Package ‘pipeliner’

October 14, 2022

Type Package
Version 0.1.1
Title Machine Learning Pipelines for R
Date 2016-12-16
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Description A framework for defining ‘pipelines’ of functions for applying data transformations, model estimation and inverse-transformations, resulting in predicted value generation (or model-scoring) functions that automatically apply the entire pipeline of functions required to go from input to predicted output.
License Apache License 2.0
URL https://github.com/alexioannides/pipeliner
BugReports https://github.com/alexioannides/pipeliner/issues
LazyData TRUE
Suggests knitr, testthat, rmarkdown, modelr, tidyverse
VignetteBuilder knitr
RoxygenNote 5.0.1
NeedsCompilation no
Repository CRAN
Date/Publication 2016-12-19 15:56:03

R topics documented:

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Faster alternative to cbind_fast

Description

This is not as 'safe' as using cbind_fast - for example, if df1 has columns with the same name as columns in df2, then they will be over-written.

Usage

`cbind_fast(df1, df2)`

Arguments

df1
A data.frame.
df2
Another data.frame

Value

A data.frame equal to df1 with the columns of df2 appended.

Examples

```r
# Not run:
df1 <- data.frame(x = 1:5, y = 1:5 * 0.1)
df2 <- data.frame(a = 6:10, b = 6:10 * 0.25)
df3 <- cbind_fast(df1, df2)
df3
# x  y  a  b
# 1 1 0.1 6 1.50
# 2 2 0.2 7 1.75
# 3 3 0.3 8 2.00
# 4 4 0.4 9 2.25
# 5 5 0.5 10 2.50
```

```
# End(Not run)
```
check_data_frame_throw_error

Validate `ml_pipeline_builder` transform method returns data.frame

Description

Helper function that checks if the object returned from a `ml_pipeline_builder` method is data.frame (if it isn’t NULL), and if it isn’t, throws an error that is customised with the returning name.

Usage

`check_data_frame_throw_error(func_return_object, func_name)`

Arguments

- `func_return_object`: The object returned from a `ml_pipeline_builder` method.
- `func_name`: The name of the function that returned the object.

Examples

```r
## Not run:
transform_method <- function(df) df
data <- data.frame(y = c(1, 2), x = c(0.1, 0.2))
data_transformed <- transform_method(data)
check_data_frame_throw_error(data_transformed, "transform_method")
# NULL
## End(Not run)
```

check_predict_method_throw_error

Validate `estimate_model` method returns an object with a `predict` method defined

Description

Helper function that checks if the object returned from the `estimate_model` method has a `predict` method defined for it.

Usage

`check_predict_method_throw_error(func_return_object)`
check_unary_func_throw_error

Arguments

func_return_object
The object returned from the estimate_model method.

Examples

## Not run:
estimation_method <- function(df) lm(eruptions ~ 0 + waiting, df)
data <- faithful
model_estimate <- estimation_method(data)
check_predict_method_throw_error(model_estimate)
# NULL

## End(Not run)

check_unary_func_throw_error

**Validate ml_pipeline_builder transform method is a unary function**

Description

Helper function that checks if a ml_pipeline_builder method is unary function (if it isn’t a NULL returning function), and if it isn’t, throws an error that is customised with the method function name.

Usage

check_unary_func_throw_error(func, func_name)

Arguments

func A ml_pipeline_builder method.
func_name The name of the ml_pipeline_builder method.

Examples

## Not run:
transform_method <- function(df) df
check_unary_func_throw_error(transform_method, "transform_method")
# NULL

## End(Not run)
estimate_model

Estimate machine learning model

Description

A function that takes as its argument another function defining how a machine learning model should be estimated based on the variables available in the input data frame. This function is wrapped (or adapted) for use within a machine learning pipeline.

Usage

estimate_model(.f)

Arguments

.f
A unary function of a data.frame that returns a fitted model object, which must have a predict.{model-class} defined and available in the enclosing environment. An error will be thrown if any of these criteria are not met.

Value

A unary function of a data.frame that returns a fitted model object that has a predict.{model-class} defined. This function is assigned the classes "estimate_model" and "ml_pipeline_section".

