Package ‘corrgrapher’

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Type Package

Title Explore Correlations Between Variables in a Machine Learning Model

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Description When exploring data or models we often examine variables one by one. This analysis is incomplete if the relationship between these variables is not taken into account. The 'corrgrapher' package facilitates simultaneous exploration of the Partial Dependence Profiles and the correlation between variables in the model. The package 'corrgrapher' is a part of the 'DrWhy.AI' universe.

License GPL (>= 2)

Depends R (>= 3.5.0)

Imports visNetwork, DALEX, ingredients, htmltools, jsonlite, ggplot2, knitr

Suggests rmarkdown, testthat, gbm, ranger, spelling, covr

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BugReports https://github.com/ModelOriented/corrgrapher/issues

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**Description**

Calculate correlation coefficients between variables in a `data.frame`, `matrix` or `table` using 3 different functions for 3 different possible pairs of variables:

- numeric - numeric
- numeric - categorical
- categorical - categorical

**Usage**

```r
calculate_cors(
  x,
  num_num_f = NULL,
  num_cat_f = NULL,
  cat_cat_f = NULL,
  max_cor = NULL
)
```

```r
## S3 method for class 'explainer'
calculate_cors(
  x,
  num_num_f = NULL,
  num_cat_f = NULL,
  cat_cat_f = NULL,
  max_cor = NULL
)
```

```r
## S3 method for class 'matrix'
calculate_cors(
  x,
  num_num_f = NULL,
  num_cat_f = NULL,
  cat_cat_f = NULL,
)
```
calculate_cors

max_cor = NULL

## S3 method for class 'table'
calculate_cors(
  x,
  num_num_f = NULL,
  num_cat_f = NULL,
  cat_cat_f = NULL,
  max_cor = NULL
)

## Default S3 method:
calculate_cors(
  x,
  num_num_f = NULL,
  num_cat_f = NULL,
  cat_cat_f = NULL,
  max_cor = NULL
)

Arguments

x
object used to select method. See more below.

num_num_f
A function used to determine correlation coefficient between a pair of numeric variables

num_cat_f
A function used to determine correlation coefficient between a pair of numeric and categorical variable

cat_cat_f
A function used to determine correlation coefficient between a pair of categorical variables

max_cor
A number used to indicate absolute correlation (like 1 in cor). Must be supplied if any of*_f arguments is supplied.

Value

A symmetrical matrix A of size n x n, where n - amount of columns in x (or dimensions for table). The value at A(i,j) is the correlation coefficient between ith and jth variable. On the diagonal, values from max_cor are set.

X argument

When x is a data.frame, all columns of numeric type are treated as numeric variables and all columns of factor type are treated as categorical variables. Columns of other types are ignored.

When x is a matrix, it is converted to data.frame using as.data.frame.matrix.

When x is an explainer, the tests are performed on its data element.

When x is a table, it is treated as contingency table. Its dimensions must be named, but none of them may be named Frequency.
Default functions

By default, the function calculates p-value of statistical tests (\texttt{cor.test} for 2 numeric, \texttt{chisq.test} for factor and \texttt{kruskal.test} for mixed).

Then, the correlation coefficients are calculated as $-\log_{10}(p\text{-value})$. Any results above 100 are treated as absolute correlation and cut to 100.

The results are then divided by 100 to fit inside $[0,1]$.

If only numeric data was supplied, the function used is \texttt{cor.test}.

Custom functions

Creating consistent measures for correlation coefficients, which are comparable for different kinds of variables, is a non-trivial task. Therefore, if user wishes to use custom function for calculating correlation coefficients, he must provide all necessary functions. Using a custom function for one case and a default for the other is consciously not supported. Naturally, user may supply copies of default functions at his own responsibility.

Function \texttt{calculate_cors} chooses, which parameters of \_f are required based on data supported. For example, for a matrix with numeric data only \texttt{num_num_f} is required. On the other hand, for a table only \texttt{cat_cat_f} is required.

All \_f parameters must be functions, which accept 2 parameters (numeric or factor vectors respectively) and return a single number from $[0,max\_num]$. The \texttt{num_cat_f} must accept numeric argument as first and factor argument as second.

See Also

\texttt{cor.test, chisq.test, kruskal.test}

Examples

```r
data(mtcars)
# Make sure, that categorical variables are factors
mtcars$vs <- factor(mtcars$vs, labels = c('V-shaped', 'straight'))
mtcars$am <- factor(mtcars$am, labels = c('automatic', 'manual'))
calculate_cors(mtcars)

# For a table:
data(HairEyeColor)
calculate_cors(HairEyeColor)

# Custom functions:
num_mtcars <- mtcars[, -which(colnames(mtcars) %in% c('vs', 'am'))]
my_f <- function(x, y) cor.test(x, y, method = 'spearman', exact=FALSE)$estimate
calculate_cors(num_mtcars, num_num_f = my_f, max_cor = 1)
```
Description
This is the main function of corrgrapher package. It does necessary calculations and creates a corrgrapher object. Feel free to pass it into plot, include it in knitr report or generate a simple HTML.

Usage

corrgrapher(x, ...)

