting object, default `"imputeoor"`.
- `param_vals` :: named `list`
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from `PipeOpImpute`.

The output is the input `Task` with all affected features having missing values imputed as described above.

State

The `$state` is a named `list` with the `$state` elements inherited from `PipeOpImpute`.

The `$state$model` contains either `".MISSING"` used for `character` and `factor` (also `ordered`) features or `numeric(1)` indicating the constant value used for imputation of `integer`, `numeric`, `POSIXct` or `Date` features.

Parameters

The parameters are the parameters inherited from `PipeOpImpute`, as well as:

- `min` :: `logical(1)`
  Should `integer` and `numeric` features be shifted below the minimum? Initialized to `TRUE`. If `FALSE` they are shifted above the maximum. See also the description above.
- `offset` :: `numeric(1)`
  Numerical non-negative offset as used in the description above for `integer`, `numeric`, `POSIXCT` and `Date`. features. Initialized to `1`.
- `multiplier` :: `numeric(1)`
  Numerical non-negative multiplier as used in the description above for `integer`, `numeric`, `POSIXct` and `Date`. features. Initialized to `1`.

Internals

Adds an explicit new `level()` to `factor` and `ordered` features, but not to `character` features. For `integer` and `numeric` features uses the `min`, `max`, `diff` and `range` functions. `integer` and `numeric` features that are entirely `NA` are imputed as `0`. `factor` and `ordered` features that are entirely `NA` are imputed as `".MISSING"`. For `POSIXct` and `Date` features the value `0` is transformed into the respective data type.

Fields

Only fields inherited from `PipeOp`.

Methods

Only methods inherited from `PipeOpImpute`/`PipeOp`.

References

Ding Y, Simonoff JS (2010). "An Investigation of Missing Data Methods for Classification Trees Applied to Binary Response Data." *Journal of Machine Learning Research*, **11**(6), 131-170. https://jmlr.org/papers/v11/ding10a.html.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: `PipeOp`, `PipeOpEncodePL`, `PipeOpEnsemble`, `PipeOpImpute`, `PipeOpTargetTrafo`, `PipeOpTaskPreproc`, `PipeOpTaskPreprocSimple`, `mlr_pipeops`, `mlr_pipeops_adas`, `mlr_pipeops_blsmote`, `mlr_pipeops_boxcox`, `mlr_pipeops_branch`, `mlr_pipeops_chunk`, `mlr_pipeops_classbalancing`, `mlr_pipeops_classifavg`, `mlr_pipeops_classweights`, `mlr_pipeops_classweightsex`, `mlr_pipeops_colapply`, `mlr_pipeops_collapsefactors`, `mlr_pipeops_colroles`, `mlr_pipeops_copy`, `mlr_pipeops_datefeatures`, `mlr_pipeops_decode`, `mlr_pipeops_encode`, `mlr_pipeops_encodeimpact`, `mlr_pipeops_encodelmer`, `mlr_pipeops_encodeplquantiles`, `mlr_pipeops_encodepltree`, `mlr_pipeops_featureunion`, `mlr_pipeops_filter`, `mlr_pipeops_fixfactors`, `mlr_pipeops_histbin`, `mlr_pipeops_ica`, `mlr_pipeops_imputecons`
`mlr_pipeops_imputehist`, `mlr_pipeops_imputelearner`, `mlr_pipeops_imputemean`, `mlr_pipeops_imputemedian`, `mlr_pipeops_imputemode`, `mlr_pipeops_imputesample`, `mlr_pipeops_info`, `mlr_pipeops_isomap`, `mlr_pipeops_kernelpca`, `mlr_pipeops_learner`, `mlr_pipeops_learner_pi_cvplus`, `mlr_pipeops_learner_quantile`
`mlr_pipeops_materialize`, `mlr_pipeops_missind`, `mlr_pipeops_modelmatrix`, `mlr_pipeops_multiplicityexply`, `mlr_pipeops_multiplicityimply`, `mlr_pipeops_mutate`, `mlr_pipeops_nearmiss`, `mlr_pipeops_nmf`, `mlr_pipeops_nop`, `mlr_pipeops_ovrsplit`, `mlr_pipeops_ovrunite`, `mlr_pipeops_pca`, `mlr_pipeops_proxy`, `mlr_pipeops_quantilebin`, `mlr_pipeops_randomprojection`, `mlr_pipeops_randomresponse`, `mlr_pipeops_regravg`, `mlr_pipeops_removeconstants`, `mlr_pipeops_renamecolumns`, `mlr_pipeops_replicate`, `mlr_pipeops_rowapply`, `mlr_pipeops_scale`, `mlr_pipeops_scalemaxabs`, `mlr_pipeops_scalerange`, `mlr_pipeops_select`, `mlr_pipeops_smote`, `mlr_pipeops_smotenc`, `mlr_pipeops_spatialsign`, `mlr_pipeops_splines`, `mlr_pipeops_subsample`, `mlr_pipeops_targetinvert`, `mlr_pipeops_targetmutate`, `mlr_pipeops_targettrafoscalerange`, `mlr_pipeops_textvectorizer`, `mlr_pipeops_threshold`, `mlr_pipeops_tomek`, `mlr_pipeops_tunethreshold`, `mlr_pipeops_unbranch`, `mlr_pipeops_updatetarget`, `mlr_pipeops_vtreat`, `mlr_pipeops_yeojohnson`

Other Imputation PipeOps: PipeOpImpute, mlr_pipeops_imputeconstant, mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputesample

Examples

```
library("mlr3")
set.seed(2409)
data = tsk("diabetes")$data()
data$y = factor(c(NA, sample(letters, size = nrow(data) - 2, replace = TRUE), NA))
data$z = ordered(c(NA, sample(1:10, size = nrow(data) - 1, replace = TRUE)))
task = TaskClassif$new("task", backend = data, target = "diabetes")
task$missings()
po = po("imputeoor")
new_task = po$train(list(task = task))[[1]]
new_task$missings()
new_task$data()

# recommended use when missing values are expected during prediction on
# factor columns that had no missing values during training
gr = po("imputeoor", create_empty_level = FALSE) %>>%
  po("imputesample", affect_columns = selector_type(types = c("factor", "ordered")))
t1 = as_task_classif(data.frame(l = as.ordered(letters[1:3]), t = letters[1:3]), target = "t")
t2 = as_task_classif(data.frame(l = as.ordered(c("a", NA, NA)), t = letters[1:3]), target = "t")
gr$train(t1)[[1]]$data()

# missing values during prediction are sampled randomly
gr$predict(t2)[[1]]$data()
```

---

mlr_pipeops_imputesample

Impute Features by Sampling

Description

Impute features by sampling from non-missing training data.

Format

R6Class object inheriting from PipeOpImpute/PipeOp.

Construction

```
PipeOpImputeSample$new(id = "imputesample", param_vals = list())
```

- id :: character(1)
  Identifier of resulting object, default "imputesample".
- param_vals :: named list
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default list().

Input and Output Channels

Input and output channels are inherited from PipeOpImpute.

The output is the input Task with all affected numeric features missing values imputed by values sampled (column-wise) from training data.

State

The $state is a named list with the $state elements inherited from PipeOpImpute.

The $state$model is a named list of training data with missings removed.

Parameters

The parameters are the parameters inherited from PipeOpImpute.

Internals

Uses the sample() function. Features that are entirely NA are imputed as the following: For factor or ordered, random levels are sampled uniformly at random. For logical, TRUE or FALSE are sampled uniformly at random. numeric and integer are imputed as 0.

Fields

Only fields inherited from PipeOp.

Methods

Only methods inherited from PipeOpImpute/PipeOp.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputecons
mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantile
mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange,

mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Other Imputation PipeOps: PipeOpImpute, mlr_pipeops_imputeconstant, mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor

Examples

```
library("mlr3")

task = tsk("diabetes")
task$missings()

po = po("imputesample")
new_task = po$train(list(task = task))[[1]]
new_task$missings()
```

---

mlr_pipeops_info *Customizable Information Printer*

Description

PipeOpInfo prints its input to the console or a logger in a customizable way. Users can define how specific object classes should be displayed using custom printer functions.

Format

R6Class object inheriting from PipeOp

Construction

```
PipeOpInfo$new(id = "info", collect_multiplicity = FALSE, log_target = "lgr::mlr3/mlr3pipelines::info")
```

- id :: character(1)
  Identifier of resulting object, default "info"
- printer :: list
  Optional mapping from object classes to printer functions. Custom functions override default printer-functions.
- collect_multiplicity :: logical(1)
  If TRUE, the input is a Multiplicity collecting channel. Multiplicity input/output is accepted and the members are aggregated.

- log_target :: character(1)
  Specifies how the input object is printed to the console. By default it is directed to a logger, whose address can be customized using the form <output>::<argument1>::<argument2>. Otherwise it can be printed as "message", "warning" or "cat". When set to "none", no customized information about the object will be printed.

Input and Output Channels

PipeOpInfo has one input channel called "input", it can take any type of input (*). PipeOpInfo has one output channel called "output", it can take any type of output (*).

State

The $state is left empty (list()).

Internals

PipeOpInfo forwards its input unchanged, but prints information about it depending on the printer and log_target settings.

Fields

Fields inherited from PipeOp, as well as:

- printer :: list
  Mapping of object classes to printer functions. Includes printer-specifications for Task, Prediction, NULL. Otherwise object is printed as is.
- log_target :: character(1)
  Specifies current output target.

Methods

Only methods inherited from PipeOp.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputecons
mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantile
mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf,

mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Examples

```
library("mlr3")

poinfo = po("info")
poinfo$train(list(tsk("mtcars")))
poinfo$predict(list(tsk("mtcars")))

# Specify customized console output for Task-objects
poinfo = po("info", log_target = "cat",
  printer = list(Task = function(x) list(head_data = head(x$data()), nrow = nrow(x$data()))))
)

poinfo$train(list(tsk("iris")))
poinfo$predict(list(tsk("iris")))
```

---

mlr_pipeops_isomap *Algorithm for Dimensionality Reduction*

Description

Reduces the dimensionality of the data of the input Task using the Isomap algorithm from the dimRed-package, preserving geodesic distances between observations. The number of neighbors (knn) and embedding dimensions (ndim) control the transformation.

Format

R6Class object inheriting from PipeOpTaskPreproc

Construction

```
PipeOpIsomap$new(id = "isomap", ...)
```

- id :: character(1)
  Identifier of resulting object, default "isomap"
- param_vals :: named list
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default list().

Input and Output Channels

Input and output channels are inherited from PipeOpTaskPreproc.

The output is the input Task with the data projected to the lower-dimensional space.

State

The $state is a named list with the $state elements inherited from PipeOpTaskPreproc, as well as:

- embed_result :: dimRedResult
  The resulting object after applying the "Isomap"-method from the dimRed-package to the data.

Parameters

The parameters are the parameters inherited from PipeOpTaskPreproc, as well as:

- knn :: integer(1)
  The number of nearest neighbors in the graph. Initialized to 50.
- ndim :: integer(1)
  The number of embedding dimensions. Initialized to 2.
- get_geod :: logical(1)
  Determines whether the distance matrix should be kept in the $state. Initialized to FALSE.
- .mute :: character
  A character vector of elements to mute during training (e.g. c("message", "output")). Initialized to NULL.

Internals

Applies the Isomap embedding from the dimRed-package.

Fields

Only fields inherited from PipeOp.

Methods

Only methods inherited from PipeOpTaskPreproc/PipeOp.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion,

mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputecons
mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian,
mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info,
mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantile
mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply,
mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf,
mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy,
mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse,
mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns, mlr_pipeops_replicate,
mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange,
mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign,
mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate,
mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold,
mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget,
mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Examples

```
library("mlr3")
po = po("isomap", .mute = c("message", "output"))
po$train(list(tsk("iris")))[[1]]$data()
po$predict(list(tsk("iris")))[[1]]$data()
```

`mlr_pipeops_kernelpca` *Kernelized Principal Component Analysis*

Description

Extracts kernel principal components from data. Only affects numerical features. See kernlab::kpca for details.

Format

R6Class object inheriting from PipeOpTaskPreproc/PipeOp.

Construction

```
PipeOpKernelPCA$new(id = "kernelpca", param_vals = list())
```

- `id` :: `character(1)`
  Identifier of resulting object, default `"kernelpca"`.
- `param_vals` :: named `list`
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from PipeOpTaskPreproc.

The output is the input Task with all affected numeric parameters replaced by their principal components.

State

The $state is a named list with the $state elements inherited from PipeOpTaskPreproc, as well as the returned S4 object of the function kernlab::kpca().

The @rotated slot of the "kpca" object is overwritten with an empty matrix for memory efficiency.

The slots of the S4 object can be accessed by accessor function. See kernlab::kpca.

Parameters

The parameters are the parameters inherited from PipeOpTaskPreproc, as well as:

- kernel :: character(1)
  The standard deviations of the principal components. See kpca().
- kpar :: list
  List of hyper-parameters that are used with the kernel function. See kpca().
- features :: numeric(1)
  Number of principal components to return. Default 0 means that all principal components are returned. See kpca().
- th :: numeric(1)
  The value of eigenvalue under which principal components are ignored. Default is 0.0001. See kpca().
- na.action :: function
  Function to specify NA action. Default is na.omit. See kpca().

Internals

Uses the kpca() function.

Fields

Only fields inherited from PipeOp.

Methods

Only methods inherited from PipeOpTaskPreproc/PipeOp.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing,

mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputecons
mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantiles, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Examples

```
library("mlr3")

task = tsk("iris")
pop = po("kernelpca", features = 3)  # only keep top 3 components

task$data()
pop$train(list(task))[[1]]$data()
```

---

mlr_pipeops_learner *Wrap a Learner into a PipeOp*

Description

Wraps an mlr3::Learner into a PipeOp.

Inherits the $param_set (and therefore $param_set$values) from the Learner it is constructed from.

Using PipeOpLearner, it is possible to embed mlr3::Learners into Graphs, which themselves can be turned into Learners using GraphLearner. This way, preprocessing and ensemble methods can be included into a machine learning pipeline which then can be handled as singular object for resampling, benchmarking and tuning.

Format

R6Class object inheriting from PipeOp.

Construction

```
PipeOpLearner$new(learner, id = NULL, param_vals = list())
```

- learner :: Learner | character(1)
  Learner to wrap, or a string identifying a Learner in the mlr3::mlr_learners Dictionary. This argument is always cloned; to access the Learner inside PipeOpLearner by-reference, use $learner.

- id :: character(1)
  Identifier of the resulting object, internally defaulting to the id of the Learner being wrapped.
- param_vals :: named list
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default list().

Input and Output Channels

PipeOpLearner has one input channel named "input", taking a Task specific to the Learner type given to learner during construction; both during training and prediction.

PipeOpLearner has one output channel named "output", producing NULL during training and a Prediction subclass during prediction; this subclass is specific to the Learner type given to learner during construction.

The output during prediction is the Prediction on the prediction input data, produced by the Learner trained on the training input data.

State

The $state is set to the $state slot of the Learner object. It is a named list with members:

- model :: any
  Model created by the Learner's $.train() function.
- train_log :: data.table with columns class (character), msg (character)
  Errors logged during training.
- train_time :: numeric(1)
  Training time, in seconds.
- predict_log :: NULL | data.table with columns class (character), msg (character)
  Errors logged during prediction.
- predict_time :: NULL | numeric(1) Prediction time, in seconds.

Parameters

The parameters are exactly the parameters of the Learner wrapped by this object.

Internals

The $state is currently not updated by prediction, so the $state$predict_log and $state$predict_time will always be NULL.

Fields

Fields inherited from PipeOp, as well as:

- learner :: Learner
  Learner that is being wrapped. Read-only.
- learner_model :: Learner
  Learner that is being wrapped. This learner contains the model if the PipeOp is trained. Read-only.
- validate :: "predefined" or NULL
  This field can only be set for Learners that have the "validation" property. Setting the field to "predefined" means that the wrapped Learner will use the internal validation task, otherwise it will be ignored. Note that specifying *how* the validation data is created is possible via the $validate field of the GraphLearner. For each PipeOp it is then only possible to either use it ("predefined") or not use it (NULL). Also see set_validate.GraphLearner for more information.
- internal_tuned_values :: named list() or NULL
  The internally tuned values if the wrapped Learner supports internal tuning, NULL otherwise.
- internal_valid_scores :: named list() or NULL
  The internal validation scores if the wrapped Learner supports internal validation, NULL otherwise.
- best_valid_scores :: named list() or NULL
  The best internal validation scores observed during training if the wrapped Learner tracks them, NULL otherwise.

Methods

Methods inherited from PipeOp.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputecons
mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantiles
mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns, mlr_pipeops_replicate,

mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Other Meta PipeOps: mlr_pipeops_learner_cv, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantiles

Examples

```
library("mlr3")

task = tsk("iris")
learner = lrn("classif.rpart", cp = 0.1)
lrn_po = mlr_pipeops$get("learner", learner)

lrn_po$train(list(task))
lrn_po$predict(list(task))
```

---

mlr_pipeops_learner_cv

Wrap a Learner into a PipeOp with Cross-validated Predictions as Features

---

Description

Wraps an mlr3::Learner into a PipeOp.

Returns cross-validated predictions during training as a Task and stores a model of the Learner trained on the whole data in $state. This is used to create a similar Task during prediction. Optionally, the fitted models obtained during the resampling phase can be reused for prediction by averaging their predictions, avoiding the need for an additional fit on the complete training data.

The Task gets features depending on the capsuled Learner's $predict_type. If the Learner's $predict.type is "response", a feature <ID>.response is created, for $predict.type "prob" the <ID>.prob.<CLASS> features are created, and for $predict.type "se" the new columns are <ID>.response and <ID>.se. <ID> denotes the $id of the PipeOpLearnerCV object.

Inherits the $param_set (and therefore $param_set$values) from the Learner it is constructed from.

PipeOpLearnerCV can be used to create "stacking" or "super learning" Graphs that use the output of one Learner as feature for another Learner. Because the PipeOpLearnerCV erases the original input features, it is often useful to use PipeOpFeatureUnion to bind the prediction Task to the original input Task.

Format

R6Class object inheriting from PipeOpTaskPreproc/PipeOp.

Construction

```
PipeOpLearnerCV$new(learner, id = NULL, param_vals = list())
```

- learner :: Learner
  Learner to use for cross validation / prediction, or a string identifying a Learner in the mlr3::mlr_learners Dictionary. This argument is always cloned; to access the Learner inside PipeOpLearnerCV by-reference, use $learner.

- id :: character(1) Identifier of the resulting object, internally defaulting to the id of the Learner being wrapped.
- param_vals :: named list
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default list().

Input and Output Channels

PipeOpLearnerCV has one input channel named "input", taking a Task specific to the Learner type given to learner during construction; both during training and prediction.

PipeOpLearnerCV has one output channel named "output", producing a Task specific to the Learner type given to learner during construction; both during training and prediction.

The output is a task with the same target as the input task, with features replaced by predictions made by the Learner. During training, this prediction is the out-of-sample prediction made by resample, during prediction, this is the ordinary prediction made on the data by a Learner trained on the training phase data.

State

The $state is set to the $state slot of the Learner object, together with the $state elements inherited from the PipeOpTaskPreproc. It is a named list with the inherited members, as well as:

- model :: any
  Model created by the Learner's $.train() function.
- train_log :: data.table with columns class (character), msg (character)
  Errors logged during training.
- train_time :: numeric(1)
  Training time, in seconds.
- predict_log :: NULL | data.table with columns class (character), msg (character)
  Errors logged during prediction.
- predict_time :: NULL | numeric(1) Prediction time, in seconds.
- predict_method :: character(1)
  "full" when prediction uses a learner fitted on all training data, "cv_ensemble" when predictions are averaged over models trained on resampling folds.
- cv_model_states :: NULL | list
  Present for predict_method = "cv_ensemble". Contains the states of the learners trained on each resampling fold.

This state is given the class "pipeop_learner_cv_state".

Parameters

The parameters are the parameters inherited from the PipeOpTaskPreproc, as well as the parameters of the Learner wrapped by this object. Besides that, parameters introduced are:

- `resampling.method` :: `character(1)`
  Which resampling method do we want to use. Currently only supports `"cv"` and `"insample"`. `"insample"` generates predictions with the model trained on all training data.
- `resampling.folds` :: `numeric(1)`
  Number of cross validation folds. Initialized to 3. Only used for `resampling.method = "cv"`.
- `resampling.keep_response` :: `logical(1)`
  Only effective during `"prob"` prediction: Whether to keep response values, if available. Initialized to `FALSE`.
- `resampling.predict_method` :: `character(1)`
  Controls how predictions are produced after training. `"full"` (default) fits the wrapped learner on the entire training data. `"cv_ensemble"` reuses the models fitted during resampling and averages their predictions. This option currently supports classification and regression learners together with `resampling.method = "cv"`.
- `resampling.prob_aggr` :: `character(1)`
  Probability aggregation used when `"cv_ensemble"` predictions are produced for classification learners that can emit class probabilities. Shares the semantics with PipeOpClassifAvg: `"mean"` (linear opinion pool, default) and `"log"` (log opinion pool / product of experts). Only present for learners that support `"prob"` predictions.
- `resampling.prob_aggr_eps` :: `numeric(1)`
  Stabilization constant applied when `resampling.prob_aggr = "log"` to clamp probabilities before taking logarithms. Defaults to `1e-12`. Only present for learners that support `"prob"` predictions.
- `resampling.se_aggr` :: `character(1)`
  Standard error aggregation used when `"cv_ensemble"` predictions are produced for regression learners with `predict_type` containing `"se"`. Shares the definitions with PipeOpRegrAvg, i.e. `"predictive"`, `"mean"`, `"within"`, `"between"`, `"none"`. Initialized to `"predictive"` (within-fold variance plus between-fold disagreement) when constructed with a Learner that has `predict_type = "se"`; otherwise to `"none"`.
  Only present for learners that support `"se"` predictions.
- `resampling.se_aggr_rho` :: `numeric(1)`
  Equicorrelation parameter for `resampling.se_aggr = "mean"`, interpreted as in PipeOpRegrAvg. Ignored otherwise. Defaults to `0` when `resampling.se_aggr = "mean"`.
  Only present for learners that support `"se"` predictions.

Internals

The `$state` is currently not updated by prediction, so the `$state$predict_log` and `$state$predict_time` will always be `NULL`.

Fields

Fields inherited from PipeOp, as well as:

- learner :: Learner
  Learner that is being wrapped. Read-only.
- learner_model :: Learner
  Learner that is being wrapped. This learner contains the model if the PipeOp is trained. Read-only.

Methods

Methods inherited from PipeOpTaskPreproc/PipeOp.

See Also

https://mlr-org.com/pipeops.html

Other Meta PipeOps: mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantiles

Examples

```
library("mlr3")

task = tsk("iris")
learner = lrn("classif.rpart")

lrncv_po = po("learner_cv", learner)
lrncv_po$learner$predict_type = "response"

nop = mlr_pipeops$get("nop")

graph = gunion(list(
  lrncv_po,
  nop
)) %>>% po("featureunion")

graph$train(task)

graph$pipeops$classif.rpart$learner$predict_type = "prob"
graph$pipeops$classif.rpart$param_set$values$resampling.predict_method = "cv_ensemble"

graph$train(task)
```

---

mlr_pipeops_learner_pi_cvplus

Wrap a Learner into a PipeOp with Cross-validation Plus Confidence Intervals as Predictions

---

Description

Wraps an mlr3::Learner into a PipeOp.

Inherits the $param_set (and therefore $param_set$values) from the Learner it is constructed from.

Using PipeOpLearnerPICVPlus, it is possible to embed a mlr3::Learner into a Graph. PipeOpLearnerPICVPlus can then be used to perform cross validation plus (or jackknife plus). During training, PipeOpLearnerPICVPlus performs cross validation on the training data. During prediction, the models from the training stage are used to construct predictive confidence intervals for the prediction data based on out-of-fold residuals and out-of-fold predictions.

Format

R6Class object inheriting from PipeOp.

Construction

```
PipeOpLearnerPICVPlus$new(learner, id = NULL, param_vals = list())
```

- learner :: LearnerRegr LearnerRegr to use for the cross validation models in the Cross Validation Plus method. This argument is always cloned; to access the Learner inside PipeOpLearnerPICVPlus by-reference, use $learner.

- id :: character(1) Identifier of the resulting object, internally defaulting to the id of the Learner being wrapped.
- param_vals :: named list
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default is list().

Input and Output Channels

PipeOpLearnerPICVPlus has one input channel named "input", taking a Task specific to the Learner type given to learner during construction; both during training and prediction.

PipeOpLearnerPICVPlus has one output channel named "output", producing NULL during training and a PredictionRegr during prediction.

The output during prediction is a PredictionRegr with predict_type quantiles on the prediction input data. The alpha and 1 - alpha quantiles are the quantiles of the prediction interval produced by the cross validation plus method. The response is the median of the prediction of all cross validation models on the prediction data.

State

The $state is a named list with members:

- cv_model_states :: list
  List of the state of each cross validation model created by the Learner's $.train() function during resampling with method "cv".

- `residuals` :: `data.table`
  `data.table` with columns `fold` and `residual`. Lists the Regression residuals for each observation and cross validation fold.

This state is given the class `"pipeop_learner_cv_state"`.

Parameters

The parameters of the `Learner` wrapped by this object, as well as:

- `folds` :: `numeric(1)`
  Number of cross validation folds. Initialized to 3.
- `alpha` :: `numeric(1)`
  Quantile to use for the cross validation plus prediction intervals. Initialized to 0.05.

Internals

The `$state` is updated during training.

Fields

Fields inherited from `PipeOp`, as well as:

- `learner` :: `Learner`
  `Learner` that is being wrapped. Read-only.
- `learner_model` :: `Learner` or `list`
  If the `PipeOpLearnerPICVPlus` has been trained, this is a `list` containing the `Learner`s of the cross validation models. Otherwise, this contains the `Learner` that is being wrapped. Read-only.
- `predict_type`
  Predict type of the `PipeOpLearnerPICVPlus`, which is always `"response"` `"quantiles"`. This can be different to the predict type of the `Learner` that is being wrapped.

Methods

Methods inherited from `PipeOp`.

References

Barber RF, Candes EJ, Ramdasa A, Tibshirani RJ (2021). "Predictive inference with the jackknife+." *Annals of Statistics*, **49**, 486–507. doi:10.1214/20AOS1965.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: `PipeOp`, `PipeOpEncodePL`, `PipeOpEnsemble`, `PipeOpImpute`, `PipeOpTargetTrafo`, `PipeOpTaskPreproc`, `PipeOpTaskPreprocSimple`, `mlr_pipeops`, `mlr_pipeops_adas`, `mlr_pipeops_blsmote`, `mlr_pipeops_boxcox`, `mlr_pipeops_branch`, `mlr_pipeops_chunk`, `mlr_pipeops_classbalancing`, `mlr_pipeops_classifavg`, `mlr_pipeops_classweights`, `mlr_pipeops_classweightsex`, `mlr_pipeops_colapply`, `mlr_pipeops_collapsefactors`, `mlr_pipeops_colroles`, `mlr_pipeops_copy`, `mlr_pipeops_datefeatures`,

mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputecons mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_quantiles, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Other Meta PipeOps: mlr_pipeops_learner, mlr_pipeops_learner_cv, mlr_pipeops_learner_quantiles

Examples

```
library("mlr3")

task = tsk("mtcars")
learner = lrn("regr.rpart")
lrncvplus_po = mlr_pipeops$get("learner_pi_cvplus", learner)

lrncvplus_po$train(list(task))
lrncvplus_po$predict(list(task))
```

---

mlr_pipeops_learner_quantiles

Wrap a Learner into a PipeOp to predict multiple Quantiles

Description

Wraps a LearnerRegr into a PipeOp to predict multiple quantiles.

PipeOpLearnerQuantiles only supports LearnerRegrs that have quantiles as a possible predict_type.

It produces quantile-based predictions for multiple quantiles in one PredictionRegr. This is especially helpful if the LearnerRegr can only predict one quantile (like for example LearnerRegrGBM in mlr3extralearners)

Inherits the $param_set (and therefore $param_set$values) from the Learner it is constructed from.

Format

R6Class object inheriting from PipeOp.

Construction

```
PipeOpLearnerQuantiles$new(learner, id = NULL, param_vals = list())
```

- `learner` :: `Learner` | `character(1)`
  `Learner` to wrap, or a string identifying a `Learner` in the `mlr3::mlr_learners` `Dictionary`. The `Learner` has to be a `LearnerRegr` with `predict_type` `"quantiles"`. This argument is always cloned; to access the `Learner` inside `PipeOpLearnerQuantiles` by-reference, use `$learner`.
- `id` :: `character(1)` Identifier of the resulting object, internally defaulting to the `id` of the `Learner` being wrapped.
- `param_vals` :: named `list`
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

`PipeOpLearnerQuantiles` has one input channel named `"input"`, taking a `TaskRegr` specific to the `Learner` type given to `learner` during construction; both during training and prediction.

`PipeOpLearnerQuantiles` has one output channel named `"output"`, producing `NULL` during training and a `PredictionRegr` object during prediction.

The output during prediction is a `PredictionRegr` on the prediction input data that aggregates all `results` produced by the `Learner` for each quantile in `quantiles`. trained on the training input data.

State

The `$state` is set during training. It is a named `list` with the member:

- `model_states` :: `list`
  List of the states of all models created by the `Learner`'s `$.train()` function.

Parameters

The parameters are exactly the parameters of the `Learner` wrapped by this object.

- `q_vals` :: `numeric`
  Quantiles to use for training and prediction. Initialized to `c(0.05, 0.5, 0.95)`
- `q_response` :: `numeric(1)`
  Which quantile in `quantiles` to use as a `response` for the `PredictionRegr` during prediction. Initialized to `0.5`.

Internals

The `$state` is updated during training.

Fields

Fields inherited from PipeOp, as well as:

- learner :: LearnerRegr
  Learner that is being wrapped. Read-only.
- learner_model :: Learner
  If PipeOpLearnerQuantiles has been trained, this is a list containing the Learners for each quantile. Otherwise, this contains the Learner that is being wrapped. Read-only.
- predict_type :: character(1)
  Predict type of the PipeOpLearnerQuantiles, which is always "response" "quantiles".

Methods

Methods inherited from PipeOp.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputecons
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Other Meta PipeOps: mlr_pipeops_learner, mlr_pipeops_learner_cv, mlr_pipeops_learner_pi_cvplus

Examples

```
library("mlr3")

task = tsk("boston_housing")
learner = lrn("regr.debug")
```

```
po = mlr_pipeops$get("learner_quantiles", learner)

po$train(list(task))
po$predict(list(task))
```

`mlr_pipeops_materialize`
Materialize Task View

Description

Materializes the active view of a `Task` by replacing its `DataBackend` with a new backend containing only the rows and columns currently used by the task.

This can be useful after operations that create virtual task views, such as `Task` `$filter()`, `$select()`, or `$cbind()`. In particular, many `PipeOpTaskPreproc` operations use `Task` `$cbind()` internally, which can create nested virtual backends. Materializing the view can reduce backend nesting and may free memory or speed up later data access.

Note that `Task` `$materialize_view()` only materializes the currently active view. Columns without any column role are dropped, and observations occuring more than once (duplicates in `$row_ids`), the resulting backend contains it only once, but the new task view will still contain it multiple times (duplicates in `$row_ids` are preserved).

Format

`R6Class` object inheriting from `PipeOp`.

Construction

```
PipeOpMaterialize$new(id = "materialize")
```

- `id` :: `character(1)`
  Identifier of resulting object. See `$id` slot of `PipeOp`.

Input and Output Channels

`PipeOpMaterialize` has one input channel named `"input"`, taking a `Task` both during training and prediction.

`PipeOpMaterialize` has one output channel named `"output"`, producing a `Task` both during training and prediction.

The output is the input `Task` with the active view materialized.

State

The `$state` is left empty (`list()`).

Parameters

`PipeOpMaterialize` has no parameters.

Internals

PipeOpMaterialize calls Task $materialize_view() on a clone of the input task, both during training and prediction. During training, the internal validation task is also materialized using $materialize_view(internal_valid_task = TRUE), but not during prediction.

Fields

Only fields inherited from PipeOp.

Methods

Only methods inherited from PipeOp.

See Also

https://mlr-org.com/pipeops.html

Other mlr3pipelines backend related: Graph, PipeOp, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_graphs, mlr_pipeops, mlr_pipeops_updatetarget

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputecons
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Examples

```
library("mlr3")

task = tsk("iris")
task$select("Petal.Length")$filter(1:10)
task$backend$colnames
task$backend$nrow
```

```
pom = PipeOpMaterialize$new("materialize")
materialized = pom$train(list(task))[[1]]
materialized$backend$colnames
materialized$backend$nrow
```

`mlr_pipeops_missind` *Add Missing Indicator Columns*

Description

Add missing indicator columns ("dummy columns") to the `Task`. Drops original features; should probably be used in combination with `PipeOpFeatureUnion` and imputation `PipeOp`s (see examples).

Note the `affect_columns` is initialized with `selector_invert(selector_type(c("factor", "ordered", "character")))`, since missing values in factorial columns are often indicated by out-of-range imputation (`PipeOpImputeOOR`).

Format

`R6Class` object inheriting from `PipeOpTaskPreprocSimple`/`PipeOpTaskPreproc`/`PipeOp`.

Construction

```
PipeOpMissInd$new(id = "missind", param_vals = list())
```

- `id` :: `character(1)` Identifier of the resulting object, defaulting to `"missind"`.
- `param_vals` :: named `list`
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

State

`$state` is a named `list` with the `$state` elements inherited from `PipeOpTaskPreproc`, as well as:

- `indicand_cols` :: `character`
  Names of columns for which indicator columns are added. If the `which` parameter is `"all"`, this is just the names of all features, otherwise it is the names of all features that had missing values during training.

Parameters

The parameters are the parameters inherited from the `PipeOpTaskPreproc`, as well as:

- `which` :: `character(1)`
  Determines for which features the indicator columns are added. Can either be `"missing_train"` (default), adding indicator columns for each feature that actually has missing values, or `"all"`, adding indicator columns for all features.

