Author Indrajeet Patil [aut] (<https://orcid.org/0000-0003-1995-6531>),
@patilindrajeets),
Etienne Bacher [aut, cre] (<https://orcid.org/0000-0002-9271-5075>),
Dominique Makowski [aut] (<https://orcid.org/0000-0001-5375-9967>),
@Dom_Makowski),
Daniel Lüdecke [aut] (<https://orcid.org/0000-0002-8895-3206>),
@strengjeacke),
Mattan S. Ben-Shachar [aut] (<https://orcid.org/0000-0002-4287-4801>),
Brenton M. Wiernik [aut] (<https://orcid.org/0000-0001-9560-6336>),
@bmwiernik),
Rémi Thériault [ctb] (<https://orcid.org/0000-0003-4315-6788>),
@rempsyc),
Thomas J. Faulkenberry [rev],
Robert Garrett [rev]

Repository CRAN

Date/Publication 2023-12-21 16:50:02 UTC

R topics documented:

adjust ......................................................... 3
assign_labels ............................................. 6
categorize .................................................. 9
center ....................................................... 13
coef_var ..................................................... 17
coerce_to_numeric ....................................... 19
contr.deviation .......................................... 20
convert_na_to ............................................. 22
convert_to_na ............................................ 25
data_addprefix ......................................... 27
data_arrange ............................................. 30
data_codebook .......................................... 31
data_duplicated ........................................ 33
data_extract ............................................. 35
data_group ............................................... 38
data_match ............................................... 40
data_merge ............................................... 42
data_modify .............................................. 46
data_partition .......................................... 48
data.peek .................................................. 50
data_read .................................................. 52
data_relocate ........................................... 54
data_restoretype ........................................ 57
data_rotate ............................................... 57
data_seek .................................................. 59
data_separate ............................................ 60
data_tabulate ............................................ 64
data_to_long ............................................. 67
adjust

Adjust data for the effect of other variable(s)
Description

This function can be used to adjust the data for the effect of other variables present in the dataset. It is based on an underlying fitting of regressions models, allowing for quite some flexibility, such as including factors as random effects in mixed models (multilevel partialization), continuous variables as smooth terms in general additive models (non-linear partialization) and/or fitting these models under a Bayesian framework. The values returned by this function are the residuals of the regression models. Note that a regular correlation between two "adjusted" variables is equivalent to the partial correlation between them.

Usage

adjust(
  data, 
  effect = NULL, 
  select = is.numeric, 
  exclude = NULL, 
  multilevel = FALSE, 
  additive = FALSE, 
  bayesian = FALSE, 
  keep_intercept = FALSE, 
  ignore_case = FALSE, 
  regex = FALSE, 
  verbose = FALSE
)

data_adjust(
  data, 
  effect = NULL, 
  select = is.numeric, 
  exclude = NULL, 
  multilevel = FALSE, 
  additive = FALSE, 
  bayesian = FALSE, 
  keep_intercept = FALSE, 
  ignore_case = FALSE, 
  regex = FALSE, 
  verbose = FALSE
)

Arguments

data A data frame.

effect Character vector of column names to be adjusted for (regressed out). If NULL (the default), all variables will be selected.

select Variables that will be included when performing the required tasks. Can be either

  • a variable specified as a literal variable name (e.g., column_name),
• a string with the variable name (e.g., "column_name"), or a character vector of variable names (e.g., c("col1", "col2", "col3")),
• a formula with variable names (e.g., ~column_1 + column_2),
• a vector of positive integers, giving the positions counting from the left (e.g., 1 or c(1, 3, 5)),
• a vector of negative integers, giving the positions counting from the right (e.g., -1 or -1:-3),
• one of the following select-helpers: starts_with(), ends_with(), contains(), a range using : or regex(""), starts_with(), ends_with(), and contains() accept several patterns, e.g starts_with("Sep", "Petal"),
• or a function testing for logical conditions, e.g. is.numeric() (or is.numeric), or any user-defined function that selects the variables for which the function returns TRUE (like: foo <- function(x) mean(x) > 3),
• ranges specified via literal variable names, select-helpers (except regex()) and (user-defined) functions can be negated, i.e. return non-matching elements, when prefixed with a -, e.g. -ends_with(""), -is.numeric or -(Sepal.Width:Petal.Length). Note: Negation means that matches are excluded, and thus, the exclude argument can be used alternatively. For instance, select=-ends_with("Length") (with -) is equivalent to exclude=ends_with("Length") (no -). In case negation should not work as expected, use the exclude argument instead.