## S3 method for class 'explainer'
corrgrapher(  
x,  
cutoff = 0.2,  
values = NULL,  
cor_functions = list(),  
...,  
feature_importance = NULL,  
partial_dependence = NULL)

## S3 method for class 'matrix'
corrgrapher(x, cutoff = 0.2, values = NULL, cor_functions = list(), ...)

## Default S3 method:  
corrgrapher(x, cutoff = 0.2, values = NULL, cor_functions = list(), ...)

Arguments

x an object to be used to select the method, which must satisfy conditions:
  • if data.frame (default), columns of numeric type must contain numerical variables and columns of factor class must contain categorical variables. Columns of other types will be ignored.
  • if explainer, methods feature_importance and partial_dependence must not return an error. See also arguments feature_importance and partial_dependence.
  • if matrix, it will be converted with as.data.frame.

... other arguments.
cutoff a number. Correlations below this are treated as no correlation. Edges corresponding to them will not be included in the graph.
values a data.frame with information about size of the nodes, containing columns value and label (consistent with colnames of x). Default set to equal for all nodes, or (for explainer) importance of variables.
corrgrapher

`cor_functions` a named list of functions to pass to `calculate_cors`. Must contain necessary functions from `num_num_f`, `num_cat_f` or `cat_cat_f`. Must contain also `max_cor`

`feature_importance` Either:
- an object of `feature_importance_explainer` class, created by `feature_importance` function, or
- a named list of parameters to pass to `feature_importance` function.

`partial_dependence` a named list with 2 elements: numerical and categorical. Both of them should be either:
- an object of `aggregated_profile_explainer` class, created by `partial_dependence` function, or
- a named list of parameters to pass to `partial_dependence`.

If only one kind of data was used, use a list with 1 object.

Details

Data analysis (and creating ML models) involves many stages. For early exploration, it is useful to have a grip not only on individual series (AKA variables) available, but also on relations between them. Unfortunately, the task of understanding correlations between variables proves to be difficult. `corrgrapher` package aims to plot correlations between variables in form of a graph. Each node on it is associated with single variable. Variables correlated with each other (positively and negatively alike) shall be close, and weakly correlated - far from each other.

Value

A `corrgrapher` object. Essentially a list, consisting of following fields:

- `nodes` - a `data.frame` to pass as argument `nodes` to `visNetwork` function
- `edges` - a `data.frame` to pass as argument `edges` to `visNetwork` function
- `pds` (if `x` was of `explainer` class) - a list with 2 elements: numerical and categorical. Each of them contains an object of `aggregated_profiles_explainer` used to create partial dependency plots.
- `data` - data used to create the object.

See Also

`plot.corrgrapher`, `knit_print.corrgrapher`, `save_to_html`

Examples

```r
# convert the category variable
df <- as.data.frame(datasets::Seatbelts)
df$law <- factor(df$law)
cgr <- corrgrapher(df)
```
**knit_print.corrgrapher**

**Knitr S3 method**

**Description**

This method allows corrgrapher objects to be displayed nicely in knitr/rmarkdown documents.

**Usage**

```r
## S3 method for class 'corrgrapher'
knit_print(x, ...)
```

**Arguments**

- `x` An object of corrgrapher class. See `corrgrapher` function.
- `...` Other parameters, passed directly to `knit_print.shiny.tag`

**Value**

2 objects will be displayed: graph of correlations on the left and a plot on the right. If `x` was created from explainer, the plot will visualize partial dependency of the currently selected variable. In other case, the plot will visualize distribution of the variable.

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**plot.corrgrapher**

**Visualize correlations in a corrgrapher object**

**Description**

Visualize correlations between variables, using previously created corrgrapher object.

**Usage**

```r
## S3 method for class 'corrgrapher'
plot(x, ...)
```

**Arguments**

- `x` a corrgrapher object. See `corrgrapher`.
- `...` other parameters, passed directly to `visNetwork` function (such as `main`, `submain`, `width`, `height` etc.)

**Value**

A `visNetwork` object; graph. On this graph, the edges are treated as springs. The variables correlated strongly (positively or negatively) are close to each other, and those not (or weakly) correlated - far from each other.
See Also

corrgrapher

Examples

df <- as.data.frame(datasets::Seatbelts)[,1:7] # drop the binary target variable
cgr <- corrgrapher(df)
plot(cgr)

print.corrgrapher  Print S3 method

Description

This method allows corrgrapher objects to be displayed nicely in RStudio viewer.

Usage

## S3 method for class 'corrgrapher'
print(x, ...)

Arguments

x  An object of corrgrapher class. See corrgrapher function.
...
Other parameters, passed directly to save_to_html function. If x was created from explainer, the plot will visualize partial dependency of the currently selected variable. In other case, the plot will visualize distribution of the variable.

save_to_html  Generate and save HTML report

Description

Create an interactive document in HTML based on corrgrapher object.

Usage

save_to_html(cgr, file = "report.html", overwrite = FALSE, ...)

Arguments

cgr  An object of corrgrapher class. See corrgrapher function.
file  File to write content to; passed directly to save_html.
overwrite  If file exists, should it be overwritten?
...
Other parameters
Value

A file of file name will be generated with 2 elements: graph of correlations in the middle and a plot on the right. If $x$ was created from explainer, the plot will visualize partial dependency of the currently selected variable. In other case, the plot will visualize distribution of the variable.
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