Examples

data <- head(faithful)
f <- estimate_model(function(df) {
  lm(eruptions ~ 1 + waiting, df)
})
f(data)
# Call:
# lm(formula = eruptions ~ 1 + waiting, data = df)
# Coefficients:
# (Intercept) waiting
# -1.53317 0.06756

func_error_handler

Custom error handler for printing the name of an enclosing function with error

Description

Custom error handler for printing the name of an enclosing function with error
inv_transform_response

Usage

func_error_handler(e, calling_func)

Arguments

e A simpleError - e.g. thrown from tryCatch
calling_func A character string naming the enclosing function (or closure) for printing with error messages

Value

NULL - throws error with custom message

Examples

## Not run:
f <- function(x) x ^ 2
tryCatch(f("a"), error = function(e) func_error_handler(e, "f"))
# Error in x^2 : non-numeric argument to binary operator
# --- called from within function: f

## End(Not run)

inv_transform_response

Inverse transform machine learning response variable

Description

A function that takes as its argument another function defining a inverse response variable transformation, and wraps (or adapts) it for use within a machine learning pipeline.

Usage

inv_transform_response(.f)

Arguments

.f A unary function of a data.frame that returns a new data.frame containing only the inverse transformed response variable. An error will be thrown if this is not the case.

Value

A unary function of a data.frame that returns the input data.frame with the inverse transformed response variable column appended. This function is assigned the classes "inv_transform_response" and "ml_pipeline_section".
Examples

data <- head(faithful)
f1 <- transform_response(function(df) {
  data.frame(y = (df$eruptions - mean(df$eruptions)) / sd(df$eruptions))
})
f2 <- inv_transform_response(function(df) {
  data.frame(eruptions2 = df$y * sd(df$eruptions) + mean(df$eruptions))
})
f2(f1(data))

# eruptions waiting y eruptions2
# 1  3.600   79  0.5412808  3.600
# 2  1.800   54 -1.3039946  1.800
# 3  3.333   74  0.2675649  3.333
# 4  2.283   62 -0.8088457  2.283
# 5  4.533   85  1.4977485  4.533
# 6  2.883   55 -0.1937539  2.883

Description

Building machine learning models often requires pre- and post-transformation of the input and/or response variables, prior to training (or fitting) the models. For example, a model may require training on the logarithm of the response and input variables. As a consequence, fitting and then generating predictions from these models requires repeated application of transformation and inverse-transformation functions, to go from the original input to original output variables (via the model).

Usage

ml_pipeline_builder()

Details

This function produces an object in which it is possible to: define transformation and inverse-transformation functions; fit a model on training data; and then generate a prediction (or model-scoring) function that automatically applies the entire pipeline of transformation and inverse-transformation to the inputs and outputs of the inner-model's predicted scores.

Calling ml_pipeline_builder() will return an 'ml_pipeline' object (actually an environment or closure), whose methods can be accessed as one would access any element of a list. For example, ml_pipeline_builder()$transform_features will allow you to get or set the transform_features function to use the pipeline. The full list of methods for defining sections of the pipeline (documented elsewhere) are:

• transform_features;
• transform_response;
• inv_transform_response; and,
• estimate_model;

The pipeline can be fit, prediction generated and the inner model accessed using the following methods:

• fit(.data);
• predict(.data); and,
• model_estimate().

Value

An object of class ml_pipeline.

See Also

transform_features, transform_response, estimate_model and inv_transform_response.