- type :: character(1)
  Determines the type of the newly created columns. Can be one of "factor" (default), "integer", "logical", "numeric".

Internals

This PipeOp should cover most cases where "dummy columns" or "missing indicators" are desired. Some edge cases:

- If imputation for factorial features is performed and only numeric features should gain missing indicators, the affect_columns parameter can be set to selector_type("numeric").
- If missing indicators should only be added for features that have more than a fraction of x missing values, the PipeOpRemoveConstants can be used with affect_columns = selector_grep("^missing_") and ratio = x.

Fields

Fields inherited from PipeOp.

Methods

Methods inherited from PipeOpTaskPreprocSimple(PipeOpTaskPreproc/PipeOp.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputecons
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Examples

```
library("mlr3")


task = tsk("diabetes")$select(c("insulin", "triceps"))
sum(complete.cases(task$data()))
task$missings()
tail(task$data())

po = po("missind")
new_task = po$train(list(task))[[1]]

tail(new_task$data())

# proper imputation + missing indicators

impgraph = list(
  po("imputesample"),
  po("missind")
) %>>% po("featureunion")

tail(impgraph$train(task)[[1]]$data())
```

---

mlr_pipeops_modelmatrix

Transform Columns by Constructing a Model Matrix

Description

Transforms columns using a given `formula` using the `stats::model.matrix()` function.

Format

`R6Class` object inheriting from `PipeOpTaskPreprocSimple`/`PipeOpTaskPreproc`/`PipeOp`.

Construction

```
PipeOpModelMatrix$new(id = "modelmatrix", param_vals = list())
```

- `id` :: `character(1)`
  Identifier of resulting object, default `"modelmatrix"`.
- `param_vals` :: named `list`
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from `PipeOpTaskPreproc`.

The output is the input `Task` with transformed columns according to the used `formula`.

State

The `$state` is a named `list` with the `$state` elements inherited from `PipeOpTaskPreproc`.

Parameters

The parameters are the parameters inherited from `PipeOpTaskPreproc`, as well as:

- `formula` :: `formula`
  Formula to use. Higher order interactions can be created using constructs like `~. ^ 2`. By default, an `(Intercept)` column of all `1`s is created, which can be avoided by adding `0 +` to the term. See `model.matrix()`.

Internals

Uses the `model.matrix()` function.

Fields

Only fields inherited from `PipeOp`.

Methods

Only methods inherited from `PipeOpTaskPreprocSimple`/`PipeOpTaskPreproc`/`PipeOp`.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: `PipeOp`, `PipeOpEncodePL`, `PipeOpEnsemble`, `PipeOpImpute`, `PipeOpTargetTrafo`, `PipeOpTaskPreproc`, `PipeOpTaskPreprocSimple`, `mlr_pipeops`, `mlr_pipeops_adas`, `mlr_pipeops_blsmote`, `mlr_pipeops_boxcox`, `mlr_pipeops_branch`, `mlr_pipeops_chunk`, `mlr_pipeops_classbalancing`, `mlr_pipeops_classifavg`, `mlr_pipeops_classweights`, `mlr_pipeops_classweightsex`, `mlr_pipeops_colapply`, `mlr_pipeops_collapsefactors`, `mlr_pipeops_colroles`, `mlr_pipeops_copy`, `mlr_pipeops_datefeatures`, `mlr_pipeops_decode`, `mlr_pipeops_encode`, `mlr_pipeops_encodeimpact`, `mlr_pipeops_encodelmer`, `mlr_pipeops_encodeplquantiles`, `mlr_pipeops_encodepltree`, `mlr_pipeops_featureunion`, `mlr_pipeops_filter`, `mlr_pipeops_fixfactors`, `mlr_pipeops_histbin`, `mlr_pipeops_ica`, `mlr_pipeops_imputecons`
`mlr_pipeops_imputehist`, `mlr_pipeops_imputelearner`, `mlr_pipeops_imputemean`, `mlr_pipeops_imputemedian`, `mlr_pipeops_imputemode`, `mlr_pipeops_imputeoor`, `mlr_pipeops_imputesample`, `mlr_pipeops_info`, `mlr_pipeops_isomap`, `mlr_pipeops_kernelpca`, `mlr_pipeops_learner`, `mlr_pipeops_learner_pi_cvplus`, `mlr_pipeops_learner_quantiles`, `mlr_pipeops_materialize`, `mlr_pipeops_missind`, `mlr_pipeops_multiplicitye`
`mlr_pipeops_multiplicityimply`, `mlr_pipeops_mutate`, `mlr_pipeops_nearmiss`, `mlr_pipeops_nmf`, `mlr_pipeops_nop`, `mlr_pipeops_ovrsplit`, `mlr_pipeops_ovrunite`, `mlr_pipeops_pca`, `mlr_pipeops_proxy`, `mlr_pipeops_quantilebin`, `mlr_pipeops_randomprojection`, `mlr_pipeops_randomresponse`, `mlr_pipeops_regravg`, `mlr_pipeops_removeconstants`, `mlr_pipeops_renamecolumns`, `mlr_pipeops_replicate`, `mlr_pipeops_rowapply`, `mlr_pipeops_scale`, `mlr_pipeops_scalemaxabs`, `mlr_pipeops_scalerange`, `mlr_pipeops_select`, `mlr_pipeops_smote`, `mlr_pipeops_smotenc`, `mlr_pipeops_spatialsign`, `mlr_pipeops_splines`, `mlr_pipeops_subsample`, `mlr_pipeops_targetinvert`, `mlr_pipeops_targetmutate`, `mlr_pipeops_targettrafoscalerange`, `mlr_pipeops_textvectorizer`, `mlr_pipeops_threshold`, `mlr_pipeops_tomek`, `mlr_pipeops_tunethreshold`, `mlr_pipeops_unbranch`, `mlr_pipeops_updatetarget`, `mlr_pipeops_vtreat`, `mlr_pipeops_yeojohnson`

Examples

```
library("mlr3")

task = tsk("iris")
pop = po("modelmatrix", formula = ~ .  ^ 2)

task$data()
pop$train(list(task))[[1]]$data()

pop$param_set$values$formula = ~ 0 + . ^ 2

pop$train(list(task))[[1]]$data()
```

`mlr_pipeops_multiplicityexply` *Explicate a Multiplicity*

Description

Explicate a `Multiplicity` by turning the input `Multiplicity` into multiple outputs.

This `PipeOp` has multiple output channels; the members of the input `Multiplicity` are forwarded each along a single edge. Therefore, only multiplicities with exactly as many members as `outnum` are accepted.

Note that `Multiplicity` is currently an experimental features and the implementation or UI may change.

Format

`R6Class` object inheriting from `PipeOp`.

Construction

```
PipeOpMultiplicityExply$new(outnum , id = "multiplicityexply", param_vals = list())
```

- `outnum` :: `numeric(1)` | `character`
  Determines the number of output channels.
- `id` :: `character(1)`
  Identifier of the resulting object, default `"multiplicityexply"`.
- `param_vals` :: named `list`
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

PipeOpMultiplicityExply has a single input channel named "input", collecting a Multiplicity of type any ("[*]") both during training and prediction.

PipeOpMultiplicityExply has multiple output channels depending on the outnum construction argument, named "output1", "output2" returning the elements of the unclassed input Multiplicity.

State

The $state is left empty (list()).

Parameters

PipeOpMultiplicityExply has no Parameters.

Internals

outnum should match the number of elements of the unclassed input Multiplicity.

Fields

Only fields inherited from PipeOp.

Methods

Only methods inherited from PipeOp.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputecons
mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantiles, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold,

mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Other Multiplicity PipeOps: Multiplicity(), PipeOpEnsemble, mlr_pipeops_classifavg, mlr_pipeops_featureunion mlr_pipeops_multiplicityimply, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_regravg, mlr_pipeops_replicate

Other Experimental Features: Multiplicity(), mlr_pipeops_multiplicityimply, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_replicate

Examples

```
library("mlr3")
task1 = tsk("iris")
task2 = tsk("mtcars")
po = po("multiplicityexply", outnum = 2)
po$train(list(Multiplicity(task1, task2)))
po$predict(list(Multiplicity(task1, task2)))
```

---

mlr_pipeops_multiplicityimply

Implicate a Multiplicity

Description

Implicate a Multiplicity by returning the input(s) converted to a Multiplicity.

This PipeOp has multiple input channels; all inputs are collected into a Multiplicity and then are forwarded along a single edge, causing the following PipeOps to be called multiple times, once for each Multiplicity member.

Note that Multiplicity is currently an experimental features and the implementation or UI may change.

Format

R6Class object inheriting from PipeOp.

Construction

```
PipeOpMultiplicityImply$new(innum = 0, id = "multiplicityimply", param_vals = list())
```

- innum :: numeric(1) | character
  Determines the number of input channels. If innum is 0 (default), a vararg input channel is created that can take an arbitrary number of inputs. If innum is a character vector, the number of input channels is the length of innum.
- id :: character(1)
  Identifier of the resulting object, default "multiplicityimply".
- param_vals :: named list
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default list().

Input and Output Channels

PipeOpMultiplicityImply has multiple input channels depending on the innum construction argument, named "input1", "input2", ... if innum is nonzero; if innum is 0, there is only one *vararg* input channel named "...". All input channels take any input ("*") both during training and prediction.

PipeOpMultiplicityImply has one output channel named "output", emitting a Multiplicity of type any ("[*]"), i.e., returning the input(s) converted to a Multiplicity both during training and prediction.

State

The $state is left empty (list()).

Parameters

PipeOpMultiplicityImply has no Parameters.

Internals

If innum is not numeric, e.g., a character, the output Multiplicity will be named based on the input channel names

Fields

Only fields inherited from PipeOp.

Methods

Only methods inherited from PipeOp.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputecons
mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantiles, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns, mlr_pipeops_replicate,

mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Other Multiplicity PipeOps: Multiplicity(), PipeOpEnsemble, mlr_pipeops_classifavg, mlr_pipeops_featureunion, mlr_pipeops_multiplicityexply, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_regravg, mlr_pipeops_replicate

Other Experimental Features: Multiplicity(), mlr_pipeops_multiplicityexply, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_replicate

Examples

```
library("mlr3")
task1 = tsk("iris")
task2 = tsk("mtcars")
po = po("multiplicityimply")
po$train(list(task1, task2))
po$predict(list(task1, task2))
```

---

mlr_pipeops_mutate *Add Features According to Expressions*

Description

Adds features according to expressions given as formulas that may depend on values of other features. This can add new features, or can change existing features.

Format

R6Class object inheriting from PipeOpTaskPreprocSimple/PipeOpTaskPreproc/PipeOp.

Construction

```
PipeOpMutate$new(id = "mutate", param_vals = list())
```

- id :: character(1)
  Identifier of resulting object, default "mutate".
- param_vals :: named list
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default list().

Input and Output Channels

Input and output channels are inherited from PipeOpTaskPreproc.

The output is the input Task with added and/or mutated features according to the mutation parameter.

State

The $state is a named list with the $state elements inherited from PipeOpTaskPreproc.

Parameters

The parameters are the parameters inherited from PipeOpTaskPreproc, as well as:

- mutation :: named list of formula
  Expressions for new features to create (or present features to change), in the form of formula. Each element of the list is a formula with the name of the element naming the feature to create or change, and the formula expression determining the result. This expression may reference other features, as well as variables visible at the creation of the formula (see examples). Initialized to list().
- delete_originals :: logical(1)
  Whether to delete original features. Even when this is FALSE, present features may still be overwritten. Initialized to FALSE.

Internals

A formula created using the ~ operator always contains a reference to the environment in which the formula is created. This makes it possible to use variables in the ~-expressions that both reference either column names or variable names.

Note that the formulas in mutation are evaluated sequentially. This allows for using variables that were constructed during evaluation of a previous formula. However, if existing features are changed, precedence is given to the original ones before the newly constructed ones.

Fields

Only fields inherited from PipeOp.

Methods

Only methods inherited from PipeOpTaskPreprocSimple/PipeOpTaskPreproc/PipeOp.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputecons
mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus,

mlr_pipeops_learner_quantiles, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Examples

```
library("mlr3")

constant = 1
pom = po("mutate")
pom$param_set$values$mutation = list(
  Sepal.Length_plus_constant = ~ Sepal.Length + constant,
  Sepal.Area = ~ Sepal.Width * Sepal.Length,
  Petal.Area = ~ Petal.Width * Petal.Length,
  Sepal.Area_plus_Petal.Area = ~ Sepal.Area + Petal.Area
)

pom$train(list(tsk("iris")))[[1]]$data()
```

---

mlr_pipeops_nearmiss *Nearmiss Down-Sampling*

Description

Generates a more balanced data set by down-sampling the instances of non-minority classes using the NEARMISS algorithm.

The algorithm down-samples by selecting instances from the non-minority classes that have the smallest mean distance to their k nearest neighbors of different classes. For this only numeric and integer features are taken into account. These must have no missing values.

This can only be applied to classification tasks. Multiclass classification is supported.

See themis::nearmiss for details.

Format

R6Class object inheriting from PipeOpTaskPreproc/PipeOp.

Construction

```
PipeOpNearmiss$new(id = "nearmiss", param_vals = list())
```

- `id` :: `character(1)`
  Identifier of resulting object, default `"nearmiss"`.
- `param_vals` :: named `list`
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from `PipeOpTaskPreproc`. Instead of a `Task`, a `TaskClassif` is used as input and output during training and prediction.

The output during training is the input `Task` with the rows removed from the non-minority classes. The output during prediction is the unchanged input.

State

The `$state` is a named `list` with the `$state` elements inherited from `PipeOpTaskPreproc`.

Parameters

The parameters are the parameters inherited from `PipeOpTaskPreproc`, as well as

- `k` :: `integer(1)`
  Number of nearest neighbors used for calculating the mean distances. Default is `5`.
- `under_ratio` :: `numeric(1)`
  Ratio of the minority-to-majority frequencies. This specifies the ratio to which the number of instances in the non-minority classes get down-sampled to, relative to the number of instances of the minority class. Default is `1`. For details, see `themis::nearmiss`.

Fields

Only fields inherited from `PipeOp`.

Methods

Only methods inherited from `PipeOpTaskPreproc`/`PipeOp`.

References

Zhang, J., Mani, I. (2003). "KNN Approach to Unbalanced Data Distributions: A Case Study Involving Information Extraction." In *Proceedings of Workshop on Learning from Imbalanced Datasets (ICML)*.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputecons
mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantiles, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Examples

```
library("mlr3")

# Create example task
task = tsk("wine")
task$head()
table(task$data(cols = "type"))

# Down-sample and balance data
pop = po("nearmiss")
nearmiss_result = pop$train(list(task))[[1]]$data()
nrow(nearmiss_result)
table(nearmiss_result$type)
```

`mlr_pipeops_nmf` *Non-negative Matrix Factorization*

Description

Extracts non-negative components from data by performing non-negative matrix factorization. Only affects non-negative numerical features. See `nmf()` for details.

Format

R6Class object inheriting from PipeOpTaskPreproc/PipeOp.

Construction

```
PipeOpNMF$new(id = "nmf", param_vals = list())
```

- id :: character(1)
  Identifier of resulting object, default "nmf".
- param_vals :: named list
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default list().

Input and Output Channels

Input and output channels are inherited from PipeOpTaskPreproc.

The output is the input Task with all affected numeric features replaced by their non-negative components.

State

The $state is a named list with the $state elements inherited from PipeOpTaskPreproc, as well as the elements of the object returned by nmf().

Parameters

The parameters are the parameters inherited from PipeOpTaskPreproc, as well as:

- rank :: integer(1)
  Factorization rank, i.e., number of components. Initialized to 2. See nmf().
- method :: character(1)
  Specification of the NMF algorithm. Initialized to "brunet". See nmf().
- seed :: character(1) | integer(1) | list() | object of class NMF | function()
  Specification of the starting point. See nmf().
- nrun :: integer(1)
  Number of runs to performs. Default is 1. More than a single run allows for the computation of a consensus matrix which will also be stored in the $state. See nmf().
- debug :: logical(1)
  Whether to toggle debug mode. Default is FALSE. See nmf().
- keep.all :: logical(1)
  Whether all factorizations are to be saved and returned. Default is FALSE. Only has an effect if nrun > 1. See nmf().
- parallel :: character(1) | integer(1) | logical(1)
  Specification of parallel handling if nrun > 1. Initialized to FALSE, as it is recommended to use mlr3's future-based parallelization. See nmf().

- parallel.required :: character(1) | integer(1) | logical(1)
  Same as parallel, but an error is thrown if the computation cannot be performed in parallel or with the specified number of processors. Initialized to FALSE, as it is recommended to use mlr3's future-based parallelization. See nmf().
- shared.memory :: logical(1)
  Whether shared memory should be enabled. See nmf().
- simplifyCB :: logical(1)
  Whether callback results should be simplified. Default is TRUE. See nmf().
- track :: logical(1)
  Whether error tracking should be enabled. Default is FALSE. See nmf().
- verbose :: integer(1) | logical(1)
  Specification of verbosity. Default is FALSE. See nmf().
- pbackend :: character(1) | integer(1) | NULL
  Specification of the parallel backend. It is recommended to use mlr3's future-based parallelization. See nmf().
- callback | function()
  Callback function that is called after each run (if nrun > 1). See nmf().

Internals

Uses the nmf() function as well as basis(), coef() and ginv(). Does not support features with missing or infinite values. Features containing negative values are currently excluded with a warning, but this will become an error in a future release. Use affect_columns = selector_non_negative() to explicitly select non-negative features.

Fields

Only fields inherited from PipeOp.

Methods

Only methods inherited from PipeOpTaskPreproc/PipeOp.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputecons
mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus,

mlr_pipeops_learner_quantiles, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Examples

```
library("mlr3")

task = tsk("iris")
pop = po("nmf")

task$data()
pop$train(list(task))[[1]]$data()

pop$state
```

---

mlr_pipeops_nop *Simply Push Input Forward*

Description

Simply pushes the input forward. Can be useful during Graph construction using the %>>%-operator to specify which PipeOp gets connected to which.

Format

R6Class object inheriting from PipeOp.

Construction

```
PipeOpNOP$new(id = "nop", param_vals = list())
```

- id :: character(1)
  Identifier of resulting object, default "nop".
- param_vals :: named list
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default list().

Input and Output Channels

PipeOpNOP has one input channel named "input", taking any input ("*") both during training and prediction.

PipeOpNOP has one output channel named "output", producing the object given as input ("*") without changes.

State

The $state is left empty (list()).

Parameters

PipeOpNOP has no parameters.

Internals

PipeOpNOP is a useful "default" stand-in for a PipeOp/Graph that does nothing.

Fields

Only fields inherited from PipeOp.

Methods

Only methods inherited from PipeOp.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputecons
mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantiles, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns
mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer,

mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Other Placeholder Pipeops: mlr_pipeops_copy

Examples

```
library("mlr3")

nop = po("nop")

nop$train(list(1))

# use `gunion` and `%>>%` to create a "bypass"
# next to "pca"
gr = gunion(list(
  po("pca"),
  nop
)) %>>% po("featureunion")

gr$train(tsk("iris"))[[1]]$data()
```

---

mlr_pipeops_ovrsplit *Split a Classification Task into Binary Classification Tasks*

Description

Splits a classification Task into several binary classification Tasks to perform "One vs. Rest" classification. This works in combination with PipeOpOVRUnite.

For each target level a new binary classification Task is constructed with the respective target level being the positive class and all other target levels being the new negative class "rest".

This PipeOp creates a Multiplicity, which means that subsequent PipeOps are executed multiple times, once for each created binary Task, until a PipeOpOVRUnite is reached.

Note that Multiplicity is currently an experimental features and the implementation or UI may change.

Format

R6Class inheriting from PipeOp.

Construction

```
PipeOpOVRSplit$new(id = "ovrsplit", param_vals = list())
```

- id :: character(1)
  Identifier of the resulting object, default "ovrsplit".
- param_vals :: named list
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default list().

Input and Output Channels

PipeOpOVRSplit has one input channel named "input" taking a TaskClassif both during training and prediction.

PipeOpOVRSplit has one output channel named "output" returning a Multiplicity of TaskClassifs both during training and prediction, i.e., the newly constructed binary classification Tasks.

State

The $state contains the original target levels of the TaskClassif supplied during training.

Parameters

PipeOpOVRSplit has no parameters.

Internals

The original target levels stored in the $state are also used during prediction when creating the new binary classification Tasks.

The names of the element of the output Multiplicity are given by the levels of the target.

If a target level "rest" is present in the input TaskClassif, the negative class will be labeled as "rest." (using as many "."‘ postfixes needed to yield a valid label).

Should be used in combination with PipeOpOVRUnite.

Fields

Only fields inherited from PipeOp.

Methods

Only methods inherited from PipeOp.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputecons
mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantiles, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrunite, mlr_pipeops_pca,

mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Other Multiplicity PipeOps: Multiplicity(), PipeOpEnsemble, mlr_pipeops_classifavg, mlr_pipeops_featureunion mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_ovrunite, mlr_pipeops_regravg, mlr_pipeops_replicate

Other Experimental Features: Multiplicity(), mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_ovrunite, mlr_pipeops_replicate

Examples

```
library(mlr3)
task = tsk("iris")
po = po("ovrsplit")
po$train(list(task))
po$predict(list(task))
```

---

mlr_pipeops_ovrunite *Unite Binary Classification Tasks*

Description

Perform "One vs. Rest" classification by (weighted) majority vote prediction from classification Predictions. This works in combination with PipeOpOVRSplit.

Weights can be set as a parameter; if none are provided, defaults to equal weights for each prediction.

Always returns a "prob" prediction, regardless of the incoming Learner's $predict_type. The label of the class with the highest predicted probability is selected as the "response" prediction.

Missing values during prediction are treated as each class label being equally likely.

This PipeOp uses a Multiplicity input, which is created by PipeOpOVRSplit and causes PipeOps on the way to this PipeOp to be called once for each individual binary Task.

Note that Multiplicity is currently an experimental features and the implementation or UI may change.

Format

R6Class inheriting from PipeOpEnsemble/PipeOp.

Construction

```
PipeOpOVRUnite$new(id = "ovrunite", param_vals = list())
```

- `id` :: `character(1)`
  Identifier of the resulting object, default `"ovrunite"`.
- `param_vals` :: named `list`
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from `PipeOpEnsemble`. Instead of a `Prediction`, a `PredictionClassif` is used as input and output during prediction and `PipeOpEnsemble`'s `collect` parameter is initialized with `TRUE` to allow for collecting a `Multiplicity` input.

State

The `$state` is left empty (`list()`).

Parameters

The parameters are the parameters inherited from the `PipeOpEnsemble`.

Internals

Inherits from `PipeOpEnsemble` by implementing the `private$.predict()` method.

Should be used in combination with `PipeOpOVRSplit`.

Fields

Only fields inherited from `PipeOpEnsemble`/`PipeOp`.

Methods

Only methods inherited from `PipeOpEnsemble`/`PipeOp`.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: `PipeOp`, `PipeOpEncodePL`, `PipeOpEnsemble`, `PipeOpImpute`, `PipeOpTargetTrafo`, `PipeOpTaskPreproc`, `PipeOpTaskPreprocSimple`, `mlr_pipeops`, `mlr_pipeops_adas`, `mlr_pipeops_blsmote`, `mlr_pipeops_boxcox`, `mlr_pipeops_branch`, `mlr_pipeops_chunk`, `mlr_pipeops_classbalancing`, `mlr_pipeops_classifavg`, `mlr_pipeops_classweights`, `mlr_pipeops_classweightsex`, `mlr_pipeops_colapply`, `mlr_pipeops_collapsefactors`, `mlr_pipeops_colroles`, `mlr_pipeops_copy`, `mlr_pipeops_datefeatures`, `mlr_pipeops_decode`, `mlr_pipeops_encode`, `mlr_pipeops_encodeimpact`, `mlr_pipeops_encodelmer`, `mlr_pipeops_encodeplquantiles`, `mlr_pipeops_encodepltree`, `mlr_pipeops_featureunion`, `mlr_pipeops_filter`, `mlr_pipeops_fixfactors`, `mlr_pipeops_histbin`, `mlr_pipeops_ica`, `mlr_pipeops_imputecons`
`mlr_pipeops_imputehist`, `mlr_pipeops_imputelearner`, `mlr_pipeops_imputemean`, `mlr_pipeops_imputemedian`, `mlr_pipeops_imputemode`, `mlr_pipeops_imputeoor`, `mlr_pipeops_imputesample`, `mlr_pipeops_info`,

mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantiles, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Other Ensembles: PipeOpEnsemble, mlr_learners_avg, mlr_pipeops_classifavg, mlr_pipeops_regravg

Other Multiplicity PipeOps: Multiplicity(), PipeOpEnsemble, mlr_pipeops_classifavg, mlr_pipeops_featureunion mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_ovrsplit, mlr_pipeops_regravg, mlr_pipeops_replicate

Other Experimental Features: Multiplicity(), mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_ovrsplit, mlr_pipeops_replicate

Examples

```
library(mlr3)
task = tsk("iris")
gr = po("ovrsplit") %>>% lrn("classif.rpart") %>>% po("ovrunite")
gr$train(task)
gr$predict(task)
gr$pipeops$classif.rpart$learner$predict_type = "prob"
gr$predict(task)
```

---

mlr_pipeops_pca *Principal Component Analysis*

Description

Extracts principal components from data. Only affects numerical features. See stats::prcomp() for details.

Format

R6Class object inheriting from PipeOpTaskPreproc/PipeOp.

Construction

```
PipeOpPCA$new(id = "pca", param_vals = list())
```

- id :: character(1)
  Identifier of resulting object, default "pca".

- param_vals :: named list
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default list().

Input and Output Channels

Input and output channels are inherited from PipeOpTaskPreproc.

The output is the input Task with all affected numeric features replaced by their principal components.

State

The $state is a named list with the $state elements inherited from PipeOpTaskPreproc, as well as the elements of the class stats::prcomp, with the exception of the $x slot. These are in particular:

- sdev :: numeric
  The standard deviations of the principal components.
- rotation :: matrix
  The matrix of variable loadings.
- center :: numeric | logical(1)
  The centering used, or FALSE.
- scale :: numeric | logical(1)
  The scaling used, or FALSE.

Parameters

The parameters are the parameters inherited from PipeOpTaskPreproc, as well as:

- center :: logical(1)
  Indicating whether the features should be centered. Default is TRUE. See prcomp().
- scale. :: logical(1)
  Whether to scale features to unit variance before analysis. Default is FALSE, but scaling is advisable. See prcomp().
- rank. :: integer(1)
  Maximal number of principal components to be used. Default is NULL: use all components. See prcomp().

Internals

Uses the prcomp() function.

Fields

Only fields inherited from PipeOp.

Methods

Only methods inherited from PipeOpTaskPreproc/PipeOp.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputecons
mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantiles, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Examples

```
library("mlr3")

task = tsk("iris")
pop = po("pca")

task$data()
pop$train(list(task))[[1]]$data()

pop$state
```

`mlr_pipeops_proxy` *Wrap another PipeOp or Graph as a Hyperparameter*

Description

Wraps another PipeOp or Graph as determined by the `content` hyperparameter. Input is routed through the `content` and the `contents'` output is returned. The `content` hyperparameter can be changed during tuning, this is useful as an alternative to PipeOpBranch.

Format

Abstract R6Class inheriting from PipeOp.

Construction

```
PipeOpProxy$new(innum = 0, outnum = 1, id = "proxy", param_vals = list())
```

- innum :: numeric(1)\cr Determines the number of input channels. If innum‘ is 0 (default), a vararg input channel is created that can take an arbitrary number of inputs.
- outnum :: ‘numeric(1)
  Determines the number of output channels.
- id :: character(1)
  Identifier of resulting object. See $id slot of PipeOp.
- param_vals :: named list
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default list().

Input and Output Channels

PipeOpProxy has multiple input channels depending on the innum construction argument, named "input1", "input2", ... if innum is nonzero; if innum is 0, there is only one *vararg* input channel named "...".

PipeOpProxy has multiple output channels depending on the outnum construction argument, named "output1", "output2", ... The output is determined by the output of the content operation (a PipeOp or Graph).

State

The $state is the trained content PipeOp or Graph.

Parameters

- content :: PipeOp | Graph
  The PipeOp or Graph that is being proxied (or an object that is converted to a Graph by as_graph()). Defaults to an instance of PipeOpFeatureUnion (combines all input if they are Tasks).

Internals

The content will internally be coerced to a graph via as_graph() prior to train and predict.

The default value for content is PipeOpFeatureUnion,

Fields

Fields inherited from PipeOp.

Methods

Only methods inherited from PipeOp.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputecons mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantiles, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Examples

```
library("mlr3")

set.seed(1234)
task = tsk("iris")

# use a proxy for preprocessing and a proxy for learning, i.e.,
# no preprocessing and classif.rpart
g = po("proxy", id = "preproc", param_vals = list(content = po("nop"))) %>>%
  po("proxy", id = "learner", param_vals = list(content = lrn("classif.rpart")))
rr_rpart = resample(task, learner = GraphLearner$new(g), resampling = rsmp("cv", folds = 3))
rr_rpart$aggregate(msr("classif.ce"))

# use pca for preprocessing and classif.rpart as the learner
g$param_set$values$preproc.content = po("pca")
g$param_set$values$learner.content = lrn("classif.rpart")
rr_pca_rpart = resample(task, learner = GraphLearner$new(g), resampling = rsmp("cv", folds = 3))
rr_pca_rpart$aggregate(msr("classif.ce"))
```

`mlr_pipeops_quantilebin` *Split Numeric Features into Quantile Bins*

Description

Splits numeric features into quantile bins.

Format

`R6Class` object inheriting from `PipeOpTaskPreprocSimple`/`PipeOpTaskPreproc`/`PipeOp`.

Construction

```
PipeOpQuantileBin$new(id = "quantilebin", param_vals = list())
```

- `id` :: `character(1)`
  Identifier of resulting object, default `"quantilebin"`.
- `param_vals` :: named `list`
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from `PipeOpTaskPreproc`.

The output is the input `Task` with all affected numeric features replaced by their binned versions.

State

The `$state` is a named `list` with the `$state` elements inherited from `PipeOpTaskPreproc`, as well as:

- `bins` :: `list`
  List of intervals representing the bins for each numeric feature.

Parameters

The parameters are the parameters inherited from `PipeOpTaskPreproc`, as well as:

- `numsplits` :: `integer(1)`
  Number of bins to create. Default is `2`.

Internals

Uses the `stats::quantile` function.

Fields

Only fields inherited from `PipeOp`.

Methods

Only methods inherited from PipeOpTaskPreprocSimple/PipeOpTaskPreproc/PipeOp.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputecons
mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantiles, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Examples

```
library("mlr3")

task = tsk("iris")
pop = po("quantilebin")

task$data()
pop$train(list(task))[[1]]$data()

pop$state
```

---

mlr_pipeops_randomprojection

Project Numeric Features onto a Randomly Sampled Subspace

Description

Projects numeric features onto a randomly sampled subspace. All numeric features (or the ones selected by `affect_columns`) are replaced by numeric features `PR1`, `PR2`, ... `PRn`

Samples with features that contain missing values result in all `PR1`..`PRn` being NA for that sample, so it is advised to do imputation *before* random projections if missing values can be expected.

Format

`R6Class` object inheriting from `PipeOpTaskPreprocSimple`/`PipeOpTaskPreproc`/`PipeOp`.

Construction

```
PipeOpRandomProjection$new(id = "randomprojection", param_vals = list())
```

- `id` :: `character(1)`
  Identifier of resulting object, default `"randomprojection"`.
- `param_vals` :: named `list`
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from `PipeOpTaskPreproc`.

The output is the input `Task` with affected numeric features projected onto a random subspace.

State

The `$state` is a named `list` with the `$state` elements inherited from `PipeOpTaskPreproc`, as well as an element `$projection`, a `matrix`.

Parameters

The parameters are the parameters inherited from `PipeOpTaskPreproc`, as well as:

- `rank` :: `integer(1)`
  The dimension of the subspace to project onto. Initialized to 1.

Internals

If there are `n` (affected) numeric features in the input `Task`, then `$state$projection` is a `rank` x `m` `matrix`. The output is calculated as `input %*% state$projection`.

The random projection matrix is obtained through Gram-Schmidt orthogonalization from a matrix with values standard normally distributed, which gives a distribution that is rotation invariant, as per Eaton: Multivariate Statistics, A Vector Space Approach, Pg. 234.

Fields

Only fields inherited from `PipeOp`.

Methods

Only methods inherited from PipeOpTaskPreprocSimple/PipeOpTaskPreproc/PipeOp.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputecons
mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantiles, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Examples

```
library("mlr3")

task = tsk("iris")
pop = po("randomprojection", rank = 2)

task$data()
pop$train(list(task))[[1]]$data()

pop$state
```

`mlr_pipeops_randomresponse`

Generate a Randomized Response Prediction

Description

Takes in a Prediction of predict_type "prob" (for PredictionClassif) or "se" (for PredictionRegr) and generates a randomized "response" prediction.

For "prob", the responses are sampled according to the probabilities of the input PredictionClassif. For "se", responses are randomly drawn according to the rdistfun parameter (default is rnorm) by using the original responses of the input PredictionRegr as the mean and the original standard errors of the input PredictionRegr as the standard deviation (sampling is done observation-wise).

Format

R6Class object inheriting from PipeOp.

Construction

```
PipeOpRandomResponse$new(id = "randomresponse", param_vals = list(), packages = character(0))
```

- id :: character(1)
  Identifier of the resulting object, default "randomresponse".
- param_vals :: named list
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default list().
- packages :: character
  Set of all required packages for the private$.predict() methods related to the rdistfun parameter. Default is character(0).

Input and Output Channels

PipeOpRandomResponse has one input channel named "input", taking NULL during training and a Prediction during prediction.

PipeOpRandomResponse has one output channel named "output", producing NULL during training and a Prediction with random responses during prediction.

State

The $state is left empty (list()).

Parameters

- rdistfun :: function
  A function for generating random responses when the predict type is "se". This function must accept the arguments n (integerish number of responses), mean (numeric for the mean), and sd (numeric for the standard deviation), and must *vectorize* over mean and sd. Default is rnorm.