If NULL, selects all columns. Patterns that found no matches are silently ignored, e.g. find_columns(iris, select = c("Species", "Test")) will just return "Species".

exclude
See select, however, column names matched by the pattern from exclude will be excluded instead of selected. If NULL (the default), excludes no columns.

multilevel
If TRUE, the factors are included as random factors. Else, if FALSE (default), they are included as fixed effects in the simple regression model.

additive
If TRUE, continuous variables as included as smooth terms in additive models. The goal is to regress-out potential non-linear effects.

bayesian
If TRUE, the models are fitted under the Bayesian framework using rstanarm.

keep_intercept
If FALSE (default), the intercept of the model is re-added. This avoids the centering around 0 that happens by default when regressing out another variable (see the examples below for a visual representation of this).

ignore_case
Logical, if TRUE and when one of the select-helpers or a regular expression is used in select, ignores lower/upper case in the search pattern when matching against variable names.

regex
Logical, if TRUE, the search pattern from select will be treated as regular expression. When regex = TRUE, select must be a character string (or a variable containing a character string) and is not allowed to be one of the supported select-helpers or a character vector of length > 1. regex = TRUE is comparable to using one of the two select-helpers, select = contains(""), or select = regex(""). However, since the select-helpers may not work when called from inside other functions (see `Details`), this argument may be used as workaround.

verbose
Toggle warnings.
assign_labels

Assign variable and value labels

Description

Assign variable and values labels to a variable or variables in a data frame. Labels are stored as attributes ("label" for variable labels and "labels") for value labels.
assign_labels

Usage

assign_labels(x, ...)

## S3 method for class 'numeric'
assign_labels(x, variable = NULL, values = NULL, ...)

## S3 method for class 'data.frame'
assign_labels(
  x,
  select = NULL,
  exclude = NULL,
  values = NULL,
  ignore_case = FALSE,
  regex = FALSE,
  verbose = TRUE,
  ...
)

Arguments

x A data frame, factor or vector.

... Currently not used.

variable The variable label as string.

values The value labels as (named) character vector. If values is not a named vector, the length of labels must be equal to the length of unique values. For a named vector, the left-hand side (LHS) is the value in x, the right-hand side (RHS) the associated value label. Non-matching labels are omitted.

select Variables that will be included when performing the required tasks. Can be either

  • a variable specified as a literal variable name (e.g., column_name),
  • a string with the variable name (e.g., "column_name"), or a character vector of variable names (e.g., c("col1", "col2", "col3")),
  • a formula with variable names (e.g., ~column_1 + column_2),
  • a vector of positive integers, giving the positions counting from the left (e.g. 1 or c(1, 3, 5)),
  • a vector of negative integers, giving the positions counting from the right (e.g., -1 or -1:-3),
  • one of the following select-helpers: starts_with(), ends_with(), contains(), a range using : or regex(" "). starts_with(), ends_with(), and contains() accept several patterns, e.g starts_with("Sep", "Petal").
  • or a function testing for logical conditions, e.g. is.numeric() (or is.numeric), or any user-defined function that selects the variables for which the function returns TRUE (like: foo <- function(x) mean(x) > 3),
  • ranges specified via literal variable names, select-helpers (except regex()) and (user-defined) functions can be negated, i.e. return non-matching elements, when prefixed with a -.

assign_labels

-(Sepal.Width:Petal.Length). **Note:** Negation means that matches are excluded, and thus, the exclude argument can be used alternatively. For instance, select=-ends_with("Length") (with ~) is equivalent to exclude=ends_with("Length") (no ~). In case negation should not work as expected, use the exclude argument instead.