Examples

data <- faithful

lm_pipeline <- ml_pipeline_builder()

lm_pipeline$transform_features(function(df) {
    data.frame(x1 = (df$waiting - mean(df$waiting)) / sd(df$waiting))
})

lm_pipeline$transform_response(function(df) {
    data.frame(y = (df$eruptions - mean(df$eruptions)) / sd(df$eruptions))
})

lm_pipeline$inv_transform_response(function(df) {
    data.frame(pred_eruptions = df$pred_model * sd(df$eruptions) + mean(df$eruptions))
})

lm_pipeline$estimate_model(function(df) {
    lm(y ~ 0 + x1, df)
})

lm_pipeline$fit(data)

head(lm_pipeline$predict(data))
# eruptions waiting x1 pred_model pred_eruptions
# 1 3.600 79 0.5960248 0.5369058 4.100592
# 2 1.800 54 -1.2428901 -1.1196093 2.209893
# 3 3.333 74 0.2282418 0.2056028 3.722452
# 4 2.283 62 -0.6544374 -0.5895245 2.814917
# 5 4.533 85 1.0373644 0.9344694 4.554360
# 6 2.883 55 -1.1693335 -1.0533487 2.285521
Description

Building machine learning models often requires pre- and post-transformation of the input and/or response variables, prior to training (or fitting) the models. For example, a model may require training on the logarithm of the response and input variables. As a consequence, fitting and then generating predictions from these models requires repeated application of transformation and inverse-transformation functions, to go from the original input to original output variables (via the model).

Usage

\[
pipeline(.data, \ldots)
\]

Arguments

- `.data` A data.frame containing the input variables required to fit the pipeline.
- `\ldots` Functions of class "ml_pipeline_section" - e.g. `transform_features()`, `transform_response()`, `inv_transform_response()` or `estimate_model()`.

Details

This function that takes individual pipeline sections - functions with class "ml_pipeline_section" - together with the data required to estimate the inner models, returning a machine pipeline capable of predicting (scoring) data end-to-end, without having to repeatedly apply input variable (feature and response) transformation and their inverses.

Value

A "ml_pipeline" object containing the pipeline prediction function `ml_pipeline$predict()` and the estimated machine learning model nested within it `ml_pipeline$inner_model()`.

Examples

data <- faithful

lm_pipeline <-
pipeline(
  .data,  # A data.frame containing the input variables required to fit the pipeline.
  transform_features(function(df) {
    data.frame(x1 = (df$waiting - mean(df$waiting)) / sd(df$waiting))
  }),
  transform_response(function(df) {
    data.frame(y = (df$eruptions - mean(df$eruptions)) / sd(df$eruptions))
  })
)
estimate_model(function(df) {
  lm(y ~ 1 + x1, df)
}),

inv_transform_response(function(df) {
  data.frame(pred_eruptions = df$pred_model * sd(df$eruptions) + mean(df$eruptions))
})

pipeliner  

Description

 Allows you to define, fit and predict machine learning pipelines.

predict.ml_pipeline  

Description

Predict method for ML pipelines

Usage

## S3 method for class 'ml_pipeline'
predict(object, data, verbose = FALSE, 
         pred_var = "pred_model", ...)

Arguments

object  An estimated pipeline object of class ml_pipeline.
data  A data.frame in which to look for input variables with which to predict.
verbose  Boolean - whether or not to return data.frame with all input and interim variables as well as predictions.
pred_var  Name to assign to for column of predictions from the 'raw' (or inner) model in the pipeline.
...  Any additional arguements than need to be passed to the underlying model’s predict methods.

Value

A vector of model predictions or scores (default); or, a data.frame containing the predicted values, input variables, as well as any interim tranformed variables.
**Examples**

```r
data <- faithful

lm_pipeline <-
  pipeline(
    data,
    estimate_model(function(df) {
      lm(eruptions ~ 1 + waiting, df)
    })
  )

in_sample_predictions <- predict(lm_pipeline, data)
head(in_sample_predictions)
# [1] 4.100592 2.209893 3.722452 2.814917 4.554360 2.285521
```

---

**predict_model**  
*Generate machine learning model prediction*

**Description**

A helper function that takes as its argument an estimated machine learning model and returns a prediction function for use within a machine learning pipeline.

**Usage**

`predict_model(.m)`

**Arguments**

- `.m` An estimated machine learning model.

**Value**

A unary function of a data.frame that returns the input data.frame with the predicted response variable column appended. This function is assigned the classes "predict_model" and "ml_pipeline_section".