Internals

If the predict_type of the input Prediction does not match "prob" or "se", the input Prediction will be returned unaltered.

Fields

Only fields inherited from PipeOp.

Methods

Only methods inherited from PipeOp.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputecons
mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantiles, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Examples

```
library(mlr3)
library(mlr3learners)

task1 = tsk("iris")
g1 = LearnerClassifRpart$new() %>>% PipeOpRandomResponse$new()
g1$train(task1)
g1$pipeops$classif.rpart$learner$predict_type = "prob"
set.seed(2409)
g1$predict(task1)

task2 = tsk("mtcars")
g2 = LearnerRegrLM$new() %>>% PipeOpRandomResponse$new()
g2$train(task2)
g2$pipeops$regr.lm$learner$predict_type = "se"
```

```
set.seed(2906)
g2$predict(task2)
```

`mlr_pipeops_regravg` *Weighted Prediction Averaging*

Description

Perform (weighted) prediction averaging from regression `Predictions` by connecting `PipeOpRegrAvg` to multiple `PipeOpLearner` outputs.

The resulting `"response"` prediction is a weighted average of the incoming `"response"` predictions. Aggregation of `"se"` predictions is controlled by the `se_aggr` parameter (see below). When `"se"` is not requested or `se_aggr = "none"`, `"se"` is dropped.

Format

`R6Class` inheriting from `PipeOpEnsemble`/`PipeOp`.

`"se"` Aggregation

Let there be `K` incoming predictions with weights `w` (sum to 1). For a given row `j`, denote per-model means `mu_i[j]` and, if available, per-model standard errors `se_i[j]`. Define

```
mu_bar[j]      = sum_i w[i] * mu_i[j]
var_between[j] = sum_i w[i] * (mu_i[j] - mu_bar[j])^2 # weighted var of means
var_within[j]  = sum_i w[i] * se_i[j]^2               # weighted mean of SE^2s
```

The following aggregation methods are available:

- `se_aggr = "predictive"` – *Within + Between (mixture/predictive SD)*

  `se[j] = sqrt(var_within[j] + var_between[j])`

  Interpretation. Treats each incoming `se_i` as that model's predictive SD at the point (or, if the learner reports SE of the conditional mean–as many `mlr3` regression learners do–then as that mean-SE). The returned `se` is the SD of the *mixture ensemble* under weighted averaging: it increases when base models disagree (epistemic spread) and when individual models are uncertain (aleatoric spread). **Notes.** If `se_i` represents *mean* SE (common in `predict.lm(se.fit=TRUE)`-style learners), the result aggregates those mean-SEs and still adds model disagreement correctly, but it will *underestimate* a true predictive SD that would additionally include irreducible noise. Requires `"se"` to be present from **all** inputs.

- `se_aggr = "mean"` – *SE of the weighted average of means under equicorrelation* With a correlation parameter `se_aggr_rho = rho`, assume `Cov(mu_i_hat, mu_j_hat) = rho * se_i * se_j` for all `i != j`. Then

```
# components:
a[j] = sum_i (w[i]^2 * se_i[j]^2)
b[j] = (sum_i w[i] * se_i[j])^2
var_mean[j] = (1 - rho) * a[j] + rho * b[j]
se[j] = sqrt(var_mean[j])
```

Interpretation. Returns the *standard error of the averaged estimator* `sum_i w[i] * mu_i`, not a predictive SD. Use when you specifically care about uncertainty of the averaged mean itself. **Notes.** `rho` is clamped to the PSD range `[-1/(K-1), 1]` for `K > 1`. Typical settings: `rho = 0` (assume independence; often optimistic for CV/bagging) and `rho = 1` (perfect correlation; conservative and equal to the weighted arithmetic mean of SEs). Requires `"se"` from **all** inputs.

- `se_aggr = "within"` – *Within-model component only*

  ```
  se[j] = sqrt(var_within[j])
  ```

  Interpretation. Aggregates only the average per-model uncertainty and **ignores** disagreement between models. Useful as a diagnostic of the aleatoric component; not a full ensemble uncertainty. **Notes.** Typically *underestimates* the uncertainty of the ensemble prediction when models disagree. Requires `"se"` from **all** inputs.

- `se_aggr = "between"` – *Between-model component only (works without `"se"`)*

  ```
  se[j] = sqrt(var_between[j])
  ```

  Interpretation. Captures only the spread of the base means (epistemic/model disagreement). **Notes.** This is the only method that does not use incoming `"se"`. It is a *lower bound* on a full predictive SD, because it omits within-model noise.

- `se_aggr = "none"` – *Do not return* `"se"` `"se"` is dropped from the output prediction.

Relationships and edge cases. For any row, `se("predictive") >= max(se("within"), se("between"))`. With a single input (`K = 1`), `"predictive"` and `"within"` return the input `"se"`, `"between"` returns `0`. Methods `"predictive"`, `"mean"`, and `"within"` require all inputs to provide `"se"`; otherwise aggregation errors.

Weights can be set as a parameter; if none are provided, defaults to equal weights for each prediction.

Construction

```
PipeOpRegrAvg$new(innum = 0, collect_multiplicity = FALSE, id = "regravg", param_vals = list())
```

- `innum` :: `numeric(1)`
  Determines the number of input channels. If `innum` is 0 (default), a vararg input channel is created that can take an arbitrary number of inputs.
- `collect_multiplicity` :: `logical(1)`
  If `TRUE`, the input is a `Multiplicity` collecting channel. This means, a `Multiplicity` input, instead of multiple normal inputs, is accepted and the members are aggregated. This requires `innum` to be 0. Default is `FALSE`.
- `id` :: `character(1)` Identifier of the resulting object, default `"regravg"`.
- `param_vals` :: named `list`
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from PipeOpEnsemble. Instead of a Prediction, a PredictionRegr is used as input and output during prediction.

State

The $state is left empty (list()).

Parameters

The parameters are the parameters inherited from the PipeOpEnsemble, as well as:

- se_aggr :: character(1)
  Controls how incoming "se" values are aggregated into an ensemble "se". One of "predictive", "mean", "within", "between", "none". See the description above for definitions and interpretation.
- se_aggr_rho :: numeric(1)
  Equicorrelation parameter used only for se_aggr = "mean". Interpreted as the common correlation between per-model mean estimators. Recommended range [0, 1]; values are clamped to [-1/(K-1), 1] for validity.

Internals

Inherits from PipeOpEnsemble by implementing the private$weighted_avg_predictions() method.

Fields

Only fields inherited from PipeOp.

Methods

Only methods inherited from PipeOpEnsemble/PipeOp.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputecons
mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantiles, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate,

mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Other Multiplicity PipeOps: Multiplicity(), PipeOpEnsemble, mlr_pipeops_classifavg, mlr_pipeops_featureunion, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_replicate

Other Ensembles: PipeOpEnsemble, mlr_learners_avg, mlr_pipeops_classifavg, mlr_pipeops_ovrunite

Examples

```
library("mlr3")

# Simple Bagging for Regression
gr = ppl("greplicate",
  po("subsample") %>>%
  po("learner", lrn("regr.rpart")),
  n = 5
) %>>%
  po("regravg")

resample(tsk("mtcars"), GraphLearner$new(gr), rsmp("holdout"))
```

---

mlr_pipeops_removeconstants

Remove Constant Features

Description

Remove constant features from a mlr3::Task. For each feature, calculates the ratio of features which differ from their mode value. All features with a ratio below a settable threshold are removed from the task. Missing values can be ignored or treated as a regular value distinct from non-missing values.

Format

R6Class object inheriting from PipeOpTaskPreprocSimple/PipeOpTaskPreproc/PipeOp.

Construction

```
PipeOpRemoveConstants$new(id = "removeconstants")
```

- `id` :: `character(1)` Identifier of the resulting object, defaulting to `"removeconstants"`.
- `param_vals` :: named `list`
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

State

`$state` is a named `list` with the `$state` elements inherited from `PipeOpTaskPreproc`, as well as:

- `features` :: `character()`
  Names of features that are being kept. Features of types that the `Filter` can not operate on are always being kept.

Parameters

The parameters are the parameters inherited from the `PipeOpTaskPreproc`, as well as:

- `ratio` :: `numeric(1)`
  Ratio of values which must be different from the mode value in order to keep a feature in the task. Initialized to 0, which means only constant features with exactly one observed level are removed.
- `rel_tol` :: `numeric(1)`
  Relative tolerance within which to consider a numeric feature constant. Set to 0 to disregard relative tolerance. Initialized to `1e-8`.
- `abs_tol` :: `numeric(1)`
  Absolute tolerance within which to consider a numeric feature constant. Set to 0 to disregard absolute tolerance. Initialized to `1e-8`.
- `na_ignore` :: `logical(1)`
  If `TRUE`, the ratio is calculated after removing all missing values first, so a column can be "constant" even if some but not all values are `NA`. Initialized to `TRUE`.

Fields

Fields inherited from `PipeOp`.

Methods

Methods inherited from `PipeOpTaskPreprocSimple`/`PipeOpTaskPreproc`/`PipeOp`.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: `PipeOp`, `PipeOpEncodePL`, `PipeOpEnsemble`, `PipeOpImpute`, `PipeOpTargetTrafo`, `PipeOpTaskPreproc`, `PipeOpTaskPreprocSimple`, `mlr_pipeops`, `mlr_pipeops_adas`, `mlr_pipeops_blsmote`, `mlr_pipeops_boxcox`, `mlr_pipeops_branch`, `mlr_pipeops_chunk`, `mlr_pipeops_classbalancing`, `mlr_pipeops_classifavg`, `mlr_pipeops_classweights`, `mlr_pipeops_classweightsex`, `mlr_pipeops_colapply`,

mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputecons mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantiles, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Examples

```
library("mlr3")
data = data.table::data.table(y = runif(10), a = 1:10, b = rep(1, 10), c = rep(1:2, each = 5))

task = TaskRegr$new("example", data, target = "y")

po = po("removeconstants")

po$train(list(task = task))[[1]]$data()

po$state
```

---

mlr_pipeops_renamecolumns

Rename Columns

Description

Renames the columns of a Task both during training and prediction. Uses the `$rename()` mutator of the Task.

Format

R6Class object inheriting from PipeOpTaskPreprocSimple/PipeOpTaskPreproc/PipeOp.

Construction

```
PipeOpRenameColumns$new(id = "renamecolumns", param_vals = list())
```

- `id` :: `character(1)`
  Identifier of resulting object, default `"renamecolumns"`.
- `param_vals` :: named `list`
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from `PipeOpTaskPreproc`.

The output is the input `Task` with the old column names changed to the new ones.

State

The `$state` is a named `list` with the `$state` elements inherited from `PipeOpTaskPreproc`.

Parameters

The parameters are the parameters inherited from `PipeOpTaskPreproc`, as well as:

- `renaming` :: named `character` | `function`
  Takes the form of either a named `character` or a `function`. For a named `character` vector, the names of the vector elements specify the old column names and the corresponding element values give the new column names. A `function` specifies how the old column names should be changed to the new column names. The function must return a `character` vector with one entry per input column name so that each selected column receives a new name. To choose columns use the `affect_columns` parameter. Initialized to `character(0)`.
- `ignore_missing` :: `logical(1)`
  Ignore if columns named in `renaming` are not found in the input `Task`. If this is `FALSE`, then names found in `renaming` not found in the `Task` cause an error. Initialized to `FALSE`.

Internals

Uses the `$rename()` mutator of the `Task` to set new column names.

Fields

Only fields inherited from `PipeOp`.

Methods

Only methods inherited from `PipeOpTaskPreprocSimple`/`PipeOpTaskPreproc`/`PipeOp`.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputecons
mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantiles, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Examples

```
library("mlr3")

task = tsk("iris")
pop = po("renamecolumns", param_vals = list(renaming = c("Petal.Length" = "PL")))
pop$train(list(task))

pof = po("renamecolumns", param_vals = list(renaming = function(colnames) {
  sub("Petal", "P", colnames)
}))
pof$train(list(task))
```

---

mlr_pipeops_replicate *Replicate the Input as a Multiplicity*

Description

Replicate the input as a Multiplicity, causing subsequent PipeOps to be executed multiple reps times.

Note that Multiplicity is currently an experimental features and the implementation or UI may change.

Format

R6Class object inheriting from PipeOp.

Construction

```
PipeOpReplicate$new(id = "replicate", param_vals = list())
```

- id :: character(1) Identifier of the resulting object, default "replicate".
- param_vals :: named list
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default list().

Input and Output Channels

PipeOpReplicate has one input channel named "input", taking any input ("*") both during training and prediction.

PipeOpReplicate has one output channel named "output" returning the replicated input as a Multiplicity of type any ("[*]") both during training and prediction.

State

The $state is left empty (list()).

Parameters

- reps :: numeric(1)
  Integer indicating the number of times the input should be replicated.

Fields

Only fields inherited from PipeOp.

Methods

Only methods inherited from PipeOp.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputecons
mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info,

mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantiles, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Other Multiplicity PipeOps: Multiplicity(), PipeOpEnsemble, mlr_pipeops_classifavg, mlr_pipeops_featureunion mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_regravg

Other Experimental Features: Multiplicity(), mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite

Examples

```
library("mlr3")
task = tsk("iris")
po = po("replicate", param_vals = list(reps = 3))
po$train(list(task))
po$predict(list(task))
```

---

mlr_pipeops_rowapply *Apply a Function to each Row of a Task*

Description

Applies a function to each row of a task. Use the `affect_columns` parameter inherited from PipeOpTaskPreprocSimple to limit the columns this function should be applied to.

Format

R6Class object inheriting from PipeOpTaskPreprocSimple/PipeOpTaskPreproc/PipeOp.

Construction

```
PipeOpColApply$new(id = "rowapply", param_vals = list())
```

- `id` :: `character(1)`
  Identifier of resulting object, default `"rowapply"`.
- `param_vals` :: named `list`
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from PipeOpTaskPreproc.

The output is the input Task with the original affected columns replaced by the columns created by applying applicator to each row.

State

The $state is a named list with the $state elements inherited from PipeOpTaskPreproc.

Parameters

The parameters are the parameters inherited from PipeOpTaskPreproc, as well as:

- applicator :: function
  Function to apply to each row in the affected columns of the task. The return value should be a vector of the same length for every input. Initialized as identity().
- col_prefix :: character(1)
  If specified, prefix to be prepended to the column names of affected columns, separated by a dot (.). Initialized as "".

Internals

Calls apply on the data, using the value of applicator as FUN.

Fields

Only fields inherited from PipeOp.

Methods

Only methods inherited from PipeOpTaskPreprocSimple/PipeOpTaskPreproc/PipeOp.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputecons
mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantiles, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite,

mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns mlr_pipeops_replicate, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Examples

```
library("mlr3")

task = tsk("iris")
pora = po("rowapply", applicator = scale)
pora$train(list(task))[[1]]  # rows are standardized
```

---

mlr_pipeops_scale *Center and Scale Numeric Features*

Description

Centers all numeric features to mean = 0 (if `center` parameter is `TRUE`) and scales them by dividing them by their root-mean-square (if `scale` parameter is `TRUE`).

The root-mean-square here is defined as `sqrt(sum(x^2)/(length(x)-1))`. If the `center` parameter is `TRUE`, this corresponds to the `sd()`.

Format

`R6Class` object inheriting from `PipeOpTaskPreproc`/`PipeOp`.

Construction

```
PipeOpScale$new(id = "scale", param_vals = list())
```

- `id` :: `character(1)`
  Identifier of resulting object, default `"scale"`.
- `param_vals` :: named `list`
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from `PipeOpTaskPreproc`.

The output is the input `Task` with all affected numeric parameters centered and/or scaled.

State

The $state is a named list with the $state elements inherited from PipeOpTaskPreproc, as well as:

- center :: numeric
  The mean / median (depending on robust) of each numeric feature during training, or 0 if center is FALSE. Will be subtracted during the predict phase.
- scale :: numeric
  The value by which features are divided. 1 if scale is FALSE
  If robust is FALSE, this is the root mean square, defined as sqrt(sum(x^2)/(length(x)-1)), of each feature, possibly after centering. If robust is TRUE, this is the median absolute deviation multiplied by 1.4826 (see stats::mad) of each feature, possibly after centering. This is 1 for features that are constant during training if center is TRUE, to avoid division-by-zero.

Parameters

The parameters are the parameters inherited from PipeOpTaskPreproc, as well as:

- center :: logical(1)
  Whether to center features, i.e. subtract their mean() from them. Default TRUE.
- scale :: logical(1)
  Whether to scale features, i.e. divide them by sqrt(sum(x^2)/(length(x)-1)). Default TRUE.
- robust :: logical(1)
  Whether to use robust scaling; instead of scaling / centering with mean / standard deviation, median and median absolute deviation mad are used. Initialized to FALSE.

Internals

Imitates the scale() function for robust = FALSE and alternatively subtracts the median and divides by mad for robust = TRUE.

Fields

Only fields inherited from PipeOp.

Methods

Only methods inherited from PipeOpTaskPreproc/PipeOp.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures,

mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputecons mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantiles, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Examples

```
library("mlr3")

task = tsk("iris")
pos = po("scale")

pos$train(list(task))[[1]]$data()

one_line_of_iris = task$filter(13)

one_line_of_iris$data()

pos$predict(list(one_line_of_iris))[[1]]$data()
```

---

mlr_pipeops_scalemaxabs

Scale Numeric Features with Respect to their Maximum Absolute Value

---

Description

Scales the numeric data columns so their maximum absolute value is `maxabs`, if possible. `NA`, `Inf` are ignored, and features that are constant 0 are not scaled.

Format

`R6Class` object inheriting from `PipeOpTaskPreprocSimple`/`PipeOpTaskPreproc`/`PipeOp`.

Construction

```
PipeOpScaleMaxAbs$new(id = "scalemaxabs", param_vals = list())
```

- `id` :: `character(1)`
  Identifier of resulting object, default `"scalemaxabs"`.
- `param_vals` :: named `list`
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from PipeOpTaskPreproc.

The output is the input Task with scaled numeric features.

State

The `$state` is a named `list` with the `$state` elements inherited from PipeOpTaskPreproc, as well as the maximum absolute values of each numeric feature.

Parameters

The parameters are the parameters inherited from PipeOpTaskPreproc, as well as:

- `maxabs` :: `numeric(1)`
  The maximum absolute value for each column after transformation. Default is 1.

Methods

Only methods inherited from PipeOpTaskPreprocSimple/PipeOpTaskPreproc/PipeOp.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputecons
mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantiles, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns

mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Examples

```
library("mlr3")

task = tsk("iris")
pop = po("scalemaxabs")

task$data()
pop$train(list(task))[[1]]$data()

pop$state
```

---

mlr_pipeops_scalerange

Linearly Transform Numeric Features to Match Given Boundaries

---

Description

Linearly transforms numeric data columns so they are between `lower` and `upper`. The formula for this is $x' = offset + x * scale$, where $scale$ is $(upper - lower)/(max(x) - min(x))$ and $offset$ is $-min(x) * scale + lower$. The same transformation is applied during training and prediction.

Format

`R6Class` object inheriting from `PipeOpTaskPreprocSimple`/`PipeOpTaskPreproc`/`PipeOp`.

Construction

```
PipeOpScaleRange$new(id = "scalerange", param_vals = list())
```

- `id` :: `character(1)`
  Identifier of resulting object, default `"scalerange"`.
- `param_vals` :: named `list`
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from `PipeOpTaskPreproc`.

The output is the input `Task` with scaled numeric features.

State

The `$state` is a named `list` with the `$state` elements inherited from `PipeOpTaskPreproc`, as well as the two transformation parameters $scale$ and $offset$ for each numeric feature.

Parameters

The parameters are the parameters inherited from `PipeOpTaskPreproc`, as well as:

- `lower` :: `numeric(1)`
  Target value of smallest item of input data. Initialized to 0.
- `upper` :: `numeric(1)`
  Target value of greatest item of input data. Initialized to 1.

Fields

Only fields inherited from `PipeOp`.

Methods

Only methods inherited from `PipeOpTaskPreprocSimple`/`PipeOpTaskPreproc`/`PipeOp`.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: `PipeOp`, `PipeOpEncodePL`, `PipeOpEnsemble`, `PipeOpImpute`, `PipeOpTargetTrafo`, `PipeOpTaskPreproc`, `PipeOpTaskPreprocSimple`, `mlr_pipeops`, `mlr_pipeops_adas`, `mlr_pipeops_blsmote`, `mlr_pipeops_boxcox`, `mlr_pipeops_branch`, `mlr_pipeops_chunk`, `mlr_pipeops_classbalancing`, `mlr_pipeops_classifavg`, `mlr_pipeops_classweights`, `mlr_pipeops_classweightsex`, `mlr_pipeops_colapply`, `mlr_pipeops_collapsefactors`, `mlr_pipeops_colroles`, `mlr_pipeops_copy`, `mlr_pipeops_datefeatures`, `mlr_pipeops_decode`, `mlr_pipeops_encode`, `mlr_pipeops_encodeimpact`, `mlr_pipeops_encodelmer`, `mlr_pipeops_encodeplquantiles`, `mlr_pipeops_encodepltree`, `mlr_pipeops_featureunion`, `mlr_pipeops_filter`, `mlr_pipeops_fixfactors`, `mlr_pipeops_histbin`, `mlr_pipeops_ica`, `mlr_pipeops_imputecons`
`mlr_pipeops_imputehist`, `mlr_pipeops_imputelearner`, `mlr_pipeops_imputemean`, `mlr_pipeops_imputemedian`, `mlr_pipeops_imputemode`, `mlr_pipeops_imputeoor`, `mlr_pipeops_imputesample`, `mlr_pipeops_info`, `mlr_pipeops_isomap`, `mlr_pipeops_kernelpca`, `mlr_pipeops_learner`, `mlr_pipeops_learner_pi_cvplus`, `mlr_pipeops_learner_quantiles`, `mlr_pipeops_materialize`, `mlr_pipeops_missind`, `mlr_pipeops_modelmatrix`, `mlr_pipeops_multiplicityexply`, `mlr_pipeops_multiplicityimply`, `mlr_pipeops_mutate`, `mlr_pipeops_nearmiss`, `mlr_pipeops_nmf`, `mlr_pipeops_nop`, `mlr_pipeops_ovrsplit`, `mlr_pipeops_ovrunite`, `mlr_pipeops_pca`, `mlr_pipeops_proxy`, `mlr_pipeops_quantilebin`, `mlr_pipeops_randomprojection`, `mlr_pipeops_randomresponse`, `mlr_pipeops_regravg`, `mlr_pipeops_removeconstants`, `mlr_pipeops_renamecolumns`
`mlr_pipeops_replicate`, `mlr_pipeops_rowapply`, `mlr_pipeops_scale`, `mlr_pipeops_scalemaxabs`, `mlr_pipeops_select`, `mlr_pipeops_smote`, `mlr_pipeops_smotenc`, `mlr_pipeops_spatialsign`, `mlr_pipeops_splines`, `mlr_pipeops_subsample`, `mlr_pipeops_targetinvert`, `mlr_pipeops_targetmutate`, `mlr_pipeops_targettrafoscalerange`, `mlr_pipeops_textvectorizer`, `mlr_pipeops_threshold`, `mlr_pipeops_tomek`, `mlr_pipeops_tunethreshold`, `mlr_pipeops_unbranch`, `mlr_pipeops_updatetarget`, `mlr_pipeops_vtreat`, `mlr_pipeops_yeojohnson`

Examples

```
library("mlr3")

task = tsk("iris")
pop = po("scalerange", param_vals = list(lower = -1, upper = 1))

task$data()
pop$train(list(task))[[1]]$data()

pop$state
```

`mlr_pipeops_select` *Remove Features Depending on a Selector*

Description

Removes features from `Task` depending on a `Selector` function: The `selector` parameter gives the features to keep. See `Selector` for selectors that are provided and how to write custom `Selector`s.

Format

`R6Class` object inheriting from `PipeOpTaskPreprocSimple`/`PipeOpTaskPreproc`/`PipeOp`.

Construction

```
PipeOpSelect$new(id = "select", param_vals = list())
```

- `id` :: `character(1)`
  Identifier of resulting object, default `"select"`.
- `param_vals` :: named `list`
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from `PipeOpTaskPreproc`.

The output is the input `Task` with features removed that were not selected by the `Selector`/`function` in `selector`.

State

The `$state` is a named `list` with the `$state` elements inherited from `PipeOpTaskPreproc`, as well as:

- `selection` :: `character`
  A vector of all feature names that are kept (i.e. not dropped) in the `Task`. Initialized to `selector_all()`

Parameters

The parameters are the parameters inherited from PipeOpTaskPreproc, as well as:

- selector :: function | Selector
  Selector function, takes a Task as argument and returns a character of features to keep. See Selector for example functions. Defaults to selector_all().

Internals

Uses task$select().

Fields

Only fields inherited from PipeOp.

Methods

Only methods inherited from PipeOpTaskPreprocSimple/PipeOpTaskPreproc/PipeOp.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputecons mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantiles, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Other Selectors: Selector

Examples

```
library("mlr3")

task = tsk("boston_housing")
pos = po("select")

pos$param_set$values$selector = selector_all()
pos$train(list(task))[[1]]$feature_names

pos$param_set$values$selector = selector_type("factor")
pos$train(list(task))[[1]]$feature_names

pos$param_set$values$selector = selector_invert(selector_type("factor"))
pos$train(list(task))[[1]]$feature_names

pos$param_set$values$selector = selector_grep("^r")
pos$train(list(task))[[1]]$feature_names
```

---

mlr_pipeops_smote *SMOTE Balancing*

Description

Generates a more balanced data set by creating synthetic instances of the minority class using the SMOTE algorithm. The algorithm samples for each minority instance a new data point based on the `K` nearest neighbors of that data point. It can only be applied to tasks with purely numeric features. See `smotefamily::SMOTE` for details.

Format

`R6Class` object inheriting from `PipeOpTaskPreproc`/`PipeOp`.

Construction

```
PipeOpSmote$new(id = "smote", param_vals = list())
```

- `id` :: `character(1)`
  Identifier of resulting object, default `"smote"`.
- `param_vals` :: named `list`
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from `PipeOpTaskPreproc`. Instead of a `Task`, a `TaskClassif` is used as input and output during training and prediction.

The output during training is the input `Task` with added synthetic rows for the minority class. The output during prediction is the unchanged input.

State

The `$state` is a named `list` with the `$state` elements inherited from `PipeOpTaskPreproc`.

Parameters

The parameters are the parameters inherited from `PipeOpTaskPreproc`, as well as:

- `K` :: `numeric(1)`
  The number of nearest neighbors used for sampling new values. See `SMOTE()`.
- `dup_size` :: `numeric`
  Desired times of synthetic minority instances over the original number of majority instances. See `SMOTE()`.

Internals

If a target level is unobserved during training, no synthetic data points will be generated for that class. No error is raised; the unobserved class is simply ignored.

Fields

Only fields inherited from `PipeOp`.

Methods

Only methods inherited from `PipeOpTaskPreproc`/`PipeOp`.

References

Chawla NV, Bowyer KW, Hall LO, Kegelmeyer WP (2002). "SMOTE: Synthetic Minority Oversampling Technique." *Journal of Artificial Intelligence Research*, **16**, 321–357. doi:10.1613/jair.953.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: `PipeOp`, `PipeOpEncodePL`, `PipeOpEnsemble`, `PipeOpImpute`, `PipeOpTargetTrafo`, `PipeOpTaskPreproc`, `PipeOpTaskPreprocSimple`, `mlr_pipeops`, `mlr_pipeops_adas`, `mlr_pipeops_blsmote`, `mlr_pipeops_boxcox`, `mlr_pipeops_branch`, `mlr_pipeops_chunk`, `mlr_pipeops_classbalancing`, `mlr_pipeops_classifavg`, `mlr_pipeops_classweights`, `mlr_pipeops_classweightsex`, `mlr_pipeops_colapply`, `mlr_pipeops_collapsefactors`, `mlr_pipeops_colroles`, `mlr_pipeops_copy`, `mlr_pipeops_datefeatures`, `mlr_pipeops_decode`, `mlr_pipeops_encode`, `mlr_pipeops_encodeimpact`, `mlr_pipeops_encodelmer`, `mlr_pipeops_encodeplquantiles`, `mlr_pipeops_encodepltree`, `mlr_pipeops_featureunion`, `mlr_pipeops_filter`, `mlr_pipeops_fixfactors`, `mlr_pipeops_histbin`, `mlr_pipeops_ica`, `mlr_pipeops_imputecons`
`mlr_pipeops_imputehist`, `mlr_pipeops_imputelearner`, `mlr_pipeops_imputemean`, `mlr_pipeops_imputemedian`, `mlr_pipeops_imputemode`, `mlr_pipeops_imputeoor`, `mlr_pipeops_imputesample`, `mlr_pipeops_info`, `mlr_pipeops_isomap`, `mlr_pipeops_kernelpca`, `mlr_pipeops_learner`, `mlr_pipeops_learner_pi_cvplus`, `mlr_pipeops_learner_quantiles`, `mlr_pipeops_materialize`, `mlr_pipeops_missind`, `mlr_pipeops_modelmatrix`, `mlr_pipeops_multiplicityexply`, `mlr_pipeops_multiplicityimply`, `mlr_pipeops_mutate`, `mlr_pipeops_nearmiss`, `mlr_pipeops_nmf`, `mlr_pipeops_nop`, `mlr_pipeops_ovrsplit`, `mlr_pipeops_ovrunite`, `mlr_pipeops_pca`, `mlr_pipeops_proxy`, `mlr_pipeops_quantilebin`, `mlr_pipeops_randomprojection`,

mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns
mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs,
mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smotenc, mlr_pipeops_spatialsign,
mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate,
mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold,
mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget,
mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Examples

```
library("mlr3")

# Create example task
data = smotefamily::sample_generator(1000, ratio = 0.80)
data$result = factor(data$result)
task = TaskClassif$new(id = "example", backend = data, target = "result")
task$data()
table(task$data()$result)

# Generate synthetic data for minority class
pop = po("smote")
smotedata = pop$train(list(task))[[1]]$data()
table(smotedata$result)
```

---

mlr_pipeops_smotenc *SMOTENC Balancing*

Description

Generates a more balanced data set by creating synthetic instances of the minority class for nominal and continuous data using the SMOTENC algorithm.

The algorithm generates for each minority instance a new data point based on the k nearest neighbors of that data point. It treats integer features as numeric. To not change feature types, the numeric, synthetic data generated for these features are rounded back to integer. Because of this, data generated through usage of this PipeOp is not exactly equal to data generated by calling themis::smotenc directly on the same data set.

It can only be applied to classification tasks with factor (or ordered) features and at least one numeric (or integer) feature that have no missing values.

See themis::smotenc for details.

Format

R6Class object inheriting from PipeOpTaskPreproc/PipeOp.

Construction

```
PipeOpSmoteNC$new(id = "smotenc", param_vals = list())
```

- `id` :: `character(1)`
  Identifier of resulting object, default `"smotenc"`.
- `param_vals` :: named `list`
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from `PipeOpTaskPreproc`. Instead of a `Task`, a `TaskClassif` is used as input and output during training and prediction.

The output during training is the input `Task` with added synthetic rows for the minority class. The output during prediction is the unchanged input.

State

The `$state` is a named `list` with the `$state` elements inherited from `PipeOpTaskPreproc`.

Parameters

The parameters are the parameters inherited from `PipeOpTaskPreproc`, as well as:

- `k` :: `integer(1)`
  Number of nearest neighbors used for generating new values from the minority class. Default is 5.
- `over_ratio` :: `numeric(1)`
  Ratio of the majority to minority class. Default is 1. For details, see `themis::smotenc`.

Internals

If a target level is unobserved during training, no synthetic data points will be generated for that class. No error is raised; the unobserved class is simply ignored.

Fields

Only fields inherited from `PipeOp`.

Methods

Only methods inherited from `PipeOpTaskPreproc`/`PipeOp`.

References

Chawla NV, Bowyer KW, Hall LO, Kegelmeyer WP (2002). "SMOTE: Synthetic Minority Oversampling Technique." *Journal of Artificial Intelligence Research*, **16**, 321–357. doi:10.1613/jair.953.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputecons
mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantiles, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns
mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Examples

```
library("mlr3")

# Create example task
data = data.frame(
  target = factor(sample(c("c1", "c2"), size = 200, replace = TRUE, prob = c(0.1, 0.9))),
  feature = rnorm(200)
)
task = TaskClassif$new(id = "example", backend = data, target = "target")
task$head()
table(task$data(cols = "target"))

# Generate synthetic data for minority class
pop = po("smotenc")
smotenc_result = pop$train(list(task))[[1]]$data()
nrow(smotenc_result)
table(smotenc_result$target)
```

---

mlr_pipeops_spatialsign

Normalize Data Row-wise

Description

Normalizes the data row-wise. This is a natural generalization of the "sign" function to higher dimensions.

Format

`R6Class` object inheriting from `PipeOpTaskPreprocSimple`/`PipeOpTaskPreproc`/`PipeOp`.

Construction

```
PipeOpSpatialSign$new(id = "spatialsign", param_vals = list())
```

- `id` :: `character(1)`
  Identifier of resulting object, default `"spatialsign"`.
- `param_vals` :: named `list`
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from `PipeOpTaskPreproc`.

The output is the input `Task` with all affected numeric features replaced by their normalized versions.

State

The `$state` is a named `list` with the `$state` elements inherited from `PipeOpTaskPreproc`.

Parameters

The parameters are the parameters inherited from `PipeOpTaskPreproc`, as well as:

- `length` :: `numeric(1)`
  Length to scale rows to. Default is 1.
- `norm` :: `numeric(1)`
  Norm to use. Rows are scaled to `sum(x^norm)^(1/norm) == length` for finite `norm`, or to `max(abs(x)) == length` if `norm` is `Inf`. Default is 2.

Fields

Only fields inherited from `PipeOp`.