If NULL, selects all columns. Patterns that found no matches are silently ignored, e.g. find_columns(iris, select = c("Species", "Test")) will just return "Species".

**Exclude**

See select, however, column names matched by the pattern from exclude will be excluded instead of selected. If NULL (the default), excludes no columns.

**Ignore case**

Logical, if TRUE and when one of the select-helpers or a regular expression is used in select, ignores lower/upper case in the search pattern when matching against variable names.

**Regex**

Logical, if TRUE, the search pattern from select will be treated as regular expression. When regex = TRUE, select must be a character string (or a variable containing a character string) and is not allowed to be one of the supported select-helpers or a character vector of length > 1. regex = TRUE is comparable to using one of the two select-helpers, select = contains("") or select = regex(""), however, since the select-helpers may not work when called from inside other functions (see 'Details'), this argument may be used as workaround.

**Verbose**

Toggle warnings.

**Value**

A labelled variable, or a data frame of labelled variables.

**Selection of variables - the select argument**

For most functions that have a select argument (including this function), the complete input data frame is returned, even when select only selects a range of variables. That is, the function is only applied to those variables that have a match in select, while all other variables remain unchanged. In other words: for this function, select will not omit any non-included variables, so that the returned data frame will include all variables from the input data frame.

**Examples**

```r
x <- 1:3
# labelling by providing required number of labels
assign_labels(
  x,
  variable = "My x",
  values = c("one", "two", "three")
)

# labelling using named vectors
data(iris)
out <- assign_labels(
  iris$Species,
  variable = "Labelled Species",
  exclude = ends_with("Length")
)
```

- **Value:** A labelled variable, or a data frame of labelled variables.

- **Selection of variables - the select argument**

  For most functions that have a select argument (including this function), the complete input data frame is returned, even when select only selects a range of variables. That is, the function is only applied to those variables that have a match in select, while all other variables remain unchanged. In other words: for this function, select will not omit any non-included variables, so that the returned data frame will include all variables from the input data frame.

- **Examples**

  ```r
  x <- 1:3
  # labelling by providing required number of labels
  assign_labels(
    x,
    variable = "My x",
    values = c("one", "two", "three")
  )
  ```
```r
categorize

values = c('setosa' = "Spec1", 'versicolor' = "Spec2", 'virginica' = "Spec3")
str(out)

# data frame example
out <- assign_labels(
  iris,
  select = "Species",
  variable = "Labelled Species",
  values = c('setosa' = "Spec1", 'versicolor' = "Spec2", 'virginica' = "Spec3")
)
str(out$Species)

# Partial labelling
x <- 1:5
assign_labels(
  x,
  variable = "My x",
  values = c('1' = "lowest", '5' = "highest")
)
```

categorize

Recode (or "cut" / "bin") data into groups of values.

Description

This function divides the range of variables into intervals and recodes the values inside these intervals according to their related interval. It is basically a wrapper around base R's `cut()`, providing a simplified and more accessible way to define the interval breaks (cut-off values).

Usage

categorize(x, ...)

## S3 method for class 'numeric'
categorize(
  x,
  split = "median",
  n_groups = NULL,
  range = NULL,
  lowest = 1,
  labels = NULL,
  verbose = TRUE,
  ...
)

## S3 method for class 'data.frame'
categorize(
  x,

select = NULL,
exclude = NULL,
split = "median",
n_groups = NULL,
range = NULL,
lowest = 1,
labels = NULL,
append = FALSE,
ignore_case = FALSE,
regex = FALSE,
verbose = TRUE,
...
}

Arguments

x A (grouped) data frame, numeric vector or factor.