**Examples**

```r
## Not run:
data <- head(faithful)
m <- estimate_model(function(df) {
  lm(eruptions ~ 1 + waiting, df)
})
predict_model(m(data))(data, "pred_eruptions")
# eruptions waiting pred_eruptions
# 1 3.600 79 3.803874
# 2 1.800 54 2.114934
# 3 3.333 74 3.466086
```
process_transform_throw_error

Validate and clean transform function output

Description
Helper function that ensures the output of applying a transform function is a data.frame and that this data frame does not duplicate variables from the original (input data) data frame. If duplicates are found they are automatically dropped from the data.frame that is returned by this function.

Usage
process_transform_throw_error(input_df, output_df, func_name)

Arguments
input_df The original (input data) data.frame - the transform function’s argument.
output_df The the transform function’s output.
func_name The name of the ml_pipeline_builder transform method.

Value
If the transform function is not NULL then a copy of the transform function’s output data.frame, with any duplicated inputs removed.

Examples
## Not run:
transform_method <- function(df) cbind_fast(df, q = df$y * df$y)
data <- data.frame(y = c(1, 2), x = c(0.1, 0.2))
data_transformed <- transform_method(data)
process_transform_throw_error(data, data_transformed, "transform_method")
# transform_method yields data.frame that duplicates input vars - dropping the following columns: 'y', 'x'
# q
# 1 1
# 2 4
## End(Not run)
transform_features  Transform machine learning feature variables

Description
A function that takes as its argument another function defining a set of feature variable transformations, and wraps (or adapts) it for use within a machine learning pipeline.

Usage
transform_features(.f)

Arguments
.f A unary function of a data.frame that returns a new data.frame containing only the transformed feature variables. An error will be thrown if this is not the case.

Value
A unary function of a data.frame that returns the input data.frame with the transformed feature variable columns appended. This function is assigned the classes "transform_features" and "ml_pipeline_section".

Examples
data <- head(faithful)
f <- transform_features(function(df) {
  data.frame(x1 = (df$waiting - mean(df$waiting)) / sd(df$waiting))
})
f(data)
# eruptions waiting x1
# 1 3.600 79 0.8324308
# 2 1.800 54 -1.0885633
# 3 3.333 74 0.4482320
# 4 2.283 62 -0.4738452
# 5 4.533 85 1.2934694
# 6 2.883 55 -1.0117236

transform_response  Transform machine learning response variable

Description
A function that takes as its argument another function defining a response variable transformation, and wraps (or adapts) it for use within a machine learning pipeline.
Usage

```
transform_response(.f)
```

Arguments

- `.f` A unary function of a data.frame that returns a new data.frame containing only the transformed response variable. An error will be thrown if this is not the case.

Value

A unary function of a data.frame that returns the input data.frame with the transformed response variable column appended. This function is assigned the classes "transform_response" and "ml_pipeline_section".

Examples

```r
data <- head(faithful)
f <- transform_response(function(df) {
  data.frame(y = (df$eruptions - mean(df$eruptions)) / sd(df$eruptions))
})
f(data)
```

```
# eruptions waiting y
# 1 3.600 79 0.5412808
# 2 1.800 54 -1.3039946
# 3 3.333 74 0.2675649
# 4 2.283 62 -0.8088457
# 5 4.533 85 1.4977485
# 6 2.883 55 -0.1937539
```

---

**try_pipeline_func_call**

*Custom tryCatch configuration for pipeline segment segment functions*

---

Description

Custom tryCatch configuration for pipeline segment segment functions

Usage

```
try_pipeline_func_call(.f, arg, func_name)
```

Arguments

- `.f` Pipeline segment function
- `arg` Argument of `.f`
- `func_name` (Character string).
**try_pipeline_func_call**

**Value**

Returns the same object as .f does (a data.frame or model object), unless an error is thrown.

**Examples**

```r
## Not run:
data <- data.frame(x = 1:3, y = 1:3 / 10)
f <- function(df) data.frame(p = df$x ^ 2, q = df$wrong)
try_pipeline_func_call(f, data, "f")
# Error in data.frame(p = df$x^2, q = df$wrong) :
#   arguments imply differing number of rows: 3, 0
# --> called from within function: f

## End(Not run)
```
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