Methods

Only methods inherited from `PipeOpTaskPreprocSimple`/`PipeOpTaskPreproc`/`PipeOp`.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputecons
mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantiles, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns
mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Examples

```
library("mlr3")

task = tsk("iris")

task$data()

pop = po("spatialsign")

pop$train(list(task))[[1]]$data()
```

`mlr_pipeops_splines` *Transforms Numeric Features into Spline Basis Expansions*

Description

Replaces numeric features with columns representing spline basis expansions.

Depending on the type parameter, constructs polynomial B-splines `splines::bs()` or natural cubic splines `splines::ns()` for the respective column.

Format

R6Class object inheriting from PipeOpTaskPreproc/PipeOp.

Construction

```
po("splines", param_vals = list())
```

- id :: character(1)
  Identifier of resulting object, default "splines".
- param_vals :: named list
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default list().

Input and Output Channels

Input and output channels are inherited from PipeOpTaskPreproc.

The output is the input Task with the selected columns transformed according to the specified Splines Method.

State

The $state is a named list with the $state elements inherited from PipeOpTaskPreproc. After training the Boundary.knots will be given to the $state.

Parameters

The parameters are the parameters inherited from PipeOpTaskPreproc, as well as:

- type :: character(1)
  Controls the type of splines that are to be created. Can be either polynomial (splines::bs) or natural (splines::ns). Initializied to "natural".
- df :: integer(1)
  Number of degrees of freedom for calculation of the spline basis matrix. Initialized to NULL. Depending on type, see either splines::bs() or splines::ns().
- knots :: named list
  Internal breakpoints that define the spline, given as a named list of numeric vectors, where each name corresponds to a feature and its value specifies the knots for that feature. Default is NULL. Depending on type, see either splines::bs() or splines::ns().
- intercept :: logical(1)
  If TRUE, an intercept is included in the basis. Default is FALSE. Depending on type, see either splines::bs() or splines::ns().
- degree :: integer(1)
  Degree of the polynomial used to compute polynomial splines. Only used if type is "polynomial". Default is 3. See splines::bs().
- Boundary.knots :: named list
  Boundary points at which to anchor the spline basis, given as a named list of numeric vectors, where each name corresponds to a feature and its value specifies the boundary points for that feature. Default is NULL. Depending on type, see either splines::bs() or splines::ns().

Internals

Creates a spline basis using either `splines::bs` or `splines::ns` depending on the hyperparameter `type`. After training, the `Boundary.knots` that were either provided by the user or calculated during training are stored in the `PipeOp`'s `$state`.

Fields

Only fields inherited from `PipeOp`.

Methods

Only methods inherited from `PipeOpTaskPreproc`/`PipeOp`.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: `PipeOp`, `PipeOpEncodePL`, `PipeOpEnsemble`, `PipeOpImpute`, `PipeOpTargetTrafo`, `PipeOpTaskPreproc`, `PipeOpTaskPreprocSimple`, `mlr_pipeops`, `mlr_pipeops_adas`, `mlr_pipeops_blsmote`, `mlr_pipeops_boxcox`, `mlr_pipeops_branch`, `mlr_pipeops_chunk`, `mlr_pipeops_classbalancing`, `mlr_pipeops_classifavg`, `mlr_pipeops_classweights`, `mlr_pipeops_classweightsex`, `mlr_pipeops_colapply`, `mlr_pipeops_collapsefactors`, `mlr_pipeops_colroles`, `mlr_pipeops_copy`, `mlr_pipeops_datefeatures`, `mlr_pipeops_decode`, `mlr_pipeops_encode`, `mlr_pipeops_encodeimpact`, `mlr_pipeops_encodelmer`, `mlr_pipeops_encodeplquantiles`, `mlr_pipeops_encodepltree`, `mlr_pipeops_featureunion`, `mlr_pipeops_filter`, `mlr_pipeops_fixfactors`, `mlr_pipeops_histbin`, `mlr_pipeops_ica`, `mlr_pipeops_imputecons`
`mlr_pipeops_imputehist`, `mlr_pipeops_imputelearner`, `mlr_pipeops_imputemean`, `mlr_pipeops_imputemedian`, `mlr_pipeops_imputemode`, `mlr_pipeops_imputeoor`, `mlr_pipeops_imputesample`, `mlr_pipeops_info`, `mlr_pipeops_isomap`, `mlr_pipeops_kernelpca`, `mlr_pipeops_learner`, `mlr_pipeops_learner_pi_cvplus`, `mlr_pipeops_learner_quantiles`, `mlr_pipeops_materialize`, `mlr_pipeops_missind`, `mlr_pipeops_modelmatrix`, `mlr_pipeops_multiplicityexply`, `mlr_pipeops_multiplicityimply`, `mlr_pipeops_mutate`, `mlr_pipeops_nearmiss`, `mlr_pipeops_nmf`, `mlr_pipeops_nop`, `mlr_pipeops_ovrsplit`, `mlr_pipeops_ovrunite`, `mlr_pipeops_pca`, `mlr_pipeops_proxy`, `mlr_pipeops_quantilebin`, `mlr_pipeops_randomprojection`, `mlr_pipeops_randomresponse`, `mlr_pipeops_regravg`, `mlr_pipeops_removeconstants`, `mlr_pipeops_renamecolumns`
`mlr_pipeops_replicate`, `mlr_pipeops_rowapply`, `mlr_pipeops_scale`, `mlr_pipeops_scalemaxabs`, `mlr_pipeops_scalerange`, `mlr_pipeops_select`, `mlr_pipeops_smote`, `mlr_pipeops_smotenc`, `mlr_pipeops_spatialsign`, `mlr_pipeops_subsample`, `mlr_pipeops_targetinvert`, `mlr_pipeops_targetmutate`, `mlr_pipeops_targettrafoscalerange`, `mlr_pipeops_textvectorizer`, `mlr_pipeops_threshold`, `mlr_pipeops_tomek`, `mlr_pipeops_tunethreshold`, `mlr_pipeops_unbranch`, `mlr_pipeops_updatetarget`, `mlr_pipeops_vtreat`, `mlr_pipeops_yeojohnson`

Examples

```
library("mlr3")

task = tsk("iris")
pop = po("splines")

pop$train(list(task))[[1]]$data()

pobk = po("splines", Boundary.knots = list(
```

```
 Petal.Length = c(0, 4), Petal.Width = c(4, 7), Sepal.Length = c(1, 5), Sepal.Width = c(3, 6))
)
pobk$train(list(task))[[1]]$data()
```

`mlr_pipeops_subsample` *Subsampling*

Description

Subsamples a `Task` to use a fraction of the rows.

Sampling happens only during training phase. Subsampling a `Task` may be beneficial for training time at possibly (depending on original `Task` size) negligible cost of predictive performance.

Format

`R6Class` object inheriting from `PipeOpTaskPreproc`/`PipeOp`.

Construction

```
PipeOpSubsample$new(id = "subsample", param_vals = list())
```

- `id` :: `character(1)` Identifier of the resulting object, default `"subsample"`
- `param_vals` :: named `list`
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from `PipeOpTaskPreproc`.

The output during training is the input `Task` with added or removed rows according to the sampling. The output during prediction is the unchanged input.

State

The `$state` is a named `list` with the `$state` elements inherited from `PipeOpTaskPreproc`.

Parameters

The parameters are the parameters inherited from `PipeOpTaskPreproc`; however, the `affect_columns` parameter is *not* present. Further parameters are:

- `frac` :: `numeric(1)`
  Fraction of rows in the `Task` to keep. May only be greater than 1 if `replace` is `TRUE`. Initialized to `(1 - exp(-1)) == 0.6321`.
- `stratify` :: `logical(1)`
  Should the subsamples be stratified by target? Initialized to `FALSE`. May only be `TRUE` for `TaskClassif` input and if `use_groups = FALSE`.

- use_groups :: logical(1)
  If TRUE and if the Task has a column with role group, grouped observations are kept together during subsampling. In case of sampling with
- replace :: logical(1)
  Sample with replacement? Initialized to FALSE.

Internals

Uses task$filter() to remove rows. If replace is TRUE and identical rows are added, then the taskrow_rolesuse can *not* be used to duplicate rows because of [inaudible]; instead the task$rbind() function is used, and a new data.table is attached that contains all rows that are being duplicated exactly as many times as they are being added.

Fields

Only fields inherited from PipeOp.

Methods

Only methods inherited from PipeOpTaskPreproc/PipeOp.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputecons
mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantiles, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns
mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Examples

```
library("mlr3")

# Subsample with stratification
pop = po("subsample", frac = 0.7, stratify = TRUE, use_groups = FALSE)
pop$train(list(tsk("iris")))

# Subsample, respecting grouping
df = data.frame(
  target = runif(3000),
  x1 = runif(3000),
  x2 = runif(3000),
  grp = sample(paste0("g", 1:100), 3000, replace = TRUE)
)
task = TaskRegr$new(id = "example", backend = df, target = "target")
task$set_col_roles("grp", "group")

pop = po("subsample", frac = 0.7, use_groups = TRUE)
pop$train(list(task))
```

---

mlr_pipeops_targetinvert

Invert Target Transformations

Description

Inverts target-transformations done during training based on a supplied inversion function. Typically should be used in combination with a subclass of PipeOpTargetTrafo.

During prediction phase the function supplied through "fun" is called with a list containing the "prediction" as a single element, and should return a list with a single element (a Prediction) that is returned by PipeOpTargetInvert.

Format

R6Class object inheriting from PipeOp.

Construction

```
PipeOpTargetInvert$new(id = "targetinvert", param_vals = list())
```

- id :: character(1)
  Identifier of resulting object, default "targetinvert".
- param_vals :: named list
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default list().

Input and Output Channels

PipeOpTargetInvert has two input channels named "fun" and "prediction". During training, both take NULL as input. During prediction, "fun" takes a function and "prediction" takes a Prediction.

PipeOpTargetInvert has one output channel named "output" and returns NULL during training and a Prediction during prediction.

State

The $state is left empty (list()).

Parameters

PipeOpTargetInvert has no parameters.

Internals

Should be used in combination with a subclass of PipeOpTargetTrafo.

Fields

Only fields inherited from PipeOp.

Methods

Only methods inherited from PipeOp.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputecons
mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantiles, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns
mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetmutate,

mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Examples

```
library(mlr3)
task = tsk("boston_housing")
po = PipeOpTargetMutate$new("logtrafo", param_vals = list(
  trafo = function(x) log(x, base = 2),
  inverter = function(x) list(response = 2 ^ x$response))
)
# Note that this example is ill-equipped to work with
# `predict_type == "se"` predictions.

po$train(list(task))
po$predict(list(task))

g = Graph$new()
g$add_pipeop(po)
g$add_pipeop(LearnerRegrRpart$new())
g$add_pipeop(PipeOpTargetInvert$new())
g$add_edge(src_id = "logtrafo", dst_id = "targetinvert",
  src_channel = 1, dst_channel = 1)
g$add_edge(src_id = "logtrafo", dst_id = "regr.rpart",
  src_channel = 2, dst_channel = 1)
g$add_edge(src_id = "regr.rpart", dst_id = "targetinvert",
  src_channel = 1, dst_channel = 2)

g$train(task)
g$predict(task)

#syntactic sugar using ppl():
tt = ppl("targettrafo", graph = PipeOpLearner$new(LearnerRegrRpart$new()))
tt$param_set$values$targetmutate.trafo = function(x) log(x, base = 2)
tt$param_set$values$targetmutate.inverter = function(x) list(response = 2 ^ x$response)
```

---

mlr_pipeops_targetmutate

Transform a Target by a Function

Description

Changes the *target* of a Task according to a function given as hyperparameter. An inverter-function that undoes the transformation during prediction must also be given.

Format

R6Class object inheriting from PipeOpTargetTrafo/PipeOp

Construction

```
PipeOpTargetMutate$new(id = "targetmutate", param_vals = list(), new_task_type = NULL)
```

- `id` :: `character(1)`
  Identifier of resulting object, default `"targetmutate"`.
- `param_vals` :: named `list`
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.
- `new_task_type` :: `character(1)` | `NULL`
  The task type to which the output is converted, must be one of `mlr_reflections$task_types$type`. Defaults to `NULL`: no change in task type.

Input and Output Channels

Input and output channels are inherited from `PipeOpTargetTrafo`.

State

The `$state` is left empty (`list()`).

Parameters

The parameters are the parameters inherited from `PipeOpTargetTrafo`, as well as:

- `trafo` :: `function` `data.table` -> `data.frame` | `data.table` | `matrix`
  Transformation function for the target. Should only be a function of the target, i.e., taking a single `data.table` argument, typically with one column. The return value is used as the new target of the resulting `Task`. To change target names, change the column name of the data using e.g. `setnames()`.
  Note that this function also gets called during prediction and should thus gracefully handle `NA` values.
  Initialized to `identity()`.
- `inverter` :: `function` `data.table` -> `data.table` | named `list`
  Inversion of the transformation function for the target. Called on a `data.table` created from a `Prediction` using `as.data.table()`, without the `$row_ids` and `$truth` columns, and should return a `data.table` or named `list` that contains the new relevant slots of a `Prediction` subclass (e.g., `$response`, `$prob`, `$se`, ...). Initialized to `identity()`.

Internals

Overloads `PipeOpTargetTrafo`'s `.transform()` and `.invert()` functions. Should be used in combination with `PipeOpTargetInvert`.

Fields

Fields inherited from `PipeOp`, as well as:

- `new_task_type` :: `character(1)`
  `new_task_type` construction argument. Read-only.

Methods

Only methods inherited from PipeOpTargetTrafo/PipeOp.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputecons
mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantiles, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns
mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Examples

```
library(mlr3)
task = tsk("boston_housing")
po = PipeOpTargetMutate$new("logtrafo", param_vals = list(
  trafo = function(x) log(x, base = 2),
  inverter = function(x) list(response = 2 ^ x$response))
)
# Note that this example is ill-equipped to work with
# `predict_type == "se"` predictions.

po$train(list(task))
po$predict(list(task))

g = Graph$new()
g$add_pipeop(po)
g$add_pipeop(LearnerRegrRpart$new())
g$add_pipeop(PipeOpTargetInvert$new())
g$add_edge(src_id = "logtrafo", dst_id = "targetinvert",
  src_channel = 1, dst_channel = 1)
g$add_edge(src_id = "logtrafo", dst_id = "regr.rpart",
```

```
  src_channel = 2, dst_channel = 1)
g$add_edge(src_id = "regr.rpart", dst_id = "targetinvert",
  src_channel = 1, dst_channel = 2)

g$train(task)
g$predict(task)

#syntactic sugar using ppl():
tt = ppl("targettrafo", graph = PipeOpLearner$new(LearnerRegrRpart$new()))
tt$param_set$values$targetmutate.trafo = function(x) log(x, base = 2)
tt$param_set$values$targetmutate.inverter = function(x) list(response = 2 ^ x$response)
```

`mlr_pipeops_targettrafoscalerange`

Linearly Transform a Numeric Target to Match Given Boundaries

---

Description

Linearly transforms a numeric target of a `TaskRegr` so it is between `lower` and `upper`. The formula for this is $x' = offset + x * scale$, where $scale$ is $(upper - lower)/(max(x) - min(x))$ and $offset$ is $-min(x) * scale + lower$. The same transformation is applied during training and prediction.

Format

`R6Class` object inheriting from `PipeOpTargetTrafo`/`PipeOp`

Construction

```
PipeOpTargetTrafoScaleRange$new(id = "targettrafoscalerange", param_vals = list())
```

- `id` :: `character(1)`
  Identifier of resulting object, default `"targettrafoscalerange"`.
- `param_vals` :: named `list`
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from `PipeOpTargetTrafo`.

State

The `$state` is a named `list` containing the slots `$offset` and `$scale`.

Parameters

The parameters are the parameters inherited from PipeOpTargetTrafo, as well as:

- `lower` :: `numeric(1)`
  Target value of smallest item of input target. Initialized to 0.
- `upper` :: `numeric(1)`
  Target value of greatest item of input target. Initialized to 1.

Internals

Overloads PipeOpTargetTrafo's `.get_state()`, `.transform()`, and `.invert()`. Should be used in combination with PipeOpTargetInvert.

Fields

Only fields inherited from PipeOp.

Methods

Only methods inherited from PipeOpTargetTrafo/PipeOp.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputecons
mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantiles, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns
mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Examples

```
library(mlr3)
task = tsk("boston_housing")
po = PipeOpTargetTrafoScaleRange$new()

po$train(list(task))
po$predict(list(task))

#syntactic sugar for a graph using ppl():
ttscalerange = ppl("targettrafo", trafo_pipeop = PipeOpTargetTrafoScaleRange$new(),
  graph = PipeOpLearner$new(LearnerRegrRpart$new()))
ttscalerange$train(task)
ttscalerange$predict(task)
ttscalerange$state$regr.rpart
```

---

mlr_pipeops_textvectorizer

Bag-of-word Representation of Character Features

Description

Computes a bag-of-word representation from a (set of) columns. Columns of type `character` are split up into words. Uses the `quanteda::dfm()` and `quanteda::dfm_trim()` functions. TF-IDF computation works similarly to `quanteda::dfm_tfidf()` but has been adjusted for train/test data split using `quanteda::docfreq()` and `quanteda::dfm_weight()`.

In short:

- Per default, produces a bag-of-words representation
- If `n` is set to values > 1, ngrams are computed
- If `df_trim` parameters are set, the bag-of-words is trimmed.
- The `scheme_tf` parameter controls term-frequency (per-document, i.e. per-row) weighting
- The `scheme_df` parameter controls the document-frequency (per token, i.e. per-column) weighting.

Parameters specify arguments to `quanteda`'s `dfm`, `dfm_trim`, `docfreq` and `dfm_weight`. What belongs to what can be obtained from each parameter's `tags` where `tokenizer` are arguments passed on to `quanteda::dfm()`. Defaults to a bag-of-words representation with token counts as matrix entries.

In order to perform the *default* `dfm_tfidf` weighting, set the `scheme_df` parameter to `"inverse"`. The `scheme_df` parameter is initialized to `"unary"`, which disables document frequency weighting.

The `PipeOp` works as follows:

1. Words are tokenized using `quanteda::tokens`.
2. Ngrams are computed using `quanteda::tokens_ngrams`.

3. A document-frequency matrix is computed using quanteda::dfm.
4. The document-frequency matrix is trimmed using quanteda::dfm_trim during train-time.
5. The document-frequency matrix is re-weighted (similar to quanteda::dfm_tfidf) if scheme_df is not set to "unary".

Format

R6Class object inheriting from PipeOpTaskPreproc/PipeOp.

Construction

```
PipeOpTextVectorizer$new(id = "textvectorizer", param_vals = list())
```

- id :: character(1)
  Identifier of resulting object, default "textvectorizer".
- param_vals :: named list
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default list().

Input and Output Channels

Input and output channels are inherited from PipeOpTaskPreproc.

The output is the input Task with all affected features converted to a bag-of-words representation.

State

The $state is a named list with the $state elements inherited from PipeOpTaskPreproc, as well as:

- colmodels :: named list
  Named list with one entry per extracted column. Each entry has two further elements:
  - tdm: sparse document-feature matrix resulting from quanteda::dfm()
  - docfreq: (weighted) document frequency resulting from quanteda::docfreq()

Parameters

The parameters are the parameters inherited from PipeOpTaskPreproc, as well as:

- return_type :: character(1)
  Whether to return an integer representation ("integer-sequence") or a Bag-of-words ("bow"). If set to "integer_sequence", tokens are replaced by an integer and padded/truncated to sequence_length. If set to "factor_sequence", tokens are replaced by a factor and padded/truncated to sequence_length. If set to "bow", a possibly weighted bag-of-words matrix is returned. Defaults to bow.
- stopwords_language :: character(1)
  Language to use for stopword filtering. Needs to be either "none", a language identifier listed in stopwords::stopwords_getlanguages("snowball") ("de", "en", ...) or "smart". "none" disables language-specific stopwords. "smart" coresponds to stopwords::stopwords(source = "smart"), which contains *English* stopwords and also removes one-character strings. Initialized to "smart".

- `extra_stopwords` :: `character`
  Extra stopwords to remove. Must be a `character` vector containing individual tokens to remove. When `n` is set to values greater than `1`, this can also contain stop-ngrams. Initialized to `character(0)`.
- `tolower` :: `logical(1)`
  Whether to convert to lower case. See `quanteda::dfm`. Default is `TRUE`.
- `stem` :: `logical(1)`
  Whether to perform stemming. See `quanteda::dfm`. Default is `FALSE`.
- `what` :: `character(1)`
  Tokenization splitter. See `quanteda::tokens`. Default is `"word"`.
- `remove_punct` :: `logical(1)`
  See `quanteda::tokens`. Default is `FALSE`.
- `remove_url` :: `logical(1)`
  See `quanteda::tokens`. Default is `FALSE`.
- `remove_symbols` :: `logical(1)`
  See `quanteda::tokens`. Default is `FALSE`.
- `remove_numbers` :: `logical(1)`
  See `quanteda::tokens`. Default is `FALSE`.
- `remove_separators` :: `logical(1)`
  See `quanteda::tokens`. Default is `TRUE`.
- `split_hypens` :: `logical(1)`
  See `quanteda::tokens`. Default is `FALSE`.
- `n` :: `integer`
  Vector of ngram lengths. See `quanteda::tokens_ngrams`. Initialized to `1`, deviating from the base function's default. Note that this can be a *vector* of multiple values, to construct ngrams of multiple orders.
- `skip` :: `integer`
  Vector of skips. See `quanteda::tokens_ngrams`. Default is `0`. Note that this can be a *vector* of multiple values.
- `sparsity` :: `numeric(1)`
  Desired sparsity of the 'tfm' matrix. See `quanteda::dfm_trim`. Default is `NULL`.
- `max_termfreq` :: `numeric(1)`
  Maximum term frequency in the 'tfm' matrix. See `quanteda::dfm_trim`. Default is `NULL`.
- `min_termfreq` :: `numeric(1)`
  Minimum term frequency in the 'tfm' matrix. See `quanteda::dfm_trim`. Default is `NULL`.
- `termfreq_type` :: `character(1)`
  How to asess term frequency. See `quanteda::dfm_trim`. Default is `"count"`.
- `scheme_df` :: `character(1)`
  Weighting scheme for document frequency: See `quanteda::docfreq`. Initialized to `"unary"` (1 for each document, deviating from base function default).
- `smoothing_df` :: `numeric(1)`
  See `quanteda::docfreq`. Default is `0`.
- `k_df` :: `numeric(1)`
  k parameter given to `quanteda::docfreq` (see there). Default is `0`.

- threshold_df :: numeric(1)
  See quanteda::docfreq. Default is 0. Only considered if scheme_df is set to "count".
- base_df :: numeric(1)
  The base for logarithms in quanteda::docfreq (see there). Default is 10.
- scheme_tf :: character(1)
  Weighting scheme for term frequency: See quanteda::dfm_weight. Default is "count".
- k_tf :: numeric(1)
  k parameter given to quanteda::dfm_weight (see there). Default is 0.5.
- base_df :: numeric(1)
  The base for logarithms in quanteda::dfm_weight (see there). Default is 10.
- sequence_length :: integer(1)
  The length of the integer sequence. Defaults to Inf, i.e. all texts are padded to the length of the longest text. Only relevant for return_type is set to "integer_sequence".

Internals

See Description. Internally uses the quanteda package. Calls quanteda::tokens, quanteda::tokens_ngrams and quanteda::dfm. During training, quanteda::dfm_trim is also called. Tokens not seen during training are dropped during prediction.

Fields

Only fields inherited from PipeOp.

Methods

Only methods inherited from PipeOpTaskPreproc/PipeOp.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputecons
mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantiles, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns
mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs,

mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Examples

```
library("mlr3")
library("data.table")
# create some text data
dt = data.table(
  txt = replicate(150, paste0(sample(letters, 3), collapse = " "))
)
task = tsk("iris")$cbind(dt)

pos = po("textvectorizer", param_vals = list(stopwords_language = "en"))

pos$train(list(task))[[1]]$data()

one_line_of_iris = task$filter(13)

one_line_of_iris$data()

pos$predict(list(one_line_of_iris))[[1]]$data()
```

---

mlr_pipeops_threshold *Change the Threshold of a Classification Prediction*

Description

Change the threshold of a Prediction during the predict step. The incoming Learner's $predict_type needs to be "prob". Internally calls PredictionClassif$set_threshold.

Format

R6Class inheriting from PipeOp.

Construction

```
PipeOpThreshold$new(id = "threshold", param_vals = list())
```

- id :: character(1) Identifier of the resulting object, default "threshold".
- param_vals :: named list
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Defaults to numeric(0).

Input and Output Channels

During training, the input and output are NULL. A PredictionClassif is required as input and returned as output during prediction.

State

The $state is left empty (list()).

Parameters

- thresholds :: numeric
  A numeric vector of thresholds for the different class levels. May have length 1 for binary classification predictions, must otherwise have length of the number of target classes; see PredictionClassif's $set_threshold() method. Initialized to 0.5, i.e. thresholding for binary classification at level 0.5.

Fields

Fields inherited from PipeOp, as well as:

- predict_type :: character(1)
  Type of prediction to return. Either "prob" (default) or "response". Setting to "response" should rarely be used; it may potentially save some memory but has no other benefits.

Methods

Only methods inherited from PipeOp.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputecons
mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantiles, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns
mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc,

mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Examples

```
library("mlr3")
t = tsk("german_credit")
gr = po(lrn("classif.rpart", predict_type = "prob")) %>>%
  po("threshold", param_vals = list(thresholds = 0.9))
gr$train(t)
gr$predict(t)
```

---

mlr_pipeops_tomek *Tomek Down-Sampling*

Description

Generates a cleaner data set by removing all majority-minority Tomek links.

The algorithm down-samples the data by removing all pairs of observations that form a Tomek link, i.e. a pair of observations that are nearest neighbors and belong to different classes. For this only numeric and integer features are taken into account. These must have no missing values.

This can only be applied to classification tasks. Multiclass classification is supported.

See themis::tomek for details.

Format

R6Class object inheriting from PipeOpTaskPreproc/PipeOp.

Construction

```
PipeOpTomek$new(id = "tomek", param_vals = list())
```

- id :: character(1)
  Identifier of resulting object, default "tomek".
- param_vals :: named list
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default list().

Input and Output Channels

Input and output channels are inherited from PipeOpTaskPreproc. Instead of a Task, a TaskClassif is used as input and output during training and prediction.

The output during training is the input Task with removed rows for pairs of observations that form a Tomek link. The output during prediction is the unchanged input.

State

The `$state` is a named `list` with the `$state` elements inherited from `PipeOpTaskPreproc`.

Parameters

The parameters are the parameters inherited from `PipeOpTaskPreproc`.

Fields

Only fields inherited from `PipeOp`.

Methods

Only methods inherited from `PipeOpTaskPreproc`/`PipeOp`.

References

Tomek I (1976). "Two Modifications of CNN." *IEEE Transactions on Systems, Man and Cybernetics*, **6**(11), 769–772. doi:10.1109/TSMC.1976.4309452.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: `PipeOp`, `PipeOpEncodePL`, `PipeOpEnsemble`, `PipeOpImpute`, `PipeOpTargetTrafo`, `PipeOpTaskPreproc`, `PipeOpTaskPreprocSimple`, `mlr_pipeops`, `mlr_pipeops_adas`, `mlr_pipeops_blsmote`, `mlr_pipeops_boxcox`, `mlr_pipeops_branch`, `mlr_pipeops_chunk`, `mlr_pipeops_classbalancing`, `mlr_pipeops_classifavg`, `mlr_pipeops_classweights`, `mlr_pipeops_classweightsex`, `mlr_pipeops_colapply`, `mlr_pipeops_collapsefactors`, `mlr_pipeops_colroles`, `mlr_pipeops_copy`, `mlr_pipeops_datefeatures`, `mlr_pipeops_decode`, `mlr_pipeops_encode`, `mlr_pipeops_encodeimpact`, `mlr_pipeops_encodelmer`, `mlr_pipeops_encodeplquantiles`, `mlr_pipeops_encodepltree`, `mlr_pipeops_featureunion`, `mlr_pipeops_filter`, `mlr_pipeops_fixfactors`, `mlr_pipeops_histbin`, `mlr_pipeops_ica`, `mlr_pipeops_imputecons`
`mlr_pipeops_imputehist`, `mlr_pipeops_imputelearner`, `mlr_pipeops_imputemean`, `mlr_pipeops_imputemedian`, `mlr_pipeops_imputemode`, `mlr_pipeops_imputeoor`, `mlr_pipeops_imputesample`, `mlr_pipeops_info`, `mlr_pipeops_isomap`, `mlr_pipeops_kernelpca`, `mlr_pipeops_learner`, `mlr_pipeops_learner_pi_cvplus`, `mlr_pipeops_learner_quantiles`, `mlr_pipeops_materialize`, `mlr_pipeops_missind`, `mlr_pipeops_modelmatrix`, `mlr_pipeops_multiplicityexply`, `mlr_pipeops_multiplicityimply`, `mlr_pipeops_mutate`, `mlr_pipeops_nearmiss`, `mlr_pipeops_nmf`, `mlr_pipeops_nop`, `mlr_pipeops_ovrsplit`, `mlr_pipeops_ovrunite`, `mlr_pipeops_pca`, `mlr_pipeops_proxy`, `mlr_pipeops_quantilebin`, `mlr_pipeops_randomprojection`, `mlr_pipeops_randomresponse`, `mlr_pipeops_regravg`, `mlr_pipeops_removeconstants`, `mlr_pipeops_renamecolumns`
`mlr_pipeops_replicate`, `mlr_pipeops_rowapply`, `mlr_pipeops_scale`, `mlr_pipeops_scalemaxabs`, `mlr_pipeops_scalerange`, `mlr_pipeops_select`, `mlr_pipeops_smote`, `mlr_pipeops_smotenc`, `mlr_pipeops_spatialsign`, `mlr_pipeops_splines`, `mlr_pipeops_subsample`, `mlr_pipeops_targetinvert`, `mlr_pipeops_targetmutate`, `mlr_pipeops_targettrafoscalerange`, `mlr_pipeops_textvectorizer`, `mlr_pipeops_threshold`, `mlr_pipeops_tunethreshold`, `mlr_pipeops_unbranch`, `mlr_pipeops_updatetarget`, `mlr_pipeops_vtreat`, `mlr_pipeops_yeojohnson`

Examples

```
library("mlr3")

# Create example task
task = tsk("iris")
task$head()
table(task$data(cols = "Species"))

# Down-sample data
pop = po("tomek")
tomek_result = pop$train(list(task))[[1]]$data()
nrow(tomek_result)
table(tomek_result$Species)
```

`mlr_pipeops_tunethreshold`

Tune the Threshold of a Classification Prediction

Description

Tunes optimal probability thresholds over different `PredictionClassif`s.

`mlr3::Learner` `predict_type`: `"prob"` is required. Thresholds for each learner are optimized using the `Optimizer` supplied via the `param_set`. Defaults to `GenSA`. Returns a single `PredictionClassif`.

This PipeOp should be used in conjunction with `PipeOpLearnerCV` in order to optimize thresholds of cross-validated predictions. In order to optimize thresholds without cross-validation, use `PipeOpLearnerCV` in conjunction with `ResamplingInsample`.

Format

`R6Class` object inheriting from `PipeOp`.

Construction

```
PipeOpTuneThreshold$new(id = "tunethreshold", param_vals = list())
```

- `id` :: `character(1)`
  Identifier of resulting object. Default: "tunethreshold".
- `param_vals` :: named `list`
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from `PipeOp`.

State

The $state is a named list with elements

- thresholds :: numeric
  Learned thresholds;

Parameters

The parameters are the parameters inherited from PipeOp, as well as:

- measure :: Measure | character
  Measure to optimize for. Will be converted to a Measure in case it is character. Initialized to "classif.ce", i.e. misclassification error.
- optimizer :: Optimizer|character(1)
  Optimizer used to find optimal thresholds. If character, converts to Optimizer via opt. Initialized to OptimizerGenSA.
- log_level :: character(1) | integer(1)
  Set a temporary log-level for lgr::get_logger("mlr3/bbotk"). Initialized to: "warn".

Internals

Uses the optimizer provided as a param_val in order to find an optimal threshold. See the optimizer parameter for more info.

Fields

Fields inherited from PipeOp, as well as:

- predict_type :: character(1)
  Type of prediction to return. Either "prob" (default) or "response". Setting to "response" should rarely be used; it may potentially save some memory but has no other benefits.

Methods

Only methods inherited from PipeOp.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputecons
mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info,

mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantiles, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Examples

```
library("mlr3")

task = tsk("iris")
pop = po("learner_cv", lrn("classif.rpart", predict_type = "prob")) %>>%
  po("tunethreshold")

task$data()
pop$train(task)

pop$state
```

---

mlr_pipeops_unbranch *Unbranch Different Paths*

Description

Used to bring together different paths created by PipeOpBranch.

Format

R6Class object inheriting from PipeOp.

Construction

```
PipeOpUnbranch$new(options, id = "unbranch", param_vals = list())
```

- options :: numeric(1) | character
  If options is 0, a vararg input channel is created that can take any number of inputs. If options is a nonzero integer number, it determines the number of input channels / options that are created, named input1...input<n>. The If options is a character, it determines the names of channels directly. The difference between these three is purely cosmetic if the user chooses to produce channel names matching with the corresponding PipeOpBranch. However, it is not necessary to have matching names and the *vararg* option is always viable.

- id :: character(1)
  Identifier of resulting object, default "unbranch".
- param_vals :: named list
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default list().

Input and Output

PipeOpUnbranch has multiple input channels depending on the options construction argument, named "input1", "input2", ... if options is a nonzero integer and named after each options value if options is a character; if options is 0, there is only one *vararg* input channel named "...". All input channels take any argument ("*") both during training and prediction.

PipeOpUnbranch has one output channel named "output", producing the only NO_OP object received as input ("*"), both during training and prediction.

State

The $state is left empty (list()).

Parameters

PipeOpUnbranch has no parameters.

Internals

See PipeOpBranch Internals on how alternative path branching works.

Fields

Only fields inherited from PipeOp.