... not used.

split Character vector, indicating at which breaks to split variables, or numeric values with values indicating breaks. If character, may be one of "median", "mean", "quantile", "equal_length", or "equal_range". "median" or "mean" will return dichotomous variables, split at their mean or median, respectively. "quantile" and "equal_length" will split the variable into n_groups groups, where each group refers to an interval of a specific range of values. Thus, the length of each interval will be based on the number of groups. "equal_range" also splits the variable into multiple groups, however, the length of the interval is given, and the number of resulting groups (and hence, the number of breaks) will be determined by how many intervals can be generated, based on the full range of the variable.

n_groups If split is "quantile" or "equal_length", this defines the number of requested groups (i.e. resulting number of levels or values) for the recoded variable(s). "quantile" will define intervals based on the distribution of the variable, while "equal_length" tries to divide the range of the variable into pieces of equal length.

range If split = "equal_range", this defines the range of values that are recoded into a new value.

lowest Minimum value of the recoded variable(s). If NULL (the default), for numeric variables, the minimum of the original input is preserved. For factors, the default minimum is 1. For split = "equal_range", the default minimum is always 1, unless specified otherwise in lowest.

labels Character vector of value labels. If not NULL, categorize() will returns factors instead of numeric variables, with labels used for labelling the factor levels. Can also be "mean" or "median" for a factor with labels as the mean/median of each groups.

verbose Toggle warnings.

select Variables that will be included when performing the required tasks. Can be either
• a variable specified as a literal variable name (e.g., column_name),
• a string with the variable name (e.g., "column_name"), or a character vector of variable names (e.g., c("col1", "col2", "col3")),
• a formula with variable names (e.g., ~column_1 + column_2),
• a vector of positive integers, giving the positions counting from the left (e.g. 1 or c(1, 3, 5)),
• a vector of negative integers, giving the positions counting from the right (e.g., -1 or -1:-3),
• one of the following select-helpers: starts_with(), ends_with(), contains(), a range using : or regex(""), starts_with(), ends_with(), and contains() accept several patterns, e.g starts_with("Sep", "Petal")
• or a function testing for logical conditions, e.g. is.numeric() (or is.numeric), or any user-defined function that selects the variables for which the function returns TRUE (like: foo <- function(x) mean(x) > 3),
• ranges specified via literal variable names, select-helpers (except regex()) and (user-defined) functions can be negated, i.e. return non-matching elements, when prefixed with a -, e.g. -ends_with(""), -is.numeric or -(Sepal.Width:Petal.Length). Note: Negation means that matches are excluded, and thus, the exclude argument can be used alternatively. For instance, select=-ends_with("Length") (with -) is equivalent to exclude=ends_with("Length") (no -). In case negation should not work as expected, use the exclude argument instead.

If NULL, selects all columns. Patterns that found no matches are silently ignored, e.g. find_columns(iris, select = c("Species", "Test")) will just return "Species".

eclude See select, however, column names matched by the pattern from exclude will be excluded instead of selected. If NULL (the default), excludes no columns.
append Logical or string. If TRUE, recoded or converted variables get new column names and are appended (column bind) to x, thus returning both the original and the recoded variables. The new columns get a suffix, based on the calling function: "_r" for recode functions, "_n" for to_numeric(), "_f" for to_factor(), or "_s" for slide(). If append=FALSE, original variables in x will be overwritten by their recoded versions. If a character value, recoded variables are appended with new column names (using the defined suffix) to the original data frame.
ignore_case Logical, if TRUE and when one of the select-helpers or a regular expression is used in select, ignores lower/upper case in the search pattern when matching against variable names.
regex Logical, if TRUE, the search pattern from select will be treated as regular expression. When regex = TRUE, select must be a character string (or a variable containing a character string) and is not allowed to be one of the supported select-helpers or a character vector of length > 1. regex = TRUE is comparable to using one of the two select-helpers, select = contains("")) or select = regex(""), however, since the select-helpers may not work when called from inside other functions (see ’Details’), this argument may be used as workaround.
Value

\( x \), recoded into groups. By default \( x \) is numeric, unless \texttt{labels} is specified. In this case, a factor is returned, where the factor levels (i.e. recoded groups are labelled accordingly).