Methods

Only methods inherited from PipeOp.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputecons
mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus,

mlr_pipeops_learner_quantiles, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Other Path Branching: NO_OP, filter_noop(), is_noop(), mlr_pipeops_branch

Examples

```
# See PipeOpBranch for a complete branching example
pou = po("unbranch")

pou$train(list(NO_OP, NO_OP, "hello", NO_OP, NO_OP))
```

---

mlr_pipeops_updatetarget

Transform a Target without an Explicit Inversion

Description

EXPERIMENTAL, API SUBJECT TO CHANGE

Handles target transformation operations that do not need explicit inversion. In case the new target is required during predict, creates a vector of NA. Works similar to PipeOpTargetTrafo and PipeOpTargetMutate, but forgoes the inversion step. In case target after the trafo is a factor, levels are saved to $state.

During prediction: Sets all target values to NA before calling the trafo again. In case target after the trafo is a factor, levels saved in the state are set during prediction.

As a special case when trafo is identity and new_target_name matches an existing column name of the data of the input Task, this column is set as the new target. Depending on drop_original_target the original target is then either dropped or added to the features.

Format

Abstract R6Class inheriting from PipeOp.

Construction

```
PipeOpUpdateTarget$new(id, param_set = ps(),
  param_vals = list(), packages = character(0))
```

- `id` :: `character(1)`
  Identifier of resulting object. See `$id` slot of `PipeOp`.
- `param_vals` :: named `list`
  List of hyperparameter settings, overwriting the hyperparameter settings given in `param_set`. The subclass should have its own `param_vals` parameter and pass it on to `super$initialize()`. Default `list()`.

Parameters

The parameters are the parameters inherited from `PipeOpTargetTrafo`, as well as:

- `trafo` :: `function`
  Transformation function for the target. Should only be a function of the target, i.e., taking a single argument. Default is `identity`. Note, that the data passed on to the target is a `data.table` consisting of all target column.
- `new_target_name` :: `character(1)`
  Optionally give the transformed target a new name. By default the original name is used.
- `new_task_type` :: `character(1)`
  Optionally a new task type can be set. Legal types are listed in `mlr_reflections$task_types$type`.
  #' `drop_original_target` :: `logical(1)`
  Whether to drop the original target column. Default: `TRUE`.

State

The `$state` is a list of class levels for each target after trafo. `list()` if none of the targets have levels.

Fields

Only fields inherited from `PipeOp`.

Methods

Only methods inherited from `PipeOp`.

See Also

https://mlr-org.com/pipeops.html

Other mlr3pipelines backend related: `Graph`, `PipeOp`, `PipeOpTargetTrafo`, `PipeOpTaskPreproc`, `PipeOpTaskPreprocSimple`, `mlr_graphs`, `mlr_pipeops`, `mlr_pipeops_materialize`

Other PipeOps: `PipeOp`, `PipeOpEncodePL`, `PipeOpEnsemble`, `PipeOpImpute`, `PipeOpTargetTrafo`, `PipeOpTaskPreproc`, `PipeOpTaskPreprocSimple`, `mlr_pipeops`, `mlr_pipeops_adas`, `mlr_pipeops_blsmote`, `mlr_pipeops_boxcox`, `mlr_pipeops_branch`, `mlr_pipeops_chunk`, `mlr_pipeops_classbalancing`, `mlr_pipeops_classifavg`, `mlr_pipeops_classweights`, `mlr_pipeops_classweightsex`, `mlr_pipeops_colapply`,

mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputecons mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantiles, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Examples

```
## Not run:
# Create a binary class task from iris
library(mlr3)
trafo_fun = function(x) {factor(ifelse(x$Species == "setosa", "setosa", "other"))}
po = PipeOpUpdateTarget$new(param_vals = list(trafo = trafo_fun, new_target_name = "setosa"))
po$train(list(tsk("iris")))
po$predict(list(tsk("iris")))

## End(Not run)
```

`mlr_pipeops_vtreat` *Interface to the vtreat Package*

Description

Provides an interface to the vtreat package.

`PipeOpVtreat` naturally works for classification tasks and regression tasks. Internally, `PipeOpVtreat` follows the fit/prepare interface of vtreat, i.e., first creating a data treatment transform object via `vtreat::NumericOutcomeTreatment()`, `vtreat::BinomialOutcomeTreatment()`, or `vtreat::MultinomialOutcomeTr` followed by calling `vtreat::fit_prepare()` on the training data and `vtreat::prepare()` during predicton.

Format

`R6Class` object inheriting from `PipeOpTaskPreproc`/`PipeOp`.

Construction

```
PipeOpVtreat$new(id = "vtreat", param_vals = list())
```

- `id` :: `character(1)`
  Identifier of resulting object, default `"vtreat"`.
- `param_vals` :: named `list`
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from `PipeOpTaskPreproc`. Instead of a `Task`, a `TaskSupervised` is used as input and output during training and prediction.

The output is the input `Task` with all affected features "prepared" by vtreat. If vtreat found "no usable vars", the input `Task` is returned unaltered.

State

The `$state` is a named `list` with the `$state` elements inherited from `PipeOpTaskPreproc`, as well as:

- `treatment_plan` :: object of class `vtreat_pipe_step` | `NULL`
  The treatment plan as constructed by vtreat based on the training data, i.e., an object of class `treatment_plan`. If vtreat found "no usable vars" and designing the treatment would have failed, this is `NULL`.

Parameters

The parameters are the parameters inherited from `PipeOpTaskPreproc`, as well as:

- `recommended` :: `logical(1)`
  Whether only the "recommended" prepared features should be returned, i.e., non constant variables with a significance value smaller than vtreat's threshold. Initialized to `TRUE`.
- `cols_to_copy` :: `function` | `Selector`
  `Selector` function, takes a `Task` as argument and returns a `character()` of features to copy. See `Selector` for example functions. Initialized to `selector_none()`.
- `minFraction` :: `numeric(1)`
  Minimum frequency a categorical level must have to be converted to an indicator column.
- `smFactor` :: `numeric(1)`
  Smoothing factor for impact coding models.
- `rareCount` :: `integer(1)`
  Allow levels with this count or below to be pooled into a shared rare-level.
- `rareSig` :: `numeric(1)`
  Suppress levels from pooling at this significance value greater.
- `collarProb` :: `numeric(1)`
  What fraction of the data (pseudo-probability) to collar data at if `doCollar = TRUE`.

- `doCollar` :: `logical(1)`
  If `TRUE` collar numeric variables by cutting off after a tail-probability specified by `collarProb` during treatment design.
- `codeRestriction` :: `character()`
  What types of variables to produce.
- `customCoders` :: named `list`
  Map from code names to custom categorical variable encoding functions.
- `splitFunction` :: `function`
  Function taking arguments nSplits, nRows, dframe, and y; returning a user desired split.
- `ncross` :: `integer(1)`
  Integer larger than one, number of cross-validation rounds to design.
- `forceSplit` :: `logical(1)`
  If `TRUE` force cross-validated significance calculations on all variables.
- `catScaling` :: `logical(1)`
  If `TRUE` use `stats::glm()` linkspace, if FALSE use `stats::lm()` for scaling.
- `verbose` :: `logical(1)`
  If `TRUE` print progress.
- `use_parallel` :: `logical(1)`
  If `TRUE` use parallel methods.
- `missingness_imputation` :: `function`
  Function of signature f(values: numeric, weights: numeric), simple missing value imputer.
  Typically, an imputation via a `PipeOp` should be preferred, see `PipeOpImpute`.
- `pruneSig` :: `numeric(1)`
  Suppress variables with significance above this level. Only effects [regression tasksmlr3::TaskRegr and binary classification tasks.
- `scale` :: `logical(1)`
  If `TRUE` replace numeric variables with single variable model regressions ("move to outcome-scale"). These have mean zero and (for variables with significant less than 1) slope 1 when regressed (lm for regression problems/glm for classification problems) against outcome.
- `varRestriction` :: `list()`
  List of treated variable names to restrict to. Only effects [regression tasksmlr3::TaskRegr and binary classification tasks.
- `trackedValues` :: named `list()`
  Named list mapping variables to know values, allows warnings upon novel level appearances (see `vtreat::track_values()`). Only effects [regression tasksmlr3::TaskRegr and binary classification tasks.
- `y_dependent_treatments` :: `character()`
  Character what treatment types to build per-outcome level. Only effects multiclass classification tasks.
- `imputation_map` :: named `list`
  List of map from column names to functions of signature f(values: numeric, weights: numeric), simple missing value imputers.
  Typically, an imputation via a `PipeOp` is to be preferred, see `PipeOpImpute`.

For more information, see `vtreat::regression_parameters()`, `vtreat::classification_parameters()`, or `vtreat::multinomial_parameters()`.

Internals

Follows vtreat's fit/prepare interface. See `vtreat::NumericOutcomeTreatment()`, `vtreat::BinomialOutcomeTreatment`
`vtreat::MultinomialOutcomeTreatment()`, `vtreat::fit_prepare()` and `vtreat::prepare()`.

Fields

Only fields inherited from `PipeOp`.

Methods

Only methods inherited from `PipeOpTaskPreproc`/`PipeOp`.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: `PipeOp`, `PipeOpEncodePL`, `PipeOpEnsemble`, `PipeOpImpute`, `PipeOpTargetTrafo`,
`PipeOpTaskPreproc`, `PipeOpTaskPreprocSimple`, `mlr_pipeops`, `mlr_pipeops_adas`, `mlr_pipeops_blsmote`,
`mlr_pipeops_boxcox`, `mlr_pipeops_branch`, `mlr_pipeops_chunk`, `mlr_pipeops_classbalancing`,
`mlr_pipeops_classifavg`, `mlr_pipeops_classweights`, `mlr_pipeops_classweightsex`, `mlr_pipeops_colapply`,
`mlr_pipeops_collapsefactors`, `mlr_pipeops_colroles`, `mlr_pipeops_copy`, `mlr_pipeops_datefeatures`,
`mlr_pipeops_decode`, `mlr_pipeops_encode`, `mlr_pipeops_encodeimpact`, `mlr_pipeops_encodelmer`,
`mlr_pipeops_encodeplquantiles`, `mlr_pipeops_encodepltree`, `mlr_pipeops_featureunion`,
`mlr_pipeops_filter`, `mlr_pipeops_fixfactors`, `mlr_pipeops_histbin`, `mlr_pipeops_ica`, `mlr_pipeops_imputecons`
`mlr_pipeops_imputehist`, `mlr_pipeops_imputelearner`, `mlr_pipeops_imputemean`, `mlr_pipeops_imputemedian`,
`mlr_pipeops_imputemode`, `mlr_pipeops_imputeoor`, `mlr_pipeops_imputesample`, `mlr_pipeops_info`,
`mlr_pipeops_isomap`, `mlr_pipeops_kernelpca`, `mlr_pipeops_learner`, `mlr_pipeops_learner_pi_cvplus`,
`mlr_pipeops_learner_quantiles`, `mlr_pipeops_materialize`, `mlr_pipeops_missind`, `mlr_pipeops_modelmatrix`,
`mlr_pipeops_multiplicityexply`, `mlr_pipeops_multiplicityimply`, `mlr_pipeops_mutate`,
`mlr_pipeops_nearmiss`, `mlr_pipeops_nmf`, `mlr_pipeops_nop`, `mlr_pipeops_ovrsplit`, `mlr_pipeops_ovrunite`,
`mlr_pipeops_pca`, `mlr_pipeops_proxy`, `mlr_pipeops_quantilebin`, `mlr_pipeops_randomprojection`,
`mlr_pipeops_randomresponse`, `mlr_pipeops_regravg`, `mlr_pipeops_removeconstants`, `mlr_pipeops_renamecolumns`
`mlr_pipeops_replicate`, `mlr_pipeops_rowapply`, `mlr_pipeops_scale`, `mlr_pipeops_scalemaxabs`,
`mlr_pipeops_scalerange`, `mlr_pipeops_select`, `mlr_pipeops_smote`, `mlr_pipeops_smotenc`,
`mlr_pipeops_spatialsign`, `mlr_pipeops_splines`, `mlr_pipeops_subsample`, `mlr_pipeops_targetinvert`,
`mlr_pipeops_targetmutate`, `mlr_pipeops_targettrafoscalerange`, `mlr_pipeops_textvectorizer`,
`mlr_pipeops_threshold`, `mlr_pipeops_tomek`, `mlr_pipeops_tunethreshold`, `mlr_pipeops_unbranch`,
`mlr_pipeops_updatetarget`, `mlr_pipeops_yeojohnson`

Examples

```
library("mlr3")

set.seed(2020)

make_data <- function(nrows) {
    d <- data.frame(x = 5 * rnorm(nrows))
    d["y"] = sin(d[["x"]]) + 0.01 * d[["x"]] + 0.1 * rnorm(nrows)
    d[4:10, "x"] = NA  # introduce NAs
    d["xc"] = paste0("level_", 5 * round(d$y / 5, 1))
```

```
    d["x2"] = rnorm(nrows)
    d[d["xc"] == "level_-1", "xc"] = NA  # introduce a NA level
    return(d)
}

task = TaskRegr$new("vtreat_regr", backend = make_data(100), target = "y")

pop = PipeOpVtreat$new()
pop$train(list(task))
```

`mlr_pipeops_yeojohnson`

Yeo-Johnson Transformation of Numeric Features

Description

Conducts a Yeo-Johnson transformation on numeric features. It therefore estimates the optimal value of lambda for the transformation. See `bestNormalize::yeojohnson()` for details.

Format

`R6Class` object inheriting from `PipeOpTaskPreproc`/`PipeOp`.

Construction

```
PipeOpYeoJohnson$new(id = "yeojohnson", param_vals = list())
```

- `id` :: `character(1)`
  Identifier of resulting object, default `"yeojohnson"`.
- `param_vals` :: named `list`
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default `list()`.

Input and Output Channels

Input and output channels are inherited from `PipeOpTaskPreproc`.

The output is the input `Task` with all affected numeric features replaced by their transformed versions.

State

The `$state` is a named `list` with the `$state` elements inherited from `PipeOpTaskPreproc`, as well as a list of class `yeojohnson` for each column, which is transformed.

Parameters

The parameters are the parameters inherited from PipeOpTaskPreproc, as well as:

- eps :: numeric(1)
  Tolerance parameter to identify the lambda parameter as zero. For details see yeojohnson().
- standardize :: logical
  Whether to center and scale the transformed values to attempt a standard normal distribution. For details see yeojohnson().
- lower :: numeric(1)
  Lower value for estimation of lambda parameter. For details see yeojohnson().
- upper :: numeric(1)
  Upper value for estimation of lambda parameter. For details see yeojohnson().

Internals

Uses the bestNormalize::yeojohnson function.

Fields

Only fields inherited from PipeOp.

Methods

Only methods inherited from PipeOpTaskPreproc/PipeOp.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputecons
mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantiles, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns
mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer,

mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat

Examples

```
library("mlr3")

task = tsk("iris")
pop = po("yeojohnson")

task$data()
pop$train(list(task))[[1]]$data()

pop$state
```

`mlr_tasks_boston_housing` *Housing Data for 506 Census Tracts of Boston*

Description

Housing Data for 506 Census Tracts of Boston

Format

R6Class object inheriting from TaskRegr.

The BostonHousing2 dataset containing the corrected data from III AMF (1979). "The Hedonic Price Approach to Measuring Demand for Neighborhood Characteristics." In *The Economics of Neighborhood*, 191–217. Elsevier. doi:10.1016/B9780126362503.500155. as provided by the mlbench package. See data description there.

`Multiplicity` *Multiplicity*

Description

A Multiplicity class S3 object.

The function of multiplicities is to indicate that PipeOps should be executed multiple times with multiple values.

A Multiplicity is a container, like a `list()`, that contains multiple values. If the message that is passed along the edge of a Graph is a Multiplicity-object, then the PipeOp that receives this object will *usually* be called once for each contained value. The result of each of these calls is then, again, packed in a Multiplicity and sent along the outgoing edge(s) of that PipeOp. This means

that a Multiplicity can cause multiple PipeOps in a row to be run multiple times, where the run for each element of the Multiplicity is independent from the others.

Most PipeOps only return a Multiplicity if their input was a Multiplicity (and after having run their code multiple times, once for each entry). However, there are a few special PipeOps that are "aware" of Multiplicity objects. These may either *create* a Multiplicity even though not having a Multiplicity input (e.g. PipeOpReplicate or PipeOpOVRSplit) – causing the subsequent PipeOps to be run multiple times – or *collect* a Multiplicity, being called only once even though their input is a Multiplicity (e.g. PipeOpOVRUnite or PipeOpFeatureUnion if constructed with the collect_multiplicity argument set to TRUE). The combination of these mechanisms makes it possible for parts of a Graph to be called variably many times if "sandwiched" between Multiplicity creating and collecting PipeOps.

Whether a PipeOp creates or collects a Multiplicity is indicated by the $input or $output slot (which indicate names and types of in/out channels). If the train and predict types of an input or output are surrounded by square brackets ("[", "]"), then this channel handles a Multiplicity explicitly. Depending on the function of the PipeOp, it will usually collect (input channel) or create (output channel) a Multiplicity. PipeOps without this indicator are Multiplicity agnostic and blindly execute their function multiple times when given a Multiplicity.

If a PipeOp is trained on a Multiplicity, the $state slot is set to a Multiplicity as well; this Multiplicity contains the "original" $state resulting from each individual call of the PipeOp with the input Multiplicity's content. If a PipeOp was trained with a Multiplicity, then the predict() argument must be a Multiplicity with the same number of elements.

Usage

```
Multiplicity(...)
```

Arguments

...	any Can be anything.

Value

Multiplicity

See Also

Other Special Graph Messages: NO_OP

Other Experimental Features: mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_replicate

Other Multiplicity PipeOps: PipeOpEnsemble, mlr_pipeops_classifavg, mlr_pipeops_featureunion, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_regravg, mlr_pipeops_replicate

NO_OP *No-Op Sentinel Used for Alternative Branching*

Description

Special data type for no-ops. Distinct from NULL for easier debugging and distinction from unintentional NULL returns.

Usage

```
NO_OP
```

Format

R6 object.

See Also

Other Path Branching: filter_noop(), is_noop(), mlr_pipeops_branch, mlr_pipeops_unbranch

Other Special Graph Messages: Multiplicity()

PipeOp *PipeOp Base Class*

Description

A PipeOp represents a transformation of a given "input" into a given "output", with two stages: "training" and "prediction". It can be understood as a generalized function that not only has multiple inputs, but also multiple outputs (as well as two stages). The "training" stage is used when training a machine learning pipeline or fitting a statistical model, and the "predicting" stage is then used for making predictions on new data.

To perform training, the $train() function is called which takes inputs and transforms them, while simultaneously storing information in its $state slot. For prediction, the $predict() function is called, where the $state information can be used to influence the transformation of the new data.

A PipeOp is usually used in a Graph object, a representation of a computational graph. It can have multiple **input channels**—think of these as multiple arguments to a function, for example when averaging different models—, and multiple **output channels**—a transformation may return different objects, for example different subsets of a Task. The purpose of the Graph is to connect different outputs of some PipeOps to inputs of other PipeOps.

Input and output channel information of a PipeOp is defined in the $input and $output slots; each channel has a *name*, a required type during training, and a required type during prediction. The $train() and $predict() functions are called with a list argument that has one entry for each declared channel (with one exception, see next paragraph). The list is automatically type-checked for each channel against $input and then passed on to the private$.train() or

private$.predict() functions. There the data is processed and a result list is created. This list is again type-checked for declared output types of each channel. The length and types of the result list is as declared in $output.

A special input channel name is "...", which creates a *vararg* channel that takes arbitrarily many arguments, all of the same type. If the $input table contains an "..."-entry, then the input given to $train() and $predict() may be longer than the number of declared input channels.

This class is an abstract base class that all PipeOps being used in a Graph should inherit from, and is not intended to be instantiated.

Format

Abstract R6Class.

Construction

PipeOp$new(id, param_set = ps(), param_vals = list(), input, output, packages = character(0), tags = cha

- id :: character(1)
  Identifier of resulting object. See $id slot.
- param_set :: ParamSet | list of expression
  Parameter space description. This should be created by the subclass and given to super$initialize(). If this is a ParamSet, it is used as the PipeOp's ParamSet directly. Otherwise it must be a list of expressions e.g. created by alist() that evaluate to ParamSets. These ParamSet are combined using a ParamSetCollection.
- param_vals :: named list
  List of hyperparameter settings, overwriting the hyperparameter settings given in param_set. The subclass should have its own param_vals parameter and pass it on to super$initialize(). Default list().
- input :: data.table with columns name (character), train (character), predict (character)
  Sets the $input slot of the resulting object; see description there.
- output :: data.table with columns name (character), train (character), predict (character)
  Sets the $output slot of the resulting object; see description there.
- packages :: character
  Set of all required packages for the PipeOp's $train and $predict methods. See $packages slot. Default is character(0).
- tags ::character
  A set of tags associated with the PipeOp. Tags describe a PipeOp's purpose. Can be used to filter as.data.table(mlr_pipeops). Default is "abstract", indicating an abstract PipeOp.

Internals

PipeOp is an abstract class with abstract functions private$.train() and private$.predict(). To create a functional PipeOp class, these two methods must be implemented. Each of these functions receives a named list according to the PipeOp's input channels, and must return a list (names are ignored) with values in the order of output channels in $output. The private$.train() and private$.predict() function should not be called by the user; instead, a $train() and

$predict() should be used. The most convenient usage is to add the PipeOp to a Graph (possibly as singleton in that Graph), and using the Graph's $train() / $predict() methods.

private$.train() and private$.predict() should treat their inputs as read-only. If they are R6 objects, they should be cloned before being manipulated in-place. Objects, or parts of objects, that are not changed, do not need to be cloned, and it is legal to return the same identical-by-reference objects to multiple outputs.

Fields

- id :: character
  ID of the PipeOp. IDs are user-configurable, and IDs of PipeOps must be unique within a Graph. IDs of PipeOps must not be changed once they are part of a Graph, instead the Graph's $set_names() method should be used.
- packages :: character
  Packages required for the PipeOp. Functions that are not in base R should still be called using :: (or explicitly attached using require()) in private$.train() *and* private$.predict(), but packages declared here are checked before any (possibly expensive) processing has started within a Graph.
- param_set :: ParamSet
  Parameters and parameter constraints. Parameter values that influence the functioning of $train and / or $predict are in the $param_set$values slot; these are automatically checked against parameter constraints in $param_set.
- state :: any | NULL
  Method-dependent state obtained during training step, and usually required for the prediction step. This is NULL if and only if the PipeOp has not been trained. The $state is the *only* slot that can be reliably modified during $train(), because private$.train() may theoretically be executed in a different R-session (e.g. for parallelization). $state should furthermore always be set to something with copy-semantics, since it is never cloned. This is a limitation not of PipeOp or mlr3pipelines, but of the way the system as a whole works, together with GraphLearner and **mlr3**.
- input :: data.table with columns name (character), train (character), predict (character)
  Input channels of PipeOp. Column name gives the names (and order) of values in the list given to $train() and $predict(). Column train is the (S3) class that an input object must conform to during training, column predict is the (S3) class that an input object must conform to during prediction. Types are checked by the PipeOp itself and do not need to be checked by private$.train() / private$.predict() code.
  A special name is "...", which creates a *vararg* input channel that accepts a variable number of inputs.
  If a row has both train and predict values enclosed by square brackets ("[", "]"), then this channel is Multiplicity-aware. If the PipeOp receives a Multiplicity value on these channels, this Multiplicity is given to the .train() and .predict() functions directly. Otherwise, the Multiplicity is transparently unpacked and the .train() and .predict() functions are called multiple times, once for each Multiplicity element. The type enclosed by square brackets indicates that only a Multiplicity containing values of this type are accepted. See Multiplicity for more information.
- output :: data.table with columns name (character), train (character), predict (character)
  Output channels of PipeOp, in the order in which they will be given in the list returned by

$train and $predict functions. Column train is the (S3) class that an output object must conform to during training, column predict is the (S3) class that an output object must conform to during prediction. The PipeOp checks values returned by private$.train() and private$.predict() against these types specifications.
If a row has both train and predict values enclosed by square brackets ("[", "]"), then this signals that the channel emits a Multiplicity of the indicated type. See Multiplicity for more information.

- innum :: numeric(1)
  Number of input channels. This equals nrow($input).
- outnum :: numeric(1)
  Number of output channels. This equals nrow($output).
- is_trained :: logical(1)
  Indicate whether the PipeOp was already trained and can therefore be used for prediction.
- tags ::character
  A set of tags associated with the PipeOp. Tags describe a PipeOp's purpose. Can be used to filter as.data.table(mlr_pipeops). PipeOp tags are inherited and child classes can introduce additional tags.
- hash :: character(1)
  Checksum calculated on the PipeOp, depending on the PipeOp's class and the slots $id and $param_set$values. If a PipeOp's functionality may change depending on more than these values, it should inherit the $hash active binding and calculate the hash as mlr3misc::calculate_hash(super$hash,
- phash :: character(1)
  Checksum calculated on the PipeOp, depending on the PipeOp's class and the slots $id but ignoring $param_set$values. If a PipeOp's functionality may change depending on more than these values, it should inherit the $hash active binding and calculate the hash as mlr3misc::calculate_hash(super$hash, <OTHER THINGS>).
- .result :: list
  If the Graph's $keep_results flag is set to TRUE, then the intermediate Results of $train() and $predict() are saved to this slot, exactly as they are returned by these functions. This is mainly for debugging purposes and done, if requested, by the Graph backend itself; it should *not* be done explicitly by private$.train() or private$.predict().
- man :: character(1)
  Identifying string of the help page that shows with help().
- label :: character(1)
  Description of the PipeOp's functionality. Derived from the title of its help page.
- properties :: character()
  The properties of the PipeOp. Currently supported values are:
  - "validation": the PipeOp can make use of the $internal_valid_task of an mlr3::Task. This is for example used for PipeOpLearners that wrap a Learner with this property, see mlr3::Learner. PipeOps that have this property, also have a $validate field, which controls whether to use the validation task, as well as a $internal_valid_scores field, which allows to access the internal validation scores after training, and a $best_valid_scores field for the best internal validation scores observed during training.
  - "internal_tuning": the PipeOp is able to internally optimize hyperparameters. This works analogously to the internal tuning implementation for mlr3::Learner. PipeOps

with that property also implement the standardized accessor `$internal_tuned_values` and have at least one parameter tagged with `"internal_tuning"`. An example for such a `PipeOp` is a `PipeOpLearner` that wraps a `Learner` with the `"internal_tuning"` property.

Programatic access to all available properties is possible via `mlr_reflections$pipeops$properties`.

Methods

- `print()`
  () -> `NULL`
  Prints the `PipeOp`s most salient information: `$id`, `$is_trained`, `$param_set$values`, `$input` and `$output`.
- `help(help_type)`
  (`character(1)`) -> help file
  Displays the help file of the concrete `PipeOp` instance. `help_type` is one of `"text"`, `"html"`, `"pdf"` and behaves as the `help_type` argument of R's `help()`.

The following public `$train()` and `$predict()` methods are the primary user-facing functions intended for direct use:

- `train(input)`
  (`list`) -> named `list`
  Train `PipeOp` on `inputs`, transform it to output and store the learned `$state`. If the `PipeOp` is already trained, already present `$state` is overwritten. Input list is typechecked against the `$input` `train` column. Return value is a list with as many entries as `$output` has rows, with each entry named after the `$output` `name` column and class according to the `$output` `train` column. The workhorse function for training each `PipeOp` is the `private$.train()` function.
- `predict(input)`
  (`list`) -> named `list`
  Predict on new data in `input`, possibly using the stored `$state`. Input and output are specified by `$input` and `$output` in the same way as for `$train()`, except that the `predict` column is used for type checking. The workhorse function for predicting in each `PipeOp` is the `private$.predict()` function.

To implement a `PipeOp` the following abstract private functions should be overloaded in the inheriting `PipeOp`. Note that these should not be called by a user; instead the public `$train()` and `$predict()` method should be used.

- `.train(input)`
  (named `list`) -> `list`
  Abstract function that must be implemented by concrete subclasses. `private$.train()` is called by `$train()` after typechecking. It must change the `$state` value to something non-`NULL` and return a list of transformed data according to the `$output` `train` column. Names of the returned list are ignored.

- `.predict(input)`
  (named `list`) -> `list`
  Abstract function that must be implemented by concrete subclasses. `private$.predict()` is called by `$predict()` after typechecking and works analogously to `private$.train()`.

Unlike `private$.train()`, `private$.predict()` should not modify the `PipeOp` in any way.

Inheriting

To create your own `PipeOp`, you need to overload the `private$.train()` and `private$.predict()` functions. It is most likely also necessary to overload the `$initialize()` function to do additional initialization. The `$initialize()` method should have at least the arguments `id` and `param_vals`, which should be passed on to `super$initialize()` unchanged. `id` should have a useful default value, and `param_vals` should have the default value `list()`, meaning no initialization of hyperparameters.

If the `$initialize()` method has more arguments, then it is necessary to also overload the `private$.additional_phash_i` function. This function should return either all objects, or a hash of all objects, that can change the function or behavior of the `PipeOp` and are independent of the class, the id, the `$state`, and the `$param_set$values`. The last point is particularly important: changing the `$param_set$values` should *not* change the return value of `private$.additional_phash_input()`.

When you are implementing a `PipeOp` that operates a task (and is not a `PipeOpTaskPreproc`), you also need to handle the `$internal_valid_task` field of the input task, if there is one.

See Also

https://mlr-org.com/pipeops.html

Other mlr3pipelines backend related: `Graph`, `PipeOpTargetTrafo`, `PipeOpTaskPreproc`, `PipeOpTaskPreprocSimple`, `mlr_graphs`, `mlr_pipeops`, `mlr_pipeops_materialize`, `mlr_pipeops_updatetarget`

Other PipeOps: `PipeOpEncodePL`, `PipeOpEnsemble`, `PipeOpImpute`, `PipeOpTargetTrafo`, `PipeOpTaskPreproc`, `PipeOpTaskPreprocSimple`, `mlr_pipeops`, `mlr_pipeops_adas`, `mlr_pipeops_blsmote`, `mlr_pipeops_boxcox`, `mlr_pipeops_branch`, `mlr_pipeops_chunk`, `mlr_pipeops_classbalancing`, `mlr_pipeops_classifavg`, `mlr_pipeops_classweights`, `mlr_pipeops_classweightsex`, `mlr_pipeops_colapply`, `mlr_pipeops_collapsefactors` `mlr_pipeops_colroles`, `mlr_pipeops_copy`, `mlr_pipeops_datefeatures`, `mlr_pipeops_decode`, `mlr_pipeops_encode`, `mlr_pipeops_encodeimpact`, `mlr_pipeops_encodelmer`, `mlr_pipeops_encodeplquantiles`, `mlr_pipeops_encodepltree`, `mlr_pipeops_featureunion`, `mlr_pipeops_filter`, `mlr_pipeops_fixfactors`, `mlr_pipeops_histbin`, `mlr_pipeops_ica`, `mlr_pipeops_imputeconstant`, `mlr_pipeops_imputehist`, `mlr_pipeops_imputelearner`, `mlr_pipeops_imputemean`, `mlr_pipeops_imputemedian`, `mlr_pipeops_imputemode`, `mlr_pipeops_imputeoor`, `mlr_pipeops_imputesample`, `mlr_pipeops_info`, `mlr_pipeops_isomap`, `mlr_pipeops_kernelpca`, `mlr_pipeops_learner`, `mlr_pipeops_learner_pi_cvplus`, `mlr_pipeops_learner_quantile` `mlr_pipeops_materialize`, `mlr_pipeops_missind`, `mlr_pipeops_modelmatrix`, `mlr_pipeops_multiplicityexply`, `mlr_pipeops_multiplicityimply`, `mlr_pipeops_mutate`, `mlr_pipeops_nearmiss`, `mlr_pipeops_nmf`, `mlr_pipeops_nop`, `mlr_pipeops_ovrsplit`, `mlr_pipeops_ovrunite`, `mlr_pipeops_pca`, `mlr_pipeops_proxy`, `mlr_pipeops_quantilebin`, `mlr_pipeops_randomprojection`, `mlr_pipeops_randomresponse`, `mlr_pipeops_regravg`, `mlr_pipeops_removeconstants`, `mlr_pipeops_renamecolumns`, `mlr_pipeops_replicate`, `mlr_pipeops_rowapply`, `mlr_pipeops_scale`, `mlr_pipeops_scalemaxabs`, `mlr_pipeops_scalerange`, `mlr_pipeops_select`, `mlr_pipeops_smote`, `mlr_pipeops_smotenc`, `mlr_pipeops_spatialsign`, `mlr_pipeops_splines`, `mlr_pipeops_subsample`, `mlr_pipeops_targetinvert`, `mlr_pipeops_targetmutate`, `mlr_pipeops_targettrafoscalerange`, `mlr_pipeops_textvectorizer`, `mlr_pipeops_threshold`, `mlr_pipeops_tomek`, `mlr_pipeops_tunethreshold`, `mlr_pipeops_unbranch`, `mlr_pipeops_updatetarget`, `mlr_pipeops_vtreat`, `mlr_pipeops_yeojohnson`

Examples

```
# example (bogus) PipeOp that returns the sum of two numbers during $train()
# as well as a letter of the alphabet corresponding to that sum during $predict().

PipeOpSumLetter = R6::R6Class("sumletter",
  inherit = PipeOp,  # inherit from PipeOp
  public = list(
    initialize = function(id = "posum", param_vals = list()) {
      super$initialize(id, param_vals = param_vals,
        # declare "input" and "output" during construction here
        # training takes two 'numeric' and returns a 'numeric';
        # prediction takes 'NULL' and returns a 'character'.
        input = data.table::data.table(name = c("input1", "input2"),
          train = "numeric", predict = "NULL"),
        output = data.table::data.table(name = "output",
          train = "numeric", predict = "character")
      )
    }
  ),
  private = list(
    # PipeOp deriving classes must implement .train and
    # .predict; each taking an input list and returning
    # a list as output.
    .train = function(input) {
      sum = input[[1]] + input[[2]]
      self$state = sum
      list(sum)
    },
    .predict = function(input) {
      list(letters[self$state])
    }
  )
)
posum = PipeOpSumLetter$new()

print(posum)

posum$train(list(1, 2))
# note the name 'output' is the name of the output channel specified
# in the $output data.table.

posum$predict(list(NULL, NULL))
```

PipeOpEncodePL *Piecewise Linear Encoding Base Class*

Description

Abstract base class for piecewise linear encoding.