Splits and breaks (cut-off values)

Breaks are in general \textit{exclusive}, this means that these values indicate the lower bound of the next group or interval to begin. Take a simple example, a numeric variable with values from 1 to 9. The median would be 5, thus the first interval ranges from 1-4 and is recoded into 1, while 5-9 would turn into 2 (compare \texttt{cbind(1:9, categorize(1:9))}). The same variable, using \texttt{split = "quantile"} and \( \texttt{n\_groups} = 3 \) would define breaks at 3.67 and 6.33 (see \texttt{quantile(1:9, probs = c(1/3, 2/3))}), which means that values from 1 to 3 belong to the first interval and are recoded into 1 (because the next interval starts at 3.67), 4 to 6 into 2 and 7 to 9 into 3.

Recoding into groups with equal size or range

\texttt{split = "equal\_length"} and \texttt{split = "equal\_range"} try to divide the range of \( x \) into intervals of similar (or same) length. The difference is that \texttt{split = "equal\_length"} will divide the range of \( x \) into \( \texttt{n\_groups} \) pieces and thereby defining the intervals used as breaks (hence, it is equivalent to \texttt{cut(x, breaks = n\_groups)}), while \texttt{split = "equal\_range"} will cut \( x \) into intervals that all have the length of range, where the first interval by defaults starts at 1. The lowest (or starting) value of that interval can be defined using the lowest argument.

Selection of variables - the \texttt{select} argument

For most functions that have a \texttt{select} argument (including this function), the complete input data frame is returned, even when \texttt{select} only selects a range of variables. That is, the function is only applied to those variables that have a match in \texttt{select}, while all other variables remain unchanged. In other words: for this function, \texttt{select} will not omit any non-included variables, so that the returned data frame will include all variables from the input data frame.

See Also

- Functions to rename stuff: \texttt{data\_rename()}, \texttt{data\_rename\_rows()}, \texttt{data\_addprefix()}, \texttt{data\_addsuffix()}
- Functions to reorder or remove columns: \texttt{data\_reorder()}, \texttt{data\_relocate()}, \texttt{data\_remove()}
- Functions to reshape, pivot or rotate data frames: \texttt{data\_to\_long()}, \texttt{data\_to\_wide()}, \texttt{data\_rotate()}
- Functions to recode data: \texttt{rescale()}, \texttt{reverse()}, \texttt{categorize()}, \texttt{recode\_values()}, \texttt{slide()}
- Functions to standardize, normalize, rank-transform: \texttt{center()}, \texttt{standardize()}, \texttt{normalize()}, \texttt{ranktransform()}, \texttt{winsorize()}
- Split and merge data frames: \texttt{data\_partition()}, \texttt{data\_merge()}
- Functions to find or select columns: \texttt{data\_select()}, \texttt{data\_find()}
- Functions to filter rows: \texttt{data\_match()}, \texttt{data\_filter()}
Examples

```r
set.seed(123)
x <- sample(1:10, size = 50, replace = TRUE)

table(x)

# by default, at median
table(categorize(x))

# into 3 groups, based on distribution (quantiles)
table(categorize(x, split = "quantile", n_groups = 3))

# into 3 groups, user-defined break
table(categorize(x, split = c(3, 5)))

set.seed(123)
x <- sample(1:100, size = 500, replace = TRUE)

# into 5 groups, try to recode into intervals of similar length,
# i.e. the range within groups is the same for all groups
table(categorize(x, split = "equal_length", n_groups = 5))

# into 5 groups, try to return same range within groups
# i.e