Piecewise linear encoding works by splitting values of features into distinct bins, through an algorithm implemented in `private$.get_bins()`, and then creating new feature columns through a continuous alternative to one-hot encoding. Here, one new feature per bin is constructed, with values being either

- `0`, if the original value was below the lower bin boundary,
- `1`, if the original value was above or equal to the upper bin boundary, or
- a scaled value between `0` and `1`, if the original value was inside the bin boundaries. Scaling is done by offsetting the original value by the lower bin boundary and dividing by the bin width.

PipeOps inheriting from this encode columns of type `numeric` and `integer`. Use the `PipeOpTaskPreproc` `$affect_columns` functionality to only encode a subset of columns, or only encode columns of a certain type, etc.

Format

Abstract `R6Class` object inheriting from `PipeOpTaskPreprocSimple`/`PipeOpTaskPreproc`/`PipeOp`.

Construction

```
PipeOpEncodePL$new(id = "encodepl", param_set = ps(), param_vals = list(), packages = character(0), tas
```

- `id` :: `character(1)`
  Identifier of resulting object. See `$id` slot of `PipeOp`.
- `param_set` :: `ParamSet`
  Parameter space description. This should be created by the subclass and given to `super$initialize()`.
- `param_vals` :: named `list`
  List of hyperparameter settings, overwriting the hyperparameter settings given in `param_set`. The subclass should have its own `param_vals` parameter and pass it on to `super$initialize()`. Default `list()`.
- `packages` :: `character`
  Set of all required packages for the `PipeOp`'s `private$.train()` and `private$.predict()` methods. See `$packages` slot. Default is `character(0)`.
- `task_type` :: `character(1)`
  The class of `Task` that should be accepted as input and will be returned as output. This should generally be a `character(1)` identifying a type of `Task`, e.g. `"Task"`, `"TaskClassif"` or `"TaskRegr"` (or another subclass introduced by other packages). Default is `"Task"`.

Input and Output Channels

Input and output channels are inherited from `PipeOpTaskPreproc`.

The output is the input `Task` with all affected `numeric` and `integer` columns encoded using piecewise linear encoding.

State

The $state is a named list with the $state elements inherited from PipeOpTaskPreproc, as well as:

- bins :: named list
  Named list of numeric vectors. Each element corresponds to and is named after one of the affected feature columns and contains the bin boundaries derived through private$.get_bins().

Parameters

The parameters are the parameters inherited from PipeOpTaskPreproc.

Internals

PipeOpEncodePL is an abstract class inheriting from PipeOpTaskPreprocSimple that allows easier implementation of different binning algorithms for piecewise linear encoding. The respective binning algorithm should be implemented as private$.get_bins().

Fields

Only fields inherited from PipeOp.

Methods

Methods inherited from PipeOpTaskPreprocSimple/PipeOpTaskPreproc/PipeOp as well as

- .get_bins(task, cols)
  (Task, character) -> named list
  Abstract method for splitting the value range of a feature column into distinct bins. The argument cols should give the names of the feature columns of the task for which bins should be derived. Returns a named list of numeric vectors containing the bin boundaries for each affected feature column, named by that corresponding feature column.

References

Gorishniy Y, Rubachev I, Babenko A (2022). "On Embeddings for Numerical Features in Tabular Deep Learning." In *Advances in Neural Information Processing Systems*, volume 35, 24991–25004. https://proceedings.neurips.cc/paper_files/paper/2022/hash/9e9f0ffc3d836836ca96cbf8fe14b105-Abstrac
html.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors,

mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputeconstant, mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantile mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Other Piecewise Linear Encoding PipeOps: mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree

---

`PipeOpEnsemble` *Ensembling Base Class*

Description

Parent class for PipeOps that aggregate predictions. Implements the `private$.train()` and `private$.predict()` methods necessary for a `PipeOp` and requires deriving classes to create the `private$weighted_avg_predictions()` function.

Format

Abstract `R6Class` inheriting from `PipeOp`.

Construction

Note: This object is typically constructed via a derived class, e.g. `PipeOpClassifAvg` or `PipeOpRegrAvg`.

```
PipeOpEnsemble$new(innum = 0, collect_multiplicity = FALSE, id, param_set = ps(), param_vals = list(), p
```

- `innum` :: `numeric(1)`
  Determines the number of input channels. If `innum` is 0 (default), a vararg input channel is created that can take an arbitrary number of inputs.
- `collect_multiplicity` :: `logical(1)`
  If `TRUE`, the input is a `Multiplicity` collecting channel. This means, a `Multiplicity` input, instead of multiple normal inputs, is accepted and the members are aggregated. This requires `innum` to be 0. Default is `FALSE`.
- `id` :: `character(1)`
  Identifier of the resulting object.

- param_set :: ParamSet
  ("Hyper"-)Parameters in form of a ParamSet for the resulting PipeOp.
- param_vals :: named list
  List of hyperparameter settings, overwriting the hyperparameter settings that would otherwise be set during construction. Default list().
- packages :: character
  Set of packages required for this PipeOp. These packages are loaded during $train() and $predict(), but not attached. Default character(0).
- prediction_type :: character(1)
  The predict entry of the $input and $output type specifications. Should be "Prediction" (default) or one of its subclasses, e.g. "PredictionClassif", and correspond to the type accepted by private$.train() and private$.predict().

Input and Output Channels

PipeOpEnsemble has multiple input channels depending on the innum construction argument, named "input1", "input2", ... if innum is nonzero; if innum is 0, there is only one *vararg* input channel named "...". All input channels take only NULL during training and take a Prediction during prediction.

PipeOpEnsemble has one output channel named "output", producing NULL during training and a Prediction during prediction.

The output during prediction is in some way a weighted averaged representation of the input.

State

The $state is left empty (list()).

Parameters

- weights :: numeric
  Relative weights of input predictions. If this has length 1, it is ignored and weighs all inputs equally. Otherwise it must have length equal to the number of connected inputs. Initialized to 1 (equal weights).

Internals

The commonality of ensemble methods using PipeOpEnsemble is that they take a NULL-input during training and save an empty $state. They can be used following a set of PipeOpLearner PipeOps to perform (possibly weighted) prediction averaging. See e.g. PipeOpClassifAvg and PipeOpRegrAvg which both inherit from this class.

Should it be necessary to use the output of preceding Learners during the "training" phase, then PipeOpEnsemble should not be used. In fact, if training time behaviour of a Learner is important, then one should use a PipeOpLearnerCV instead of a PipeOpLearner, and the ensemble can be created with a Learner encapsulated by a PipeOpLearner. See LearnerClassifAvg and LearnerRegrAvg for examples.

Fields

Only fields inherited from PipeOp.

Methods

Methods inherited from PipeOp as well as:

- `weighted_avg_prediction(inputs, weights, row_ids, truth)`
  (`list` of Prediction, `numeric`, `integer` | `character`, `list`) -> `NULL`
  Create Predictions that correspond to the weighted average of incoming Predictions. This is called by `private$.predict()` with cleaned and sanity-checked values: `inputs` are guaranteed to fit together, `row_ids` and `truth` are guaranteed to be the same as each one in `inputs`, and `weights` is guaranteed to have the same length as `inputs`.
  This method is abstract, it must be implemented by deriving classes.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputeconstant, mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantile, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Other Multiplicity PipeOps: Multiplicity(), mlr_pipeops_classifavg, mlr_pipeops_featureunion, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_regravg, mlr_pipeops_replicate

Other Ensembles: mlr_learners_avg, mlr_pipeops_classifavg, mlr_pipeops_ovrunite, mlr_pipeops_regravg

PipeOpImpute *Imputation Base Class*

Description

Abstract base class for feature imputation.

Format

Abstract R6Class object inheriting from PipeOp.

Construction

```
PipeOpImpute$$new(id, param_set = ps(), param_vals = list(), whole_task_dependent = FALSE, empty_level_
  packages = character(0), task_type = "Task")
```

- id :: character(1)
  Identifier of resulting object. See $id slot of PipeOp.
- param_set :: ParamSet
  Parameter space description. This should be created by the subclass and given to super$initialize().
- param_vals :: named list
  List of hyperparameter settings, overwriting the hyperparameter settings given in param_set. The subclass should have its own param_vals parameter and pass it on to super$initialize(). Default list().
- whole_task_dependent :: logical(1)
  Whether the context_columns parameter should be added which lets the user limit the columns that are used for imputation inference. This should generally be FALSE if imputation depends only on individual features (e.g. mode imputation), and TRUE if imputation depends on other features as well (e.g. kNN-imputation).
- empty_level_control :: logical(1)
  Control how to handle edge cases where NAs occur in factor or ordered features only during prediction but not during training. Can be one of "never", "always", or "param":
  - If set to "never", no empty level is introduced during training, but columns that have missing values only during prediction will *not* be imputed.
  - If set to "always", an unseen level is added to the feature during training and missing values are imputed as that value during prediction.
  - Finally, if set to "param", the hyperparameter create_empty_level is added and control over this behavior is left to the user.

  For implementation details, see Internals below. Default is "never".
- packages :: character
  Set of all required packages for the PipeOp's private$.train and private$.predict methods. See $packages slot. Default is character(0).

- task_type :: character(1)
  The class of Task that should be accepted as input and will be returned as output. This should generally be a character(1) identifying a type of Task, e.g. "Task", "TaskClassif" or "TaskRegr" (or another subclass introduced by other packages). Default is "Task".
- feature_types :: character
  Feature types affected by the PipeOp. See private$.select_cols() for more information.

Input and Output Channels

PipeOpImpute has one input channel named "input", taking a Task, or a subclass of Task if the task_type construction argument is given as such; both during training and prediction.

PipeOpImpute has one output channel named "output", producing a Task, or a subclass; the Task type is the same as for input; both during training and prediction.

The output Task is the modified input Task with features imputed according to the private$.impute() function.

State

The $state is a named list; besides members added by inheriting classes, the members are:

- affected_cols :: character
  Names of features being selected by the affect_columns parameter.
- context_cols :: character
  Names of features being selected by the context_columns parameter.
- intasklayout :: data.table
  Copy of the training Task's $feature_types slot. This is used during prediction to ensure that the prediction Task has the same features, feature layout, and feature types as during training.
- outtasklayout :: data.table
  Copy of the trained Task's $feature_types slot. This is used during prediction to ensure that the Task resulting from the prediction operation has the same features, feature layout, and feature types as after training.
- model :: named list
  Model used for imputation. This is a list named by Task features, containing the result of the private$.train_imputer() or private$.train_nullmodel() function for each one.
- imputed_train :: character
  Names of features that were imputed during training. This is used to ensure that factor levels that were added during training are also added during prediction. Note that features that are imputed during prediction but not during training will still have inconsistent factor levels.

Parameters

- affect_columns :: function | Selector | NULL
  What columns the PipeOpImpute should operate on. The parameter must be a Selector function, which takes a Task as argument and returns a character of features to use.
  See Selector for example functions. Defaults to NULL, which selects all features.

- `context_columns` :: `function` | `Selector` | `NULL`
  What columns the `PipeOpImpute` imputation may depend on. This parameter is only present if the constructor is called with the `whole_task_dependent` argument set to `TRUE`.
  The parameter must be a `Selector` function, which takes a `Task` as argument and returns a `character` of features to use.
  See `Selector` for example functions. Defaults to `NULL`, which selects all features.
- `create_empty_level` :: `logical(1)`
  Whether an empty level should always be created for `factor` or `ordered` columns during training. If `FALSE`, columns that had no `NA`s during training but have `NA`s during prediction will not be imputed. This parameter is only present if the constructor is called with the `empty_level_control` argument set to `"param"`. Initialized to `FALSE`.

Internals

`PipeOpImpute` is an abstract class inheriting from `PipeOp` that makes implementing imputer `PipeOp`s simple.

Internally, the construction argument `empty_level_control` and the hyperparameter `create_empty_level` (should it exist) modify the `private$.create_empty_level` field. Behavior then depends on whether this field is set to `TRUE` or `FALSE` and works by controlling for which cases imputation is performed on `factor` or `ordered` columns. Its setting has no impact on columns of other types.
If `private$.create_empty_level` is set to `TRUE`, `private$.impute()` is called for all `factor` or `ordered` columns during training, regardless of whether they have any missing values. For this to lead to the creation of an empty level for columns with no missing values, inheriting `PipeOp`s must implement `private$.train_imputer()` in such a way that it returns the name of the level to be created for the feature types `factor` and `ordered`.
If `private$.create_empty_level` is set to `FALSE`, `private$.impute()` is not called during prediction for `factor` or `ordered` columns which were not modified during training. This means that `NA`s will not be imputed for these columns.
See `PipeOpImputeOOR`, for a detailed explanation of why these controls are necessary.

Fields

Fields inherited from `PipeOp`.

Methods

Methods inherited from `PipeOp`, as well as:

- `.select_cols(task)`
  (`Task`) -> `character`
  Selects which columns the `PipeOp` operates on. In contrast to the `affect_columns` parameter. `private$.select_cols()` is for the *inheriting class* to determine which columns the operator should function on, e.g. based on feature type, while `affect_columns` is a way for the *user* to limit the columns that a `PipeOpTaskPreproc` should operate on. This method can optionally be overloaded when inheriting `PipeOpImpute`; If this method is not overloaded, it defaults to selecting the columns of type indicated by the `feature_types` construction argument.
- `.train_imputer(feature, type, context)`
  (`atomic`, `character(1)`, `data.table`) -> `any`

Abstract function that must be overloaded when inheriting. Called once for each feature selected by `affect_columns` to create the model entry to be used for `private$.impute()`. This function is only called for features with at least one non-missing value.

- `.train_nullmodel(feature, type, context)`
(`atomic`, `character(1)`, `data.table`) -> `any`
Like `.train_imputer()`, but only called for each feature that only contains missing values. This is not an abstract function and, if not overloaded, gives a default response of `0` (`integer`, `numeric`), `c(TRUE, FALSE)` (`logical`), all available levels (`factor`/`ordered`), or the empty string (`character`).
- `.impute(feature, type, model, context)`
(`atomic`, `character(1)`, `any`, `data.table`) -> `atomic`
Imputes the features. `model` is the model created by `private$.train_imputer()`. Default behaviour is to assume `model` is an atomic vector from which values are sampled to impute missing values of `feature`. `model` may have an attribute `probabilities` for non-uniform sampling. If `model` has length zero, `feature` is returned unchanged.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpTargetTrafo, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputeconstant, mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantile, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Other Imputation PipeOps: mlr_pipeops_imputeconstant, mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample

PipeOpTargetTrafo *Target Transformation Base Class*

Description

Base class for handling target transformation operations. Target transformations are different from feature transformation because they have to be "inverted" after prediction. The target is transformed during the training phase and information to invert this transformation is sent along to PipeOpTargetInvert which then inverts this transformation during the prediction phase. This inversion may need info about both the training and the prediction data.

Users can overload up to four private$-functions: .get_state() (optional), .transform() (mandatory), .train_invert() (optional), and .invert() (mandatory).

Format

Abstract R6Class inheriting from PipeOp.

Construction

```
PipeOpTargetTrafo$new(id, param_set = ps(), param_vals = list(), packages = character(0), task_type_in
```

- id :: character(1)
  Identifier of resulting object. See $id slot of PipeOp.
- param_set :: ParamSet
  Parameter space description. This should be created by the subclass and given to super$initialize().
- param_vals :: named list
  List of hyperparameter settings, overwriting the hyperparameter settings given in param_set. The subclass should have its own param_vals parameter and pass it on to super$initialize(). Default list().
- task_type_in :: character(1)
  The class of Task that should be accepted as input. This should generally be a character(1) identifying a type of Task, e.g. "Task", "TaskClassif" or "TaskRegr" (or another subclass introduced by other packages). Default is "Task".
- task_type_out :: character(1)
  The class of Task that is produced as output. This should generally be a character(1) identifying a type of Task, e.g. "Task", "TaskClassif" or "TaskRegr" (or another subclass introduced by other packages). Default is the value of task_type_in.
- packages :: character
  Set of all required packages for the PipeOp's methods. See $packages slot. Default is character(0).
- tags :: character | NULL
  Tags of the resulting PipeOp. This is added to the tag "target transform". Default NULL.

Input and Output Channels

PipeOpTargetTrafo has one input channels named "input" taking a Task (or whatever class was specified by the task_type during construction) both during training and prediction.

PipeOpTargetTrafo has two output channels named "fun" and "output". During training, "fun" returns NULL and during prediction, "fun" returns a function that can later be used to invert the transformation done during training according to the overloaded .train_invert() and .invert() functions. "output" returns the modified input Task (or task_type) according to the overloaded transform() function both during training and prediction.

State

The $state is a named list and should be returned explicitly by the user in the overloaded .get_state() function.

Internals

PipeOpTargetTrafo is an abstract class inheriting from PipeOp. It implements the private$.train() and private$.predict() functions. These functions perform checks and go on to call .get_state(), .transform(), .train_invert(). .invert() is packaged and sent along the "fun" output to be applied to a Prediction by PipeOpTargetInvert. A subclass of PipeOpTargetTrafo should implement these functions and be used in combination with PipeOpTargetInvert.

Fields

Fields inherited from PipeOp.

Methods

Methods inherited from PipeOp, as well as:

- .get_state(task)
(Task) -> list
Called by PipeOpTargetTrafo's implementation of private$.train(). Takes a single Task as input and returns a list to set the $state. .get_state() will be called a single time during *training* right before .transform() is called. The return value (i.e. the $state) should contain info needed in .transform() as well as in .invert().
The base implementation returns list() and should be overloaded if setting the state is desired.
- .transform(task, phase)
(Task, character(1)) -> Task
Called by PipeOpTargetTrafo's implementation of private$.train() and private$.predict(). Takes a single Task as input and modifies it. This should typically consist of calculating a new target and modifying the Task by using the convert_task function. .transform() will be called during training and prediction because the target (and if needed also type) of the input Task must be transformed both times. Note that unlike $.train(), the argument is *not* a list but a singular Task, and the return object is also *not* a list but a singular Task. The phase argument is "train" during training phase and "predict" during prediction phase and can be used to enable different behaviour during training and prediction. When phase is "train", the $state slot (as previously set by .get_state()) may also be modified, alternatively or in

addition to overloading `.get_state()`.
The input should *not* be cloned and if possible should be changed in-place.
This function is abstract and should be overloaded by inheriting classes.

- `.train_invert(task)`
(Task) -> any
Called by `PipeOpTargetTrafo`'s implementation of `private$.predict()`. Takes a single Task as input and returns an arbitrary value that will be given as `predict_phase_state` to `.invert()`. This should not modify the input Task.
The base implementation returns a list with a single element, the `$truth` column of the Task, and should be overloaded if a more training-phase-dependent state is desired.
- `.invert(prediction, predict_phase_state)`
(Prediction, any) -> Prediction
Takes a Prediction and a `predict_phase_state` object as input and inverts the prediction.
This function is sent as `"fun"` to PipeOpTargetInvert.
This function is abstract and should be overloaded by inheriting classes. Care should be taken that the `predict_type` of the Prediction being inverted is handled well.
- `.invert_help(predict_phase_state)`
(`predict_phase_state` object) -> `function`
Helper function that packages `.invert()` that can later be used for the inversion.

See Also

https://mlr-org.com/pipeops.html

Other mlr3pipelines backend related: Graph, PipeOp, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_graphs, mlr_pipeops, mlr_pipeops_materialize, mlr_pipeops_updatetarget

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTaskPreproc, PipeOpTaskPreprocSimple, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputeconstant, mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantile, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

PipeOpTaskPreproc *Task Preprocessing Base Class*

Description

Base class for handling most "preprocessing" operations. These are operations that have exactly one Task input and one Task output, and expect the column layout of these Tasks during input and output to be the same.

Prediction-behavior of preprocessing operations should always be independent for each row in the input-Task. This means that the prediction-operation of preprocessing-PipeOps should commute with rbind(): Running prediction on an n-row Task should result in the same result as rbind()-ing the prediction-result from n 1-row Tasks with the same content. In the large majority of cases, the number and order of rows should also not be changed during prediction.

Users must implement private$.train_task() and private$.predict_task(), which have a Task input and should return that Task. The Task should, if possible, be manipulated in-place, and should not be cloned.

Alternatively, the private$.train_dt() and private$.predict_dt() functions can be implemented, which operate on data.table objects instead. This should generally only be done if all data is in some way altered (e.g. PCA changing all columns to principal components) and not if only a few columns are added or removed (e.g. feature selection) because this should be done at the Task-level with private$.train_task(). The private$.select_cols() function can be overloaded for private$.train_dt() and private$.predict_dt() to operate only on subsets of the Task's data, e.g. only on numerical columns.

If the can_subset_cols argument of the constructor is TRUE (the default), then the hyperparameter affect_columns is added, which can limit the columns of the Task that is modified by the PipeOpTaskPreproc using a Selector function. Note this functionality is entirely independent of the private$.select_cols() functionality.

PipeOpTaskPreproc is useful for operations that behave differently during training and prediction. For operations that perform essentially the same operation and only need to perform extra work to build a $state during training, the PipeOpTaskPreprocSimple class can be used instead.

Format

Abstract R6Class inheriting from PipeOp.

Construction

```
PipeOpTaskPreproc$new(id, param_set = ps(), param_vals = list(), can_subset_cols = TRUE,
  packages = character(0), task_type = "Task", tags = NULL, feature_types = mlr_reflections$task_feature
```

- id :: character(1)
  Identifier of resulting object. See $id slot of PipeOp.
- param_set :: ParamSet
  Parameter space description. This should be created by the subclass and given to super$initialize().

- param_vals :: named list
  List of hyperparameter settings, overwriting the hyperparameter settings given in param_set. The subclass should have its own param_vals parameter and pass it on to super$initialize(). Default list().
- can_subset_cols :: logical(1)
  Whether the affect_columns parameter should be added which lets the user limit the columns that are modified by the PipeOpTaskPreproc. This should generally be FALSE if the operation adds or removes rows from the Task, and TRUE otherwise. Default is TRUE.
- packages :: character
  Set of all required packages for the PipeOp's private$.train() and private$.predict() methods. See $packages slot. Default is character(0).
- task_type :: character(1)
  The class of Task that should be accepted as input and will be returned as output. This should generally be a character(1) identifying a type of Task, e.g. "Task", "TaskClassif" or "TaskRegr" (or another subclass introduced by other packages). Default is "Task".
- tags :: character | NULL
  Tags of the resulting PipeOp. This is added to the tag "data transform". Default NULL.
- feature_types :: character
  Feature types affected by the PipeOp. See private$.select_cols() for more information. Defaults to all available feature types.

Input and Output Channels

PipeOpTaskPreproc has one input channel named "input", taking a Task, or a subclass of Task if the task_type construction argument is given as such; both during training and prediction.

PipeOpTaskPreproc has one output channel named "output", producing a Task, or a subclass; the Task type is the same as for input; both during training and prediction.

The output Task is the modified input Task according to the overloaded private$.train_task()/private$.predict_taks or private$.train_dt()/private$.predict_dt() functions.

State

The $state is a named list; besides members added by inheriting classes, the members are:

- affect_cols :: character
  Names of features being selected by the affect_columns parameter, if present; names of *all* present features otherwise.
- intasklayout :: data.table
  Copy of the training Task's $feature_types slot. This is used during prediction to ensure that the prediction Task has the same features, feature layout, and feature types as during training.
- outtasklayout :: data.table
  Copy of the trained Task's $feature_types slot. This is used during prediction to ensure that the Task resulting from the prediction operation has the same features, feature layout, and feature types as after training.

- dt_columns :: character
  Names of features selected by the private$.select_cols() call during training. This is only present if the private$.train_dt() functionality is used, and not present if the private$.train_task() function is overloaded instead.
- feature_types :: character
  Feature types affected by the PipeOp. See private$.select_cols() for more information.

Parameters

- affect_columns :: function | Selector | NULL
  What columns the PipeOpTaskPreproc should operate on. This parameter is only present if the constructor is called with the can_subset_cols argument set to TRUE (the default).
  The parameter must be a Selector function, which takes a Task as argument and returns a character of features to use.
  See Selector for example functions. Defaults to NULL, which selects all features.

Internals

PipeOpTaskPreproc is an abstract class inheriting from PipeOp. It implements the private$.train() and $.predict() functions. These functions perform checks and go on to call private$.train_task() and private$.predict_task(). A subclass of PipeOpTaskPreproc may implement these functions, or implement private$.train_dt() and private$.predict_dt() instead. This works by having the default implementations of private$.train_task() and private$.predict_task() call private$.train_dt() and private$.predict_dt(), respectively.

The affect_columns functionality works by unsetting columns by removing their "col_role" before processing, and adding them afterwards by setting the col_role to "feature".

Fields

Fields inherited from PipeOp.

Methods

Methods inherited from PipeOp, as well as:

- .train_task(task)
  (Task) -> Task
  Called by the PipeOpTaskPreproc's implementation of private$.train(). Takes a single Task as input and modifies it (ideally in-place without cloning) while storing information in the $state slot. Note that unlike $.train(), the argument is *not* a list but a singular Task, and the return object is also *not* a list but a singular Task. Also, contrary to private$.train(), the $state being generated must be a list, which the PipeOpTaskPreproc will add additional slots to (see Section *State*). Care should be taken to avoid name collisions between $state elements added by private$.train_task() and PipeOpTaskPreproc.
  By default this function calls the private$.train_dt() function, but it can be overloaded to perform operations on the Task directly.
- .predict_task(task)
  (Task) -> Task
  Called by the PipeOpTaskPreproc's implementation of $.predict(). Takes a single Task as

input and modifies it (ideally in-place without cloning) while using information in the `$state` slot. Works analogously to `private$.train_task()`. If `private$.predict_task()` should only be overloaded if `private$.train_task()` is overloaded (i.e. `private$.train_dt()` is *not* used).

- `.train_dt(dt, levels, target)`
  (`data.table`, named `list`, `any`) -> `data.table` | `data.frame` | `matrix`
  Train `PipeOpTaskPreproc` on `dt`, transform it and store a state in `$state`. A transformed object must be returned that can be converted to a `data.table` using `as.data.table`. `dt` does not need to be copied deliberately, it is possible and encouraged to change it in-place.
  The `levels` argument is a named list of factor levels for factorial or character features. If the input `Task` inherits from `TaskSupervised`, the `target` argument contains the `$truth()` information of the training `Task`; its type depends on the `Task` type being trained on.
  This method can be overloaded when inheriting from `PipeOpTaskPreproc`, together with `private$.predict_dt()` and optionally `private$.select_cols()`; alternatively, `private$.train_task()` and `private$.predict_task()` can be overloaded.
- `.predict_dt(dt, levels)`
  (`data.table`, named `list`) -> `data.table` | `data.frame` | `matrix`
  Predict on new data in `dt`, possibly using the stored `$state`. A transformed object must be returned that can be converted to a `data.table` using `as.data.table`. `dt` does not need to be copied deliberately, it is possible and encouraged to change it in-place.
  The `levels` argument is a named list of factor levels for factorial or character features.
  This method can be overloaded when inheriting `PipeOpTaskPreproc`, together with `private$.train_dt()` and optionally `private$.select_cols()`; alternatively, `private$.train_task()` and `private$.predict_task()` can be overloaded.
- `.select_cols(task)`
  (`Task`) -> `character`
  Selects which columns the `PipeOp` operates on, if `private$.train_dt()` and `private$.predict_dt()` are overloaded. This function is not called if `private$.train_task()` and `private$.predict_task()` are overloaded. In contrast to the `affect_columns` parameter. `private$.select_cols()` is for the *inheriting class* to determine which columns the operator should function on, e.g. based on feature type, while `affect_columns` is a way for the *user* to limit the columns that a `PipeOpTaskPreproc` should operate on.
  This method can optionally be overloaded when inheriting `PipeOpTaskPreproc`, together with `private$.train_dt()` and `private$.predict_dt()`; alternatively, `private$.train_task()` and `private$.predict_task()` can be overloaded.
  If this method is not overloaded, it defaults to selecting of type indicated by the `feature_types` construction argument.

See Also

https://mlr-org.com/pipeops.html

Other mlr3pipelines backend related: `Graph`, `PipeOp`, `PipeOpTargetTrafo`, `PipeOpTaskPreprocSimple`, `mlr_graphs`, `mlr_pipeops`, `mlr_pipeops_materialize`, `mlr_pipeops_updatetarget`

Other PipeOps: `PipeOp`, `PipeOpEncodePL`, `PipeOpEnsemble`, `PipeOpImpute`, `PipeOpTargetTrafo`, `PipeOpTaskPreprocSimple`, `mlr_pipeops`, `mlr_pipeops_adas`, `mlr_pipeops_blsmote`, `mlr_pipeops_boxcox`, `mlr_pipeops_branch`, `mlr_pipeops_chunk`, `mlr_pipeops_classbalancing`, `mlr_pipeops_classifavg`, `mlr_pipeops_classweights`, `mlr_pipeops_classweightsex`, `mlr_pipeops_colapply`, `mlr_pipeops_collapsefactors`

mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputeconstant, mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantile, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

---

`PipeOpTaskPreprocSimple`

Simple Task Preprocessing Base Class

Description

Base class for handling many "preprocessing" operations that perform essentially the same operation during training and prediction. Instead implementing a `private$.train_task()` and a `private$.predict_task()` operation, only a `private$.get_state()` and a `private$.transform()` operation needs to be defined, both of which take one argument: a Task.

Alternatively, analogously to the PipeOpTaskPreproc approach of offering `private$.train_dt()`/`private$.predict_dt(`
the `private$.get_state_dt()` and `private$.transform_dt()` functions may be implemented.

`private$.get_state` must not change its input value in-place and must return something that will be written into `$state` (which must not be NULL), `private$.transform()` should modify its argument in-place; it is called both during training and prediction.

This inherits from PipeOpTaskPreproc and behaves essentially the same.

Format

Abstract R6Class inheriting from PipeOpTaskPreproc/PipeOp.

Construction

```
PipeOpTaskPreprocSimple$new(id, param_set = ps(), param_vals = list(), can_subset_cols = TRUE,
  packages = character(0), task_type = "Task", tags = NULL, feature_types = mlr_reflections$task_feature
```

(Construction is identical to PipeOpTaskPreproc.)

- id :: character(1)
  Identifier of resulting object. See $id slot of PipeOp.
- param_set :: ParamSet
  Parameter space description. This should be created by the subclass and given to super$initialize().
- param_vals :: named list
  List of hyperparameter settings, overwriting the hyperparameter settings given in param_set. The subclass should have its own param_vals parameter and pass it on to super$initialize(). Default list().
- can_subset_cols :: logical(1)
  Whether the affect_columns parameter should be added which lets the user limit the columns that are modified by the PipeOpTaskPreprocSimple. This should generally be FALSE if the operation adds or removes rows from the Task, and TRUE otherwise. Default is TRUE.
- packages :: character
  Set of all required packages for the PipeOp's private$.train() and private$.predict() methods. See $packages slot. Default is character(0).
- task_type :: character(1)
  The class of Task that should be accepted as input and will be returned as output. This should generally be a character(1) identifying a type of Task, e.g. "Task", "TaskClassif" or "TaskRegr" (or another subclass introduced by other packages). Default is "Task".
- tags :: character | NULL
  Tags of the resulting PipeOp. This is added to the tag "data transform". Default NULL.
- feature_types :: character
  Feature types affected by the PipeOp. See private$.select_cols() for more information. Defaults to all available feature types.

Input and Output Channels

Input and output channels are inherited from PipeOpTaskPreproc.

The output during training and prediction is the Task, modified by private$.transform() or private$.transform_dt().

State

The $state is a named list with the $state elements inherited from PipeOpTaskPreproc.

Parameters

The parameters are the parameters inherited from PipeOpTaskPreproc.

Internals

PipeOpTaskPreprocSimple is an abstract class inheriting from PipeOpTaskPreproc and implementing the private$.train_task() and private$.predict_task() functions. A subclass of PipeOpTaskPreprocSimple may implement the functions private$.get_state() and private$.transform(), or alternatively the functions private$.get_state_dt() and private$.transform_dt() (as well as private$.select_cols(), in the latter case). This works by having the default implementations of private$.get_state() and private$.transform() call private$.get_state_dt() and private$.transform_dt().

Fields

Fields inherited from PipeOp.

Methods

Methods inherited from PipeOpTaskPreproc, as well as:

- .get_state(task)
(Task) -> named list
Store create something that will be stored in $state during training phase of PipeOpTaskPreprocSimple. The state can then influence the private$.transform() function. Note that private$.get_state() must *return* the state, and should not store it in $state. It is not strictly necessary to implement either private$.get_state() or private$.get_state_dt(); if they are not implemented, the state will be stored as list().
This method can optionally be overloaded when inheriting from PipeOpTaskPreprocSimple, together with private$.transform(); alternatively, private$.get_state_dt() (optional) and private$.transform_dt() (and possibly private$.select_cols(), from PipeOpTaskPreproc) can be overloaded.
- .transform(task)
(Task) -> Task
Predict on new data in task, possibly using the stored $state. task should not be cloned, instead it should be changed in-place. This method is called both during training and prediction phase, and should essentially behave the same independently of phase. (If this is incongruent with the functionality to be implemented, then it should inherit from PipeOpTaskPreproc, not from PipeOpTaskPreprocSimple.)
This method can be overloaded when inheriting from PipeOpTaskPreprocSimple, optionally with private$.get_state(); alternatively, private$.get_state_dt() (optional) and private$.transform_dt() (and possibly private$.select_cols(), from PipeOpTaskPreproc) can be overloaded.
- .get_state_dt(dt)
(data.table) -> named list
Create something that will be stored in $state during training phase of PipeOpTaskPreprocSimple. The state can then influence the private$.transform_dt() function. Note that private$.get_state_dt() must *return* the state, and should not store it in $state. If neither private$.get_state() nor private$.get_state_dt() are overloaded, the state will be stored as list().
This method can optionally be overloaded when inheriting from PipeOpTaskPreprocSimple, together with private$.transform_dt() (and optionally private$.select_cols(), from PipeOpTaskPreproc); Alternatively, private$.get_state() (optional) and private$.transform() can be overloaded.
- .transform_dt(dt)
(data.table) -> data.table | data.frame | matrix
Predict on new data in dt, possibly using the stored $state. A transformed object must be returned that can be converted to a data.table using as.data.table. dt does not need to be copied deliberately, it is possible and encouraged to change it in-place. This method is called both during training and prediction phase, and should essentially behave the same independently of phase. (If this is incongruent with the functionality to be implemented, then it should inherit from PipeOpTaskPreproc, not from PipeOpTaskPreprocSimple.)
This method can optionally be overloaded when inheriting from PipeOpTaskPreprocSimple,

together with `private$.transform_dt()` (and optionally `private$.select_cols()`, from PipeOpTaskPreproc); Alternatively, `private$.get_state()` (optional) and `private$.transform()` can be overloaded.

See Also

https://mlr-org.com/pipeops.html

Other PipeOps: PipeOp, PipeOpEncodePL, PipeOpEnsemble, PipeOpImpute, PipeOpTargetTrafo, PipeOpTaskPreproc, mlr_pipeops, mlr_pipeops_adas, mlr_pipeops_blsmote, mlr_pipeops_boxcox, mlr_pipeops_branch, mlr_pipeops_chunk, mlr_pipeops_classbalancing, mlr_pipeops_classifavg, mlr_pipeops_classweights, mlr_pipeops_classweightsex, mlr_pipeops_colapply, mlr_pipeops_collapsefactors, mlr_pipeops_colroles, mlr_pipeops_copy, mlr_pipeops_datefeatures, mlr_pipeops_decode, mlr_pipeops_encode, mlr_pipeops_encodeimpact, mlr_pipeops_encodelmer, mlr_pipeops_encodeplquantiles, mlr_pipeops_encodepltree, mlr_pipeops_featureunion, mlr_pipeops_filter, mlr_pipeops_fixfactors, mlr_pipeops_histbin, mlr_pipeops_ica, mlr_pipeops_imputeconstant, mlr_pipeops_imputehist, mlr_pipeops_imputelearner, mlr_pipeops_imputemean, mlr_pipeops_imputemedian, mlr_pipeops_imputemode, mlr_pipeops_imputeoor, mlr_pipeops_imputesample, mlr_pipeops_info, mlr_pipeops_isomap, mlr_pipeops_kernelpca, mlr_pipeops_learner, mlr_pipeops_learner_pi_cvplus, mlr_pipeops_learner_quantile, mlr_pipeops_materialize, mlr_pipeops_missind, mlr_pipeops_modelmatrix, mlr_pipeops_multiplicityexply, mlr_pipeops_multiplicityimply, mlr_pipeops_mutate, mlr_pipeops_nearmiss, mlr_pipeops_nmf, mlr_pipeops_nop, mlr_pipeops_ovrsplit, mlr_pipeops_ovrunite, mlr_pipeops_pca, mlr_pipeops_proxy, mlr_pipeops_quantilebin, mlr_pipeops_randomprojection, mlr_pipeops_randomresponse, mlr_pipeops_regravg, mlr_pipeops_removeconstants, mlr_pipeops_renamecolumns, mlr_pipeops_replicate, mlr_pipeops_rowapply, mlr_pipeops_scale, mlr_pipeops_scalemaxabs, mlr_pipeops_scalerange, mlr_pipeops_select, mlr_pipeops_smote, mlr_pipeops_smotenc, mlr_pipeops_spatialsign, mlr_pipeops_splines, mlr_pipeops_subsample, mlr_pipeops_targetinvert, mlr_pipeops_targetmutate, mlr_pipeops_targettrafoscalerange, mlr_pipeops_textvectorizer, mlr_pipeops_threshold, mlr_pipeops_tomek, mlr_pipeops_tunethreshold, mlr_pipeops_unbranch, mlr_pipeops_updatetarget, mlr_pipeops_vtreat, mlr_pipeops_yeojohnson

Other mlr3pipelines backend related: Graph, PipeOp, PipeOpTargetTrafo, PipeOpTaskPreproc, mlr_graphs, mlr_pipeops, mlr_pipeops_materialize, mlr_pipeops_updatetarget

---

po *Shorthand PipeOp Constructor*

Description

Create

- a `PipeOp` from `mlr_pipeops` from given ID
- a `PipeOpLearner` from a `Learner` object
- a `PipeOpFilter` from a `Filter` object
- a `PipeOpSelect` from a `Selector` object
- a clone of a `PipeOp` from a given `PipeOp` (possibly with changed settings)

The object is initialized with given parameters and `param_vals`.

`po()` taks a single `obj` (`PipeOp` id, `Learner`, ...) and converts it to a `PipeOp`. `pos()` (with plural-s) takes either a `character`-vector, or a list of objects, and creates a `list` of `PipeOp`s.

Usage

```
po(.obj, ...)

pos(.objs, ...)
```

Arguments

.obj	[any] The object from which to construct a PipeOp. If this is a character(1), it is looked up in the mlr_pipeops dictionary. Otherwise, it is converted to a PipeOp.
...	any Additional parameters to give to constructed object. This may be an argument of the constructor of the PipeOp, in which case it is given to this constructor; or it may be a parameter value, in which case it is given to the param_vals argument of the constructor.
.objs	character | list Either a character of PipeOps to look up in mlr_pipeops, or a list of other objects to be converted to a PipeOp. If this is a named list, then the names are used as $id slot for the resulting PipeOps.

Value

A PipeOp (for po()), or a list of PipeOps (for pos()).

Examples

```
library("mlr3")

po("learner", lrn("classif.rpart"), cp = 0.3)

po(lrn("classif.rpart"), cp = 0.3)

# is equivalent with:
mlr_pipeops$get("learner", lrn("classif.rpart"),
  param_vals = list(cp = 0.3))

mlr3pipelines::pos(c("pca", original = "nop"))
```

---

ppl *Shorthand Graph Constructor*

Description

Creates a Graph from mlr_graphs from given ID

ppl() taks a character(1) and returns a Graph. ppls() takes a character vector of any list and returns a list of possibly muliple Graphs.

Usage

```
ppl(.key, ...)

ppls(.keys, ...)
```

Arguments

.key	[character(1)] The key of the Graph in mlr_graphs.
...	any Additional parameters to give to constructed object. This may be an argument of the constructor of the underlying function.
.keys	[character] The key of possibly multiple Graphs in mlr_graphs. If this is named, a named list is returned, but unlike pos() it will not set any $id slots.

Value

Graph (for ppl()) or list of Graphs (for ppls()).

Examples

```
library("mlr3")

gr = ppl("bagging", graph = po(lrn("regr.rpart")),
  averager = po("regravg", collect_multiplicity = TRUE))
```

---

preproc *Simple Pre-processing*

Description

Function that offers a simple and direct way to train or predict PipeOps and Graphs on Tasks, data.frames or data.tables.

Training happens if predict is set to FALSE and no state is passed to this function. Prediction happens if predict is set to TRUE and if the passed Graph or PipeOp is either trained or a state is explicitly passed to this function.

The passed PipeOp or Graph gets modified by-reference.

Usage

```
preproc(indata, processor, state = NULL, predict = !is.null(state))
```

Arguments

indata	(Task | data.frame | data.table) Data to be pre-processed.
processor	(Graph | PipeOp) Graph or PipeOp accepting a Task that has one output channel. Whenever indata is passed a data.frame or data.table, the output channel must return a Task to be converted back into a data.frame or data.table. Additionally, processors which only work on sub-classes of TaskSupervised will not accept data.frame or data.table, as it would be unclear which column was the target. Be aware that the processor gets modified by-reference both during training, and if a state is passed to this function. This especially means that the state of a trained processor will get overwritten when state is passed. You may want to use dictionary sugar functions to select a processor and to set its hyperparameters, e.g. po() or ppl().
state	(named list | NULL) Optional state to be used for prediction, if the processor is untrained or if the current state of the processor should be overwritten. Must be a complete and correct state for the respective processor. Default NULL (do not overwrite processor's state).
predict	(logical(1)) Whether to predict (TRUE) or train (FALSE). By default, this is FALSE if state is NULL (state's default), and TRUE otherwise.

Value

any \| data.frame \| data.table: If indata is a Task, whatever is returned by the processor's single output channel is returned. If indata is a data.frame or data.table, an object of the same class is returned, or if the processor's output channel does not return a Task, an error is thrown.

Internals

If processor is a PipeOp, the S3 method preproc.PipeOp gets called first, converting the PipeOp into a Graph and wrapping the state appropriately, before calling the S3 method preproc.Graph with the modified objects.

If indata is a data.frame or data.table, a TaskUnsupervised is constructed internally. This implies that processors which only work on sub-classes of TaskSupervised will not work with these input types for indata.

Examples

```
library("mlr3")

task = tsk("iris")
pop = po("pca")

# Training
preproc(task, pop)
```

```
# Note that the PipeOp gets trained through this
pop$is_trained

# Predicting a trained PipeOp (trained through previous call to preproc)
preproc(task, pop, predict = TRUE)

# Predicting using a given state
# We use the state of the PipeOp from the last example and then reset it
state = pop$state
pop$state = NULL
preproc(task, pop, state)

# Note that the PipeOp's state may get overwritten inadvertently during
# training or if a state is given
pop$state$sdev
preproc(tsk("wine"), pop)
pop$state$sdev

# Multiple preproc() calls can be piped, using dictionary sugar to set parameters:
# tsk("penguins") |>
#   preproc(po("imputemode", affect_columns = selector_name("sex"))) |>
#   preproc(po("imputemean"))
# This is equivalent to the following:
task = tsk("penguins")
impute_sex = po("imputemode", affect_columns = selector_name("sex"))
task = preproc(task, impute_sex)
impute_numeric = po("imputemean")
task = preproc(task, impute_numeric)
task

# Use preproc with a Graph
gr = po("pca", rank. = 4) %>>% po("learner", learner = lrn("classif.rpart"))
preproc(tsk("sonar"), gr)  # returns NULL because of the learner
preproc(tsk("sonar"), gr, predict = TRUE)

# Training with a data.table input
# Note that `$data()` drops the information that "Species" is the target.
# It gets handled like an ordinary feature here.
dt = tsk("iris")$data()
preproc(dt, pop)

# Predicting with a data.table input
preproc(dt, pop)
```

---

register_autoconvert_function

Add Autoconvert Function to Conversion Register

Description

Add functions that perform conversion to a desired class.

Whenever a Graph or a PipeOp is called with an object that does not conform to its declared input type, the "autoconvert register" is queried for functions that may turn the object into a desired type.

Conversion functions should try to avoid cloning.

Usage

```
register_autoconvert_function(cls, fun, packages = character(0))
```

Arguments

cls	character(1) The class that fun converts to.
fun	function The conversion function. Must take one argument and return an object of class cls, or possibly a sub-class as recognized by are_types_compatible().
packages	character The packages required to be loaded for fun to operate.

Value

NULL.

See Also

Other class hierarchy operations: add_class_hierarchy_cache(), reset_autoconvert_register(), reset_class_hierarchy_cache()

Examples

```
# This lets mlr3pipelines automatically try to convert a string into
# a `PipeOp` by querying the [`mlr_pipeops`] [`Dictionary`][mlr3misc::Dictionary].
# This is an example and not necessary, because mlr3pipelines adds it by default.
register_autoconvert_function("PipeOp", function(x) as_pipeop(x), packages = "mlr3pipelines")
```

---

reset_autoconvert_register

Reset Autoconvert Register

Description

Reset autoconvert register to factory default, thereby undoing any calls to register_autoconvert_function() by the user.

Usage

```
reset_autoconvert_register()
```

Value

NULL

See Also

Other class hierarchy operations: add_class_hierarchy_cache(), register_autoconvert_function(), reset_class_hierarchy_cache()

---

reset_class_hierarchy_cache *Reset the Class Hierarchy Cache*

Description

Reset the class hierarchy cache to factory default, thereby undoing any calls to add_class_hierarchy_cache() by the user.

Usage

```
reset_class_hierarchy_cache()
```

Value

NULL

See Also

Other class hierarchy operations: add_class_hierarchy_cache(), register_autoconvert_function(), reset_autoconvert_register()

Selector *Selector Functions*

Description

A Selector function is used by different PipeOps, most prominently PipeOpSelect and many PipeOps inheriting from PipeOpTaskPreproc, to determine a subset of Tasks to operate on.

Even though a Selector is a function that can be written itself, it is preferable to use the Selector constructors shown here. Each of these can be called with its arguments to create a Selector, which can then be given to the PipeOpSelect selector parameter, or many PipeOpTaskPreprocs' affect_columns parameter. See there for examples of this usage.

Usage

```
selector_all()

selector_none()

selector_type(types)

selector_grep(pattern, ignore.case = FALSE, perl = FALSE, fixed = FALSE)

selector_name(feature_names, assert_present = FALSE)

selector_invert(selector)

selector_intersect(selector_x, selector_y)

selector_union(selector_x, selector_y)

selector_setdiff(selector_x, selector_y)

selector_missing()

selector_non_missing()

selector_cardinality_greater_than(min_cardinality)

selector_positive(na_ignore = TRUE)

selector_negative(na_ignore = TRUE)

selector_non_negative(na_ignore = TRUE)

selector_non_positive(na_ignore = TRUE)

selector_non_zero(na_ignore = TRUE)
```

Arguments

types	(character) Type of feature to select
pattern	(character(1)) grep pattern
ignore.case	(logical(1)) ignore case
perl	(logical(1)) perl regex
fixed	(logical(1)) fixed pattern instead of regex

`feature_names` (`character`)
Select features by exact name match.

`assert_present` (`logical(1)`)
Throw an error if `feature_names` are not all present in the task being operated on.

`selector` (`Selector`)
`Selector` to invert.

`selector_x` (`Selector`)
First `Selector` to query.

`selector_y` (`Selector`)
Second `Selector` to query.

`min_cardinality`
(`integer`)
Minimum number of levels required to be selected.

`na_ignore` (`logical(1)`)
Whether to ignore missing values when checking whether all values satisfy the selector's condition. If `TRUE`, missing values do not influence the check. If `FALSE`, features containing missing values are not selected. Defaults to `TRUE`.

Value

`function`: A `Selector` function that takes a `Task` and returns the feature names to be processed.

Functions

- `selector_all()`: `selector_all` selects all features.
- `selector_none()`: `selector_none` selects none of the features.
- `selector_type()`: `selector_type` selects features according to type. Legal types are listed in `mlr_reflections$task_feature_types`.
- `selector_grep()`: `selector_grep` selects features with names matching the `grep()` pattern.
- `selector_name()`: `selector_name` selects features with names matching exactly the names listed.
- `selector_invert()`: `selector_invert` inverts a given `Selector`: It always selects the features that would be *dropped* by the other `Selector`, and drops the features that would be kept.
- `selector_intersect()`: `selector_intersect` selects the intersection of two `Selector`s: Only features selected by both `Selector`s are selected in the end.
- `selector_union()`: `selector_union` selects the union of two `Selector`s: Features selected by either `Selector` are selected in the end.
- `selector_setdiff()`: `selector_setdiff` selects the setdiff of two `Selector`s: Features selected by `selector_x` are selected, unless they are also selected by `selector_y`.
- `selector_missing()`: `selector_missing` selects features with missing values.
- `selector_non_missing()`: `selector_non_missing` selects features without missing values.

- `selector_cardinality_greater_than()`: `selector_cardinality_greater_than` selects categorical features with cardinality greater then a given threshold.
- `selector_positive()`: `selector_positive` selects integer and numeric features whose values are all greater than zero.
- `selector_negative()`: `selector_negative` selects integer and numeric features whose values are all less than zero.
- `selector_non_negative()`: `selector_non_negative` selects integer and numeric features whose values are all greater than or equal to zero.
- `selector_non_positive()`: `selector_non_positive` selects integer and numeric features whose values are all less than or equal to zero.
- `selector_non_zero()`: `selector_non_zero` selects integer and numeric features whose values are all non-zero.

Details

A `Selector` is a `function` that has one input argument (commonly named `task`). The function is called with the `Task` that a `PipeOp` is operating on. The return value of the function must be a `character` vector that is a subset of the feature names present in the `Task`.

For example, a `Selector` that selects all columns is

```
function(task) {
  task$feature_names
}
```

(this is the `selector_all()`-`Selector`.) A `Selector` that selects all columns that have names shorter than four letters would be:

```
function(task) {
  task$feature_names[
    nchar(task$feature_names) < 4
  ]
}
```

A `Selector` that selects only the column `"Sepal.Length"` (as in the iris task), if present, is

```
function(task) {
  intersect(task$feature_names, "Sepal.Length")
}
```

It is preferable to use the `Selector` construction functions like `select_type`, `select_grep` etc. if possible, instead of writing custom `Selector`s.

See Also

Other Selectors: `mlr_pipeops_select`

Examples

```
library("mlr3")

iris_task = tsk("iris")
bh_task = tsk("boston_housing")

sela = selector_all()
sela(iris_task)
sela(bh_task)

self = selector_type("factor")
self(iris_task)
self(bh_task)

selg = selector_grep("a.*i")
selg(iris_task)
selg(bh_task)

selgi = selector_invert(selg)
selgi(iris_task)
selgi(bh_task)

selgf = selector_union(selg, self)
selgf(iris_task)
selgf(bh_task)
```

`set_validate.GraphLearner` *Configure Validation for a GraphLearner*

Description

Configure validation for a graph learner.

In a `GraphLearner`, validation can be configured on two levels:

1. On the `GraphLearner` level, which specifies **how** the validation set is constructed before entering the graph.
2. On the level of the individual `PipeOps` (such as `PipeOpLearner`), which specifies which pipeops actually make use of the validation data (set its `$validate` field to `"predefined"`) or not (set it to `NULL`). This can be specified via the argument `ids`.

Usage

```
## S3 method for class 'GraphLearner'
set_validate(
  learner,
  validate,
  ids = NULL,
```

```
  args_all = list(),
  args = list(),
  ...
)
```

Arguments

learner	(GraphLearner) The graph learner to configure.
validate	(numeric(1), "predefined", "test", or NULL) How to set the $validate field of the learner. If set to NULL all validation is disabled, both on the graph learner level, but also for all pipeops.
ids	(NULL or character()) For which pipeops to enable validation. This parameter is ignored when validate is set to NULL. By default, validation is enabled for the final PipeOp in the Graph.
args_all	(list()) Rarely needed. A named list of parameter values that are passed to all subsequet set_validate() calls on the individual PipeOps.
args	(named list()) Rarely needed. A named list of lists, specifying additional argments to be passed to set_validate() when calling it on the individual PipeOps.
...	(any) Currently unused.

Examples

```
library(mlr3)

glrn = as_learner(po("pca") %>>% lrn("classif.debug"))
set_validate(glrn, 0.3)
glrn$validate
glrn$graph$pipeops$classif.debug$learner$validate

set_validate(glrn, NULL)
glrn$validate
glrn$graph$pipeops$classif.debug$learner$validate

set_validate(glrn, 0.2, ids = "classif.debug")
glrn$validate
glrn$graph$pipeops$classif.debug$learner$validate
```

%>>% *PipeOp Composition Operator*

Description

These operators creates a connection that "pipes" data from the source g1 into the sink g2. Both source and sink can either be a Graph or a PipeOp (or an object that can be automatically converted into a Graph or PipeOp, see as_graph() and as_pipeop()).
%>>% and %>>!% try to automatically match output channels of g1 to input channels of g2; this is only possible if either

- the number of output channels of g1 (as given by g1$output) is equal to the number of input channels of g2 (as given by g2$input), or
- g1 has only one output channel (i.e. g1$output has one line), or
- g2 has only one input channel, which is a *vararg* channel (i.e. g2$input has one line, with name entry "...").

Connections between channels are created in the order in which they occur in g1 and g2, respectively: g1's output channel 1 is connected to g2's input channel 1, channel 2 to 2 etc.
%>>% always creates deep copies of its input arguments, so they cannot be modified by reference afterwards. To access individual PipeOps after composition, use the resulting Graph's $pipeops list. %>>!%, on the other hand, tries to avoid cloning its first argument: If it is a Graph, then this Graph will be modified in-place.

When %>>!% fails, then it leaves g1 in an incompletely modified state. It is therefore usually recommended to use %>>%, since the very marginal gain of performance from using %>>!% often does not outweigh the risk of either modifying objects by-reference that should not be modified or getting graphs that are in an incompletely modified state. However, when creating long Graphs, chaining with %>>!% instead of %>>% can give noticeable performance benefits because %>>% makes a number of clone()-calls that is quadratic in chain length, %>>!% only linear.

concat_graphs(g1, g2, in_place = FALSE) is equivalent to g1 %>>% g2. concat_graphs(g1, g2, in_place = TRUE) is equivalent to g1 %>>!% g2.

Both arguments of %>>% are automatically converted to Graphs using as_graph(); this means that objects on either side may be objects that can be automatically converted to PipeOps (such as Learners or Filters), or that can be converted to Graphs. This means, in particular, lists of Graphs, PipeOps or objects convertible to that, because as_graph() automatically applies gunion() to lists. See examples. If the first argument of %>>!% is not a Graph, then it is cloned just as when %>>% is used; %>>!% only avoids clone() if the first argument is a Graph.

Note that if g1 is NULL, g2 converted to a Graph will be returned. Analogously, if g2 is NULL, g1 converted to a Graph will be returned.

Usage

```
g1 %>>% g2

concat_graphs(g1, g2, in_place = FALSE)

g1 %>>!% g2
```

Arguments

g1	(Graph | PipeOp | Learner | Filter | list | ...) Graph / PipeOp / object-convertible-to-PipeOp to put in front of g2.

g2	(Graph | PipeOp | Learner | Filter | list | ...) Graph / PipeOp / object-convertible-to-PipeOp to put after g1.
in_place	(logical(1)) Whether to try to avoid cloning g1. If g1 is not a Graph, then it is cloned regardless.

Value

Graph: the constructed Graph.

See Also

Other Graph operators: as_graph(), as_pipeop(), assert_graph(), assert_pipeop(), chain_graphs(), gunion(), mlr_graphs_greplicate

Examples

```
o1 = PipeOpScale$new()
o2 = PipeOpPCA$new()
o3 = PipeOpFeatureUnion$new(2)

# The following two are equivalent:
pipe1 = o1 %>>% o2

pipe2 = Graph$new()$
  add_pipeop(o1)$
  add_pipeop(o2)$
  add_edge(o1$id, o2$id)

# Note automatical gunion() of lists.
# The following three are equivalent:
graph1 = list(o1, o2) %>>% o3

graph2 = gunion(list(o1, o2)) %>>% o3

graph3 = Graph$new()$
  add_pipeop(o1)$
  add_pipeop(o2)$
  add_pipeop(o3)$
  add_edge(o1$id, o3$id, dst_channel = 1)$
  add_edge(o2$id, o3$id, dst_channel = 2)

pipe1 %>>!% o3  # modify pipe1 in-place

pipe1  # contains o1, o2, and o3 now.

o1 %>>!% o2

o1  # not changed, because not a Graph.
```

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mlr_pipeops_colroles, *39*, *41*, *44*, *46*, *48*, *50*, *53*, *56*, *58*, *61*, *63*, *66*, 67, *70*, *74*, *76*, *80*, *82*, *84*, *87*, *89*, *92*, *95*, *98*, *100*, *102*, *105*, *107*, *109*, *111*, *113*, *115*, *118*, *120*, *122*, *124*, *127*, *129*, *135*, *138*, *140*, *142*, *144*, *146*, *148*, *150*, *153*, *155*, *157*, *159*, *161*, *164*, *166*, *168*, *170*, *172*, *175*, *178*, *180*, *181*, *183*, *185*, *187*, *189*, *191*, *193*, *196*, *198*, *200*, *202*, *204*, *207*, *209*, *213*, *215*, *217*, *219*, *221*, *224*, *227*, *229*, *237*, *240*, *243*, *247*, *250*, *255*, *258*

mlr_pipeops_copy, *39*, *41*, *44*, *46*, *48*, *50*, *53*, *56*, *58*, *61*, *63*, *66*, *68*, 69, *74*, *76*, *80*, *82*, *84*, *87*, *89*, *92*, *95*, *98*, *100*, *102*, *105*, *107*, *109*, *111*, *113*, *115*, *118*, *120*, *122*, *124*, *127*, *129*, *135*, *138*, *140*, *142*, *144*, *146*, *148*, *150*, *153*, *155*, *157–159*, *161*, *164*, *166*, *168*, *170*, *172*, *175*, *178*, *180*, *181*, *183*, *185*, *187*, *189*, *191*, *193*, *196*, *198*, *200*, *202*, *204*, *207*, *209*, *213*, *215*, *217*, *219*, *221*, *224*, *227*, *229*, *237*, *240*, *243*, *247*, *250*, *255*, *258*

mlr_pipeops_datefeatures, *39*, *41*, *44*, *46*, *48*, *50*, *53*, *56*, *58*, *61*, *63*, *66*, *68*, *70*, 71, *76*, *80*, *82*, *84*, *87*, *89*, *92*, *95*, *98*, *100*, *102*, *105*, *107*, *109*, *111*, *113*, *115*, *118*, *120*, *122*, *124*, *127*, *129*, *135*, *138*, *140*, *142*, *144*, *146*, *148*, *150*, *153*, *155*, *157*, *159*, *161*, *164*, *166*, *168*, *170*, *172*, *175*, *178*, *180*, *181*, *183*, *185*, *187*, *189*, *191*, *193*, *196*, *198*, *200*, *202*, *204*, *207*, *209*, *213*, *215*, *217*, *219*, *221*, *224*, *227*, *229*, *237*, *240*, *243*, *247*, *250*, *255*, *258*

mlr_pipeops_decode, *39*, *41*, *44*, *46*, *48*, *50*, *53*, *56*, *58*, *61*, *63*, *66*, *68*, *70*, *74*, 74, *80*, *82*, *85*, *87*, *89*, *92*, *95*, *98*, *100*, *103*, *105*, *107*, *109*, *111*, *113*, *115*, *118*, *120*, *122*, *124*, *127*, *129*, *136*, *138*, *140*, *142*, *144*, *146*, *148*, *150*, *153*, *155*, *157*, *159*, *161*, *164*, *166*, *168*, *170*, *172*, *175*, *178*, *180*, *181*, *183*, *186*, *187*, *189*, *191*, *193*, *196*, *198*, *200*, *202*, *204*, *207*, *209*, *213*, *215*, *217*, *219*, *221*, *224*, *227*, *229*, *237*, *240*, *243*, *247*, *250*, *255*, *258*

mlr_pipeops_encode, *39*, *41*, *44*, *46*, *48*, *50*, *53*, *56*, *58*, *61*, *63*, *66*, *68*, *70*, *74*, *76*, 78, *82*, *85*, *87*, *89*, *92*, *95*, *98*, *100*, *103*, *105*, *107*, *109*, *111*, *113*, *115*, *118*, *120*, *122*, *124*, *127*, *129*, *136*, *138*, *140*, *142*, *144*, *146*, *148*, *150*, *153*, *155*, *157*, *159*, *161*, *164*, *166*, *168*, *170*, *172*, *175*, *178*, *180*, *181*, *183*, *186*, *187*, *189*, *191*, *193*, *196*, *198*, *200*, *202*, *204*, *207*, *209*, *213*, *215*, *217*, *219*, *221*, *224*, *227*, *229*, *237*, *240*, *243*, *247*, *250*, *255*, *258*

mlr_pipeops_encodeimpact, *39*, *41*, *44*, *46*, *48*, *50*, *53*, *56*, *58*, *61*, *63*, *66*, *68*, *70*, *74*, *76*, *80*, 81, *85*, *87*, *89*, *92*, *95*, *98*, *100*, *103*, *105*, *107*, *109*, *111*, *113*, *115*, *118*, *120*, *122*, *124*, *127*, *129*, *136*, *138*, *140*, *142*, *144*, *146*, *148*, *150*, *153*, *155*, *157*, *159*, *161*, *164*, *166*, *168*, *170*, *172*, *175*, *178*, *180*, *181*, *183*, *186*, *187*, *189*, *191*, *193*, *196*, *198*, *200*, *202*, *204*, *207*, *209*, *213*, *215*, *217*, *219*, *221*, *224*, *227*, *229*, *237*, *240*, *243*, *247*, *250*, *255*, *258*

mlr_pipeops_encodelmer, *39*, *41*, *44*, *46*, *48*, *50*, *53*, *56*, *58*, *61*, *63*, *66*, *68*, *70*, *74*, *76*, *80*, *82*, 83, *87*, *89*, *92*, *95*, *98*, *100*, *103*, *105*, *107*, *109*, *111*, *113*, *115*, *118*, *120*, *122*, *124*, *127*, *129*, *136*, *138*, *140*, *142*, *144*, *146*, *148*, *150*, *153*, *155*, *157*, *159*, *161*, *164*, *166*, *168*, *170*, *172*, *175*, *178*, *180*, *181*, *183*, *186*, *187*, *189*, *191*, *193*, *196*, *198*, *200*, *202*, *204*, *207*, *209*, *213*, *215*, *217*, *219*, *221*, *224*, *227*, *229*, *237*, *240*, *243*, *247*, *250*, *255*, *258*

mlr_pipeops_encodeplquantiles, *39*, *41*, *44*, *46*, *48*, *50*, *53*, *56*, *58*, *61*, *63*, *66*,

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mlr_pipeops_encodepltree, *39*, *41*, *44*, *46*, *48*, *50*, *53*, *56*, *58*, *61*, *63*, *66*, *68*, *70*, *74*, *76*, *80*, *82*, *85*, *87*, 88, *92*, *95*, *98*, *100*, *103*, *105*, *107*, *109*, *111*, *113*, *115*, *118*, *120*, *122*, *124*, *127*, *129*, *136*, *138*, *140*, *142*, *144*, *146*, *148*, *150*, *153*, *155*, *157*, *159*, *161*, *164*, *166*, *168*, *170*, *172*, *175*, *178*, *180, 181*, *183*, *186, 187*, *189*, *191*, *193*, *196*, *198*, *200*, *202*, *204*, *207*, *209*, *213*, *215*, *217*, *219*, *221*, *224*, *227*, *229*, *237*, *240, 241*, *243*, *247*, *250*, *255*, *258*

mlr_pipeops_featureunion, *39*, *41*, *44*, *46*, *48*, *50*, *53*, *56*, *58*, *61*, *63*, *66*, *68*, *70*, *74*, *76*, *80*, *82*, *85*, *87*, *89*, 91, *95*, *98*, *100*, *103*, *105*, *107*, *109*, *111*, *113*, *115*, *118*, *120*, *122*, *124*, *127*, *129*, *136*, *138*, *140*, *142*, *144*, *146–150*, *153*, *155*, *157*, *159–162*, *164*, *166*, *168*, *170*, *172*, *175, 176*, *178*, *180–183*, *186, 187*, *189*, *191*, *193*, *196*, *198*, *200*, *202*, *204*, *207*, *209*, *213*, *215*, *217*, *219*, *221*, *224*, *227*, *229*, *231*, *237*, *240*, *243*, *247*, *250*, *255*, *258*

mlr_pipeops_filter, *39*, *41*, *44*, *46*, *48*, *50*, *53*, *56*, *58*, *61*, *63*, *66*, *68*, *70*, *74*, *76*, *80*, *82*, *85*, *87*, *89*, *92*, 93, *98*, *100*, *103*, *105*, *107*, *109*, *111*, *113*, *115*, *118*, *120*, *122*, *125*, *127*, *129*, *136*, *138*, *140*, *142*, *144*, *146*, *148*, *150*, *153*, *155*, *157*, *159*, *161*, *164*, *166*, *168*, *170*, *172*, *175*, *178*, *180, 181*, *183*, *186, 187*, *189*, *191*, *193*, *196*, *198*, *200*, *202*, *204*, *207*, *209*, *213*, *215*, *217*, *219*, *221*, *224*, *227*, *229*, *237*, *240*, *243*, *247*, *250*, *255*, *258*

mlr_pipeops_fixfactors, *39*, *41*, *44*, *46*, *48*, *50*, *53*, *56*, *58*, *61*, *63*, *66*, *68*, *70*, *74*, *76*, *80*, *82*, *85*, *87*, *89*, *92*, *95*, 96, *100*, *103*, *105*, *107*, *109*, *111*, *113*, *115*, *118*, *120*, *122*, *125*, *127*, *129*, *136*, *138*, *140*, *142*, *144*, *146*, *148*, *150*, *153*, *155*, *157*, *159*, *161*, *164*, *166*, *168*, *170*, *172*, *175*, *178*, *180, 181*, *183*, *186, 187*, *189*, *191*, *193*, *196*, *198*, *200*, *202*, *204*, *207*, *209*, *213*, *215*, *217*, *219*, *221*, *224*, *227*, *229*, *237*, *240*, *243*, *247*, *250*, *255*, *258*

mlr_pipeops_histbin, *39*, *41*, *44*, *46*, *48*, *50*, *53*, *56*, *58*, *61*, *63*, *66*, *68*, *70*, *74*, *76*, *80*, *82*, *85*, *87*, *90*, *92*, *95*, *98*, 99, *103*, *105*, *107*, *109*, *111*, *113*, *115*, *118*, *120*, *122*, *125*, *127*, *129*, *136*, *138*, *140*, *142*, *144*, *146*, *148*, *150*, *153*, *155*, *157*, *159*, *161*, *164*, *166*, *168*, *170*, *172*, *175*, *178*, *180, 181*, *183*, *186, 187*, *189*, *191*, *193*, *196*, *198*, *200*, *202*, *204*, *207*, *209*, *213*, *215*, *217*, *219*, *221*, *224*, *227*, *229*, *237*, *241*, *243*, *247*, *250*, *255*, *258*

mlr_pipeops_ica, *39*, *41*, *44*, *46*, *48*, *50*, *53*, *56*, *58*, *61*, *63*, *66*, *68*, *70*, *74*, *76*, *80*, *82*, *85*, *87*, *90*, *92*, *95*, *98*, *100*, 101, *105*, *107*, *109*, *111*, *113*, *115*, *118*, *120*, *122*, *125*, *127*, *129*, *136*, *138*, *140*, *142*, *144*, *146*, *148*, *150*, *153*, *155*, *157*, *159*, *161*, *164*, *166*, *168*, *170*, *172*, *175*, *178*, *180, 181*, *183*, *186, 187*, *189*, *191*, *193*, *196*, *198*, *200*, *202*, *204*, *207*, *209*, *213*, *215*, *217*, *219*, *221*, *224*, *227*, *229*, *237*, *241*, *243*, *247*, *250*, *255*, *258*

mlr_pipeops_imputeconstant, *39*, *41*, *44*, *46*, *48*, *50*, *53*, *56*, *58*, *61*, *63*, *66*, *68*, *70*, *74*, *76*, *80*, *82*, *85*, *87*, *90*, *92*, *95*, *98*, *100*, *103*, 103, *107*, *109–116*, *118–122*, *125*, *127*, *129*, *136*, *138*, *140*, *142*, *144*, *146*, *148*, *150*, *153*, *155*, *157*, *159*, *161*, *164*, *166*, *168*, *170*, *172*, *175*, *178*, *180, 181*, *183*, *186, 187*, *189*, *191*, *193*, *196*, *198*, *200*, *202*, *204*, *207*, *209*, *213*, *215*,

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mlr_pipeops_imputehist, *39*, *41*, *44*, *46*, *48*, *50*, *53*, *56*, *58*, *61*, *63*, *66*, *68*, *70*, *74*, *76*, *80*, *82*, *85*, *87*, *90*, *92*, *95*, *98*, *100*, *103*, *105*, 105, *109, 110*, *112–116*, *118–122*, *125*, *127*, *129*, *136*, *138*, *140*, *142*, *144*, *146*, *148*, *150*, *153*, *155*, *157*, *159*, *161*, *164*, *166*, *168*, *170*, *172*, *175*, *178*, *180, 181*, *183*, *186, 187*, *189*, *191*, *193*, *196*, *198*, *200*, *202*, *204*, *207*, *209*, *213*, *215*, *217*, *219*, *221*, *224*, *227*, *229*, *237*, *241*, *243*, *247*, *250*, *255*, *258*

mlr_pipeops_imputelearner, *39*, *41*, *44*, *46*, *48*, *50*, *53*, *56*, *58*, *61*, *63*, *66*, *68*, *70*, *74*, *76*, *80*, *82*, *85*, *87*, *90*, *92*, *95*, *98*, *100*, *103*, *105*, *107*, 107, *112–116*, *118–122*, *125*, *127*, *129*, *136*, *138*, *140*, *142*, *144*, *146*, *148*, *150*, *153*, *155*, *157*, *159*, *161*, *164*, *166*, *168*, *170*, *172*, *175*, *178*, *180, 181*, *183*, *186, 187*, *189*, *191*, *193*, *196*, *198*, *200*, *202*, *204*, *207*, *209*, *213*, *215*, *217*, *219*, *221*, *224*, *227*, *229*, *237*, *241*, *243*, *247*, *250*, *255*, *258*

mlr_pipeops_imputemean, *39*, *41*, *44*, *46*, *48*, *50*, *53*, *56*, *58*, *61*, *63*, *66*, *68*, *70*, *74*, *76*, *80*, *82*, *85*, *87*, *90*, *92*, *95*, *98*, *100*, *103*, *105*, *107*, *109, 110*, 110, *113–116*, *118–122*, *125*, *127*, *129*, *136*, *138*, *140*, *142*, *144*, *146*, *148*, *150*, *153*, *155*, *157*, *159*, *161*, *164*, *166*, *168*, *170*, *172*, *175*, *178*, *180, 181*, *183*, *186, 187*, *189*, *191*, *193*, *196*, *198*, *200*, *202*, *204*, *207*, *209*, *213*, *215*, *217*, *219*, *221*, *224*, *227*, *229*, *237*, *241*, *243*, *247*, *250*, *255*, *258*

mlr_pipeops_imputemedian, *39*, *41*, *44*, *46*, *48*, *50*, *53*, *56*, *58*, *61*, *63*, *66*, *68*, *70*, *74*, *76*, *80*, *82*, *85*, *87*, *90*, *92*, *95*, *98*, *100*, *103*, *105*, *107*, *109, 110*, *112*, 112, *115, 116*, *118–122*, *125*, *127*, *129*, *136*, *138*, *140*, *142*, *144*, *146*, *148*, *150*, *153*, *155*, *157*, *159*, *161*, *164*, *166*, *168*, *170*, *172*, *175*, *178*, *180, 181*, *183*, *186, 187*, *189*, *191*, *193*, *196*, *198*, *200*, *202*, *204*, *207*, *209*, *213*, *215*, *217*, *219*, *221*, *224*, *227*, *229*, *237*, *241*, *243*, *247*, *250*, *255*, *258*

mlr_pipeops_imputemode, *39*, *41*, *44*, *46*, *48*, *50*, *53*, *56*, *58*, *61*, *63*, *66*, *68*, *70*, *74*, *76*, *80*, *82*, *85*, *87*, *90*, *92*, *95*, *98*, *100*, *103*, *105*, *107*, *109, 110*, *112–114*, 114, *118–122*, *125*, *127*, *129*, *136*, *138*, *140*, *142*, *144*, *146*, *148*, *150*, *153*, *155*, *157*, *159*, *161*, *164*, *166*, *168*, *170*, *172*, *175*, *178*, *180, 181*, *183*, *186, 187*, *189*, *191*, *193*, *196*, *198*, *200*, *202*, *204*, *207*, *209*, *213*, *215*, *217*, *219*, *221*, *224*, *227*, *229*, *237*, *241*, *243*, *247*, *250*, *255*, *258*

mlr_pipeops_imputeoor, *39*, *41*, *44*, *46*, *48*, *50*, *53*, *56*, *58*, *61*, *63*, *66*, *68*, *70*, *74*, *76*, *80*, *82*, *85*, *87*, *90*, *92*, *95*, *98*, *100*, *103*, *105*, *107*, *109, 110*, *112–116*, 116, *120–122*, *125*, *127*, *129*, *136*, *138*, *140*, *142*, *144*, *146*, *148*, *150*, *153*, *155*, *157*, *159*, *161*, *164*, *166*, *168*, *170*, *172*, *175*, *178*, *180, 181*, *183*, *186, 187*, *189*, *191*, *193*, *196*, *198*, *200*, *202*, *204*, *207*, *209*, *213*, *215*, *217*, *219*, *221*, *224*, *227*, *229*, *237*, *241*, *243*, *247*, *250*, *255*, *258*

mlr_pipeops_imputesample, *39*, *41*, *44*, *46*, *48*, *50*, *53*, *56*, *58*, *61*, *63*, *66*, *68*, *70*, *74*, *76*, *80*, *82*, *85*, *87*, *90*, *92*, *95*, *98*, *100*, *103*, *105*, *107*, *109, 110*, *112–116*, *118, 119*, 119, *122*, *125*, *127*, *129*, *136*, *138*, *140*, *142*, *144*, *146*, *148*, *150*, *153*, *155*, *157*, *159*, *161*, *164*, *166*, *168*, *170*, *172*, *175*, *178*, *180, 181*, *183*, *186, 187*, *189*, *191*, *193*, *196*, *198*, *200*, *202*, *204*, *207*, *209*, *213*, *215*, *217*, *219*, *221*, *224*, *227*, *229*, *237*, *241*, *243*, *247*, *250*, *255*, *258*

mlr_pipeops_info, *39*, *41*, *44*, *46*, *48*, *50*, *53*, *56*, *58*, *61*, *63*, *66*, *68*, *70*, *74*, *76*, *80*, *82*, *85*, *87*, *90*, *92*, *95*, *98*, *100*, *103*, *105*, *107*, *109*, *112, 113*, *115*, *118*,

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mlr_pipeops_isomap, *39*, *41*, *44*, *46*, *48*, *50*, *53*, *56*, *58*, *61*, *63*, *66*, *68*, *70*, *74*, *76*, *80*, *82*, *85*, *87*, *90*, *92*, *95*, *98*, *100*, *103*, *105*, *107*, *109*, *112*, *113*, *115*, *118*, *120*, *122*, 123, *127*, *129*, *136*, *138*, *140*, *142*, *144*, *146*, *148*, *150*, *153*, *155*, *157*, *159*, *162*, *164*, *166*, *168*, *170*, *172*, *175*, *178*, *180*, *182*, *183*, *186*, *187*, *189*, *191*, *193*, *196*, *198*, *200*, *202*, *204*, *207*, *209*, *213*, *215*, *217*, *220*, *221*, *224*, *227*, *229*, *237*, *241*, *243*, *247*, *250*, *255*, *258*

mlr_pipeops_kernelpca, *39*, *42*, *44*, *46*, *48*, *50*, *53*, *56*, *58*, *61*, *63*, *66*, *68*, *70*, *74*, *76*, *80*, *82*, *85*, *87*, *90*, *92*, *95*, *98*, *100*, *103*, *105*, *107*, *109*, *112*, *113*, *115*, *118*, *120*, *122*, *125*, 125, *129*, *136*, *138*, *140*, *142*, *144*, *146*, *148*, *150*, *153*, *155*, *157*, *159*, *162*, *164*, *166*, *168*, *170*, *172*, *175*, *178*, *180*, *182*, *183*, *186*, *187*, *189*, *191*, *193*, *196*, *198*, *200*, *202*, *204*, *207*, *209*, *213*, *215*, *217*, *220*, *221*, *224*, *227*, *229*, *237*, *241*, *243*, *247*, *250*, *255*, *258*

mlr_pipeops_learner, *39*, *42*, *44*, *46*, *48*, *50*, *53*, *56*, *58*, *61*, *63*, *66*, *68*, *70*, *74*, *76*, *80*, *82*, *85*, *87*, *90*, *92*, *95*, *98*, *100*, *103*, *105*, *107*, *109*, *112*, *113*, *115*, *118*, *120*, *122*, *125*, *127*, 127, *133*, *136*, *138*, *140*, *142*, *144*, *146*, *148*, *150*, *153*, *155*, *157*, *159*, *162*, *164*, *166*, *168*, *170*, *172*, *175*, *178*, *180*, *182*, *183*, *186*, *187*, *189*, *191*, *193*, *196*, *198*, *200*, *202*, *204*, *207*, *209*, *213*, *215*, *217*, *220*, *221*, *224*, *227*, *229*, *237*, *241*, *243*, *247*, *250*, *255*, *258*

mlr_pipeops_learner_cv, *130*, 130, *136*, *138*

mlr_pipeops_learner_pi_cvplus, *39*, *42*, *44*, *46*, *48*, *50*, *53*, *56*, *58*, *61*, *63*, *66*, *68*, *70*, *74*, *76*, *80*, *82*, *85*, *87*, *90*, *92*, *95*, *98*, *100*, *103*, *105*, *107*, *109*, *112*, *113*, *115*, *118*, *120*, *122*, *125*, *127*, *129*, *130*, *133*, 133, *138*, *140*, *142*, *144*, *146*, *148*, *150*, *153*, *155*, *157*, *159*, *162*, *164*, *166*, *168*, *170*, *172*, *175*, *178*, *180*, *182*, *183*, *186*, *187*, *189*, *191*, *193*, *196*, *198*, *200*, *202*, *204*, *207*, *209*, *213*, *215*, *217*, *220*, *221*, *224*, *227*, *229*, *237*, *241*, *243*, *247*, *250*, *255*, *258*

mlr_pipeops_learner_quantiles, *39*, *42*, *44*, *46*, *48*, *50*, *53*, *56*, *58*, *61*, *63*, *66*, *68*, *70*, *74*, *76*, *80*, *82*, *85*, *87*, *90*, *92*, *96*, *98*, *100*, *103*, *105*, *107*, *109*, *112*, *113*, *115*, *118*, *120*, *122*, *125*, *127*, *129*, *130*, *133*, *136*, 136, *140*, *142*, *144*, *146*, *148*, *151*, *153*, *156*, *157*, *159*, *162*, *164*, *166*, *168*, *170*, *172*, *175*, *178*, *180*, *182*, *183*, *186*, *187*, *189*, *191*, *193*, *196*, *198*, *200*, *202*, *204*, *207*, *209*, *213*, *215*, *217*, *220*, *222*, *224*, *227*, *229*, *237*, *241*, *243*, *247*, *250*, *255*, *258*

mlr_pipeops_materialize, *15*, *21*, *39*, *42*, *44*, *46*, *48*, *50*, *53*, *56*, *58*, *61*, *63*, *66*, *68*, *70*, *74*, *76*, *80*, *82*, *85*, *87*, *90*, *92*, *96*, *98*, *100*, *103*, *105*, *107*, *109*, *112*, *113*, *115*, *118*, *120*, *122*, *125*, *127*, *129*, *136*, *138*, 139, *142*, *144*, *146*, *148*, *151*, *153*, *156*, *157*, *159*, *162*, *164*, *166*, *168*, *170*, *172*, *175*, *178*, *180*, *182*, *183*, *186*, *187*, *189*, *191*, *193*, *196*, *198*, *200*, *202*, *204*, *207*, *209*, *213*, *215*, *217*, *220*, *222–224*, *227*, *229*, *237*, *241*, *243*, *247*, *250*, *254*, *255*, *258*

mlr_pipeops_missind, *39*, *42*, *44*, *46*, *48*, *50*, *53*, *56*, *58*, *61*, *63*, *66*, *68*, *70*, *74*, *76*, *80*, *82*, *85*, *87*, *90*, *92*, *96*, *98*, *100*, *103*, *105*, *107*, *109*, *112*, *113*, *115*, *118*, *120*, *122*, *125*, *127*, *129*, *136*, *138*, *140*, 141, *144*, *146*, *148*, *151*, *153*, *156*, *157*, *159*, *162*, *164*, *166*, *168*, *170*, *172*, *175*, *178*, *180*, *182*, *183*, *186*, *187*, *189*, *191*, *193*, *196*,

198, *200*, *202*, *204*, *207*, *209*, *213*, *215*, *217*, *220*, *222*, *224*, *227*, *229*, *237*, *241*, *243*, *247*, *250*, *255*, *258*

mlr_pipeops_modelmatrix, *39*, *42*, *44*, *46*, *48*, *50*, *53*, *56*, *58*, *61*, *63*, *66*, *68*, *70*, *74*, *76*, *80*, *82*, *85*, *87*, *90*, *92*, *96*, *98*, *100*, *103*, *105*, *107*, *109*, *112*, *113*, *115*, *118*, *120*, *122*, *125*, *127*, *129*, *136*, *138*, *140*, *142*, 143, *146*, *148*, *151*, *153*, *156*, *157*, *159*, *162*, *164*, *166*, *168*, *170*, *172*, *175*, *178*, *180*, *182*, *183*, *186*, *187*, *189*, *191*, *193*, *196*, *198*, *200*, *202*, *204*, *207*, *209*, *213*, *215*, *217*, *220*, *222*, *224*, *227*, *229*, *237*, *241*, *243*, *247*, *250*, *255*, *258*

mlr_pipeops_multiplicityexply, *39*, *42*, *44*, *46*, *48*, *50*, *53*, *56*, *58*, *61*, *63*, *66*, *68*, *70*, *74*, *76*, *80*, *82*, *85*, *87*, *90*, *92*, *93*, *96*, *98*, *100*, *103*, *105*, *107*, *109*, *112*, *113*, *115*, *118*, *120*, *122*, *125*, *127*, *129*, *136*, *138*, *140*, *142*, *144*, 145, *148*, *149*, *151*, *153*, *156*, *157*, *159*, *160*, *162*, *164*, *166*, *168*, *170*, *172*, *175*, *176*, *178*, *180*, *182*, *183*, *186*, *187*, *189*, *191*, *193*, *196*, *198*, *200*, *202*, *204*, *207*, *209*, *213*, *215*, *217*, *220*, *222*, *224*, *227*, *229*, *231*, *237*, *241*, *243*, *247*, *250*, *255*, *258*

mlr_pipeops_multiplicityimply, *39*, *42*, *44*, *46*, *48*, *50*, *53*, *56*, *58*, *61*, *63*, *66*, *68*, *70*, *74*, *77*, *80*, *82*, *85*, *87*, *90*, *92*, *93*, *96*, *98*, *100*, *103*, *105*, *107*, *109*, *112*, *113*, *115*, *118*, *120*, *122*, *125*, *127*, *129*, *136*, *138*, *140*, *142*, *144*, *146*, *147*, 147, *151*, *153*, *156*, *157*, *159*, *160*, *162*, *164*, *166*, *168*, *170*, *172*, *175*, *176*, *178*, *180*, *182*, *183*, *186*, *187*, *189*, *191*, *193*, *196*, *198*, *200*, *202*, *204*, *207*, *209*, *213*, *215*, *217*, *220*, *222*, *224*, *227*, *229*, *231*, *237*, *241*, *243*, *247*, *250*, *255*, *258*

mlr_pipeops_mutate, *39*, *42*, *44*, *46*, *48*, *50*, *53*, *56*, *58*, *61*, *63*, *66*, *68*, *70*, *74*, *77*, *80*, *82*, *85*, *87*, *90*, *92*, *96*, *98*, *100*, *103*, *105*, *107*, *109*, *112*, *113*, *115*, *118*, *120*, *122*, *125*, *127*, *129*, *136*, *138*, *140*, *142*, *144*, *146*, *148*, 149, *153*, *156*, *157*, *159*, *162*, *164*, *166*, *168*, *170*, *172*, *175*, *178*, *180*, *182*, *183*, *186*, *187*, *189*, *191*, *193*, *196*, *198*, *200*, *202*, *204*, *207*, *209*, *213*, *215*, *217*, *220*, *222*, *224*, *227*, *229*, *237*, *241*, *243*, *247*, *250*, *255*, *258*

mlr_pipeops_nearmiss, *39*, *42*, *44*, *46*, *48*, *50*, *53*, *56*, *58*, *61*, *63*, *66*, *68*, *70*, *74*, *77*, *80*, *82*, *85*, *87*, *90*, *92*, *96*, *98*, *100*, *103*, *105*, *107*, *109*, *112*, *113*, *115*, *118*, *120*, *122*, *125*, *127*, *129*, *136*, *138*, *140*, *142*, *144*, *146*, *148*, *151*, 151, *156*, *157*, *159*, *162*, *164*, *166*, *168*, *170*, *172*, *176*, *178*, *180*, *182*, *183*, *186*, *187*, *189*, *191*, *193*, *196*, *198*, *200*, *202*, *204*, *207*, *209*, *213*, *215*, *217*, *220*, *222*, *224*, *227*, *229*, *237*, *241*, *243*, *247*, *250*, *255*, *258*

mlr_pipeops_nmf, *39*, *42*, *44*, *46*, *48*, *50*, *53*, *56*, *58*, *61*, *63*, *66*, *68*, *70*, *74*, *77*, *80*, *82*, *85*, *87*, *90*, *92*, *96*, *98*, *100*, *103*, *105*, *107*, *109*, *112*, *113*, *115*, *118*, *120*, *122*, *125*, *127*, *129*, *136*, *138*, *140*, *142*, *144*, *146*, *148*, *151*, *153*, 153, *157*, *159*, *162*, *164*, *166*, *168*, *170*, *172*, *176*, *178*, *180*, *182*, *183*, *186*, *187*, *189*, *191*, *193*, *196*, *198*, *200*, *202*, *204*, *207*, *209*, *213*, *215*, *217*, *220*, *222*, *224*, *227*, *229*, *237*, *241*, *243*, *247*, *250*, *255*, *258*

mlr_pipeops_nop, *39*, *42*, *44*, *46*, *48*, *50*, *53*, *56*, *58*, *61*, *63*, *66*, *68*, *70*, *71*, *74*, *77*, *80*, *82*, *85*, *87*, *90*, *92*, *96*, *98*, *100*, *103*, *105*, *107*, *109*, *112*, *113*, *115*, *118*, *120*, *123*, *125*, *127*, *129*, *136*, *138*, *140*, *142*, *144*, *146*, *148*, *151*, *153*, *156*, 156, *159*, *162*, *164*, *166*, *168*, *170*, *172*, *176*, *178*, *180*, *182*, *183*, *186*, *187*, *189*, *191*, *193*, *196*, *198*, *200*, *202*, *204*, *207*, *209*, *213*, *215*, *217*, *220*, *222*, *224*, *227*, *229*, *237*, *241*, *243*, *247*, *250*, *255*, *258*

mlr_pipeops_ovrsplit, *39*, *42*, *44*, *46*, *48*, *50*, *53*, *56*, *58*, *61*, *63*, *66*, *68*, *70*, *74*, *77*, *80*, *82*, *85*, *87*, *90*, *92*, *93*, *96*, *98*, *100*, *103*, *105*, *107*, *109*, *112*, *113*, *115*, *118*, *120*, *123*, *125*, *127*, *129*,

136, *138*, *140*, *142*, *144*, *146–149*, *151*, *153*, *156*, *157*, 158, *162*, *164*, *166*, *168*, *170*, *172*, *176*, *178*, *180*, *182*, *183*, *186*, *187*, *189*, *191*, *193*, *196*, *198*, *200*, *202*, *204*, *207*, *209*, *213*, *215*, *217*, *220*, *222*, *224*, *227*, *229*, *231*, *237*, *241*, *243*, *247*, *250*, *255*, *258*

mlr_pipeops_ovrunite, *33*, *39*, *42*, *44*, *46*, *48*, *50*, *53*, *56*, *58*, *61*, *63*, *66*, *68*, *70*, *74*, *77*, *80*, *82*, *85*, *87*, *90*, *92*, *93*, *96*, *98*, *100*, *103*, *105*, *107*, *109*, *112*, *113*, *115*, *118*, *120*, *123*, *125*, *127*, *129*, *136*, *138*, *140*, *142*, *144*, *146–149*, *151*, *153*, *156*, *157*, *159*, *160*, 160, *164*, *166*, *168*, *170*, *172*, *176*, *178*, *180*, *182*, *183*, *186*, *187*, *189*, *191*, *193*, *196*, *198*, *200*, *202*, *204*, *207*, *209*, *213*, *215*, *217*, *220*, *222*, *224*, *227*, *229*, *231*, *237*, *241*, *243*, *247*, *250*, *255*, *258*

mlr_pipeops_pca, *40*, *42*, *44*, *46*, *48*, *50*, *53*, *56*, *58*, *61*, *63*, *66*, *68*, *70*, *74*, *77*, *80*, *82*, *85*, *87*, *90*, *92*, *96*, *98*, *100*, *103*, *105*, *107*, *109*, *112*, *113*, *115*, *118*, *120*, *123*, *125*, *127*, *129*, *136*, *138*, *140*, *142*, *144*, *146*, *148*, *151*, *153*, *156*, *157*, *159*, *162*, 162, *166*, *168*, *170*, *172*, *176*, *178*, *180*, *182*, *184*, *186*, *187*, *189*, *191*, *193*, *196*, *198*, *200*, *202*, *204*, *207*, *209*, *213*, *215*, *217*, *220*, *222*, *224*, *227*, *229*, *237*, *241*, *243*, *247*, *250*, *255*, *258*

mlr_pipeops_proxy, *40*, *42*, *44*, *46*, *48*, *50*, *53*, *56*, *58*, *61*, *63*, *66*, *68*, *70*, *74*, *77*, *80*, *82*, *85*, *87*, *90*, *92*, *96*, *98*, *100*, *103*, *105*, *107*, *109*, *112*, *113*, *115*, *118*, *120*, *123*, *125*, *127*, *129*, *136*, *138*, *140*, *142*, *144*, *146*, *148*, *151*, *153*, *156*, *157*, *160*, *162*, *164*, 164, *168*, *170*, *172*, *176*, *178*, *180*, *182*, *184*, *186*, *187*, *189*, *191*, *193*, *196*, *198*, *200*, *202*, *204*, *207*, *209*, *213*, *215*, *217*, *220*, *222*, *224*, *227*, *229*, *237*, *241*, *243*, *247*, *250*, *255*, *258*

mlr_pipeops_quantilebin, *40*, *42*, *44*, *46*, *48*, *50*, *53*, *56*, *58*, *61*, *63*, *66*, *68*, *70*, *74*, *77*, *80*, *82*, *85*, *87*, *90*, *93*, *96*, *98*, *100*, *103*, *105*, *107*, *109*, *112*, *114*, *116*, *118*, *120*, *123*, *125*, *127*, *129*, *136*, *138*, *140*, *142*, *144*, *146*, *148*, *151*, *153*, *156*, *157*, *160*, *162*, *164*, *166*, 167, *170*, *172*, *176*, *178*, *180*, *182*, *184*, *186*, *187*, *189*, *191*, *193*, *196*, *198*, *200*, *202*, *204*, *207*, *209*, *213*, *215*, *217*, *220*, *222*, *224*, *227*, *229*, *237*, *241*, *243*, *247*, *250*, *255*, *258*

mlr_pipeops_randomprojection, *40*, *42*, *44*, *46*, *48*, *50*, *53*, *56*, *58*, *61*, *63*, *66*, *68*, *70*, *74*, *77*, *80*, *82*, *85*, *87*, *90*, *93*, *96*, *98*, *100*, *103*, *105*, *107*, *109*, *112*, *114*, *116*, *118*, *120*, *123*, *125*, *127*, *129*, *136*, *138*, *140*, *142*, *144*, *146*, *148*, *151*, *153*, *156*, *157*, *160*, *162*, *164*, *166*, *168*, 168, *172*, *176*, *178*, *180*, *182*, *184*, *186*, *187*, *189*, *191*, *193*, *196*, *198*, *200*, *202*, *204*, *207*, *209*, *213*, *215*, *217*, *220*, *222*, *224*, *227*, *229*, *237*, *241*, *243*, *247*, *250*, *255*, *258*

mlr_pipeops_randomresponse, *40*, *42*, *44*, *46*, *48*, *50*, *53*, *56*, *58*, *61*, *63*, *66*, *68*, *70*, *74*, *77*, *80*, *82*, *85*, *87*, *90*, *93*, *96*, *98*, *100*, *103*, *105*, *107*, *109*, *112*, *114*, *116*, *118*, *120*, *123*, *125*, *127*, *129*, *136*, *138*, *140*, *142*, *144*, *146*, *148*, *151*, *153*, *156*, *157*, *160*, *162*, *164*, *166*, *168*, *170*, 170, *176*, *178*, *180*, *182*, *184*, *186*, *187*, *189*, *191*, *194*, *196*, *198*, *200*, *202*, *204*, *207*, *209*, *213*, *215*, *217*, *220*, *222*, *224*, *227*, *229*, *237*, *241*, *243*, *247*, *250*, *255*, *258*

mlr_pipeops_regravg, *33*, *40*, *42*, *44*, *46*, *48*, *50*, *53*, *56*, *59*, *61*, *63*, *66*, *68*, *70*, *74*, *77*, *80*, *82*, *85*, *87*, *90*, *93*, *96*, *98*, *100*, *103*, *105*, *107*, *109*, *112*, *114*, *116*, *118*, *120*, *123*, *125*, *127*, *129*, *136*, *138*, *140*, *142*, *144*, *146–149*, *151*, *153*, *156*, *157*, *160*, *162*, *164*, *166*, *168*, *170*, *172*, 173, *178*, *180*, *182*, *184*, *186*, *187*, *189*, *191*, *194*, *196*, *198*, *200*, *202*, *204*, *207*, *209*, *213*, *215*, *217*, *220*, *222*, *224*, *227*, *229*, *231*, *237*, *241*, *243*, *247*, *250*,

255, *258*

mlr_pipeops_removeconstants, *40*, *42*, *44*, *46*, *48*, *50*, *53*, *56*, *59*, *61*, *63*, *66*, *68*, *70*, *74*, *77*, *80*, *82*, *85*, *87*, *90*, *93*, *96*, *98*, *100*, *103*, *105*, *107*, *109*, *112*, *114*, *116*, *118*, *120*, *123*, *125*, *127*, *129*, *136*, *138*, *140*, *142*, *144*, *146*, *148*, *151*, *153*, *156, 157*, *160*, *162*, *164*, *166*, *168*, *170*, *172*, *176*, 176, *180*, *182*, *184*, *186, 187*, *189*, *191*, *194*, *196*, *198*, *200*, *202*, *204*, *207*, *209*, *213*, *215*, *217*, *220*, *222*, *224*, *227*, *229*, *237*, *241*, *243*, *247*, *250*, *255*, *258*

mlr_pipeops_renamecolumns, *40*, *42*, *44*, *46*, *48*, *50*, *53*, *56*, *59*, *61*, *63*, *66*, *68*, *70*, *74*, *77*, *80*, *82*, *85*, *87*, *90*, *93*, *96*, *98*, *100*, *103*, *105*, *107*, *109*, *112*, *114*, *116*, *118*, *120*, *123*, *125*, *127*, *129*, *136*, *138*, *140*, *142*, *144*, *146*, *148*, *151*, *153*, *156, 157*, *160*, *162*, *164*, *166*, *168*, *170*, *172*, *176*, *178*, 178, *182*, *184*, *186, 187*, *189*, *191*, *194*, *196*, *198*, *200*, *202*, *204*, *207*, *209*, *213*, *215*, *217*, *220*, *222*, *224*, *227*, *229*, *237*, *241*, *243*, *247*, *250*, *255*, *258*

mlr_pipeops_replicate, *40*, *42*, *44*, *46*, *48*, *50*, *53*, *56*, *59*, *61*, *63*, *66*, *68*, *70*, *74*, *77*, *80*, *82*, *85*, *87*, *90*, *93*, *96*, *98*, *100*, *103*, *105*, *107*, *109*, *112*, *114*, *116*, *118*, *120*, *123*, *125*, *127*, *129*, *136*, *138*, *140*, *142*, *144*, *146–149*, *151*, *153*, *156, 157*, *160*, *162*, *164*, *166*, *168*, *170*, *172*, *176*, *178*, *180*, 180, *184*, *186*, *188, 189*, *191*, *194*, *196*, *198*, *200*, *202*, *204*, *207*, *209*, *213*, *215*, *217*, *220*, *222*, *224*, *227*, *229*, *231*, *237*, *241*, *243*, *247*, *250*, *255*, *258*

mlr_pipeops_rowapply, *40*, *42*, *44*, *46*, *48*, *50*, *53*, *56*, *59*, *61*, *63*, *66*, *68*, *70*, *74*, *77*, *80*, *82*, *85*, *87*, *90*, *93*, *96*, *98*, *100*, *103*, *105*, *107*, *109*, *112*, *114*, *116*, *118*, *120*, *123*, *125*, *127*, *130*, *136*, *138*, *140*, *142*, *144*, *146*, *149*, *151*, *153*, *156, 157*, *160*, *162*, *164*, *166*, *168*, *170*, *172*, *176*, *178*, *180*, *182*, 182, *186*, *188, 189*, *191*, *194*, *196*, *198*, *200*, *202*, *204*, *207*, *209*, *213*, *215*, *217*, *220*, *222*, *224*, *227*, *229*, *237*, *241*, *243*, *247*, *250*, *255*, *258*

mlr_pipeops_scale, *40*, *42*, *44*, *46*, *48*, *50*, *53*, *56*, *59*, *61*, *63*, *66*, *68*, *70*, *74*, *77*, *80*, *82*, *85*, *87*, *90*, *93*, *96*, *98*, *100*, *103*, *105*, *107*, *109*, *112*, *114*, *116*, *118*, *120*, *123*, *125*, *127*, *130*, *136*, *138*, *140*, *142*, *144*, *146*, *149*, *151*, *153*, *156, 157*, *160*, *162*, *164*, *166*, *168*, *170*, *172*, *176*, *178*, *180*, *182*, *184*, 184, *188, 189*, *191*, *194*, *196*, *198*, *200*, *202*, *204*, *207*, *209*, *213*, *215*, *217*, *220*, *222*, *224*, *227*, *229*, *237*, *241*, *243*, *247*, *250*, *255*, *258*

mlr_pipeops_scalemaxabs, *40*, *42*, *44*, *46*, *48*, *50*, *53*, *56*, *59*, *61*, *63*, *66*, *68*, *70*, *74*, *77*, *80*, *82*, *85*, *87*, *90*, *93*, *96*, *98*, *100*, *103*, *105*, *107*, *109*, *112*, *114*, *116*, *118*, *120*, *123*, *125*, *127*, *130*, *136*, *138*, *140*, *142*, *144*, *146*, *149*, *151*, *153*, *156, 157*, *160*, *162*, *164*, *166*, *168*, *170*, *172*, *176*, *178*, *180*, *182*, *184*, *186*, 186, *189*, *191*, *194*, *196*, *198*, *200*, *202*, *204*, *207*, *209*, *213*, *215*, *217*, *220*, *222*, *224*, *227*, *229*, *237*, *241*, *243*, *247*, *250*, *255*, *258*

mlr_pipeops_scalerange, *40*, *42*, *44*, *46*, *48*, *50*, *53*, *56*, *59*, *61*, *63*, *66*, *68*, *70*, *74*, *77*, *80*, *82*, *85*, *87*, *90*, *93*, *96*, *98*, *100*, *103*, *105*, *107*, *109*, *112*, *114*, *116*, *118*, *120*, *123*, *125*, *127*, *130*, *136*, *138*, *140*, *142*, *144*, *146*, *149*, *151*, *153*, *156, 157*, *160*, *162*, *164*, *166*, *168*, *170*, *172*, *176*, *178*, *180*, *182*, *184*, *186*, *188*, 188, *191*, *194*, *196*, *198*, *200*, *202*, *204*, *207*, *209*, *214, 215*, *217*, *220*, *222*, *224*, *227*, *229*, *237*, *241*, *243*, *247*, *250*, *255*, *258*

mlr_pipeops_select, *40*, *42*, *44*, *46*, *49, 50*, *53*, *56*, *59*, *61*, *63*, *66*, *68*, *70*, *74*, *77*, *80*, *82*, *85*, *87*, *90*, *93*, *96*, *98*, *100*, *103*, *105*, *107*, *109*, *112*, *114*, *116*, *118*, *121*, *123*, *125*, *127*, *130*, *136*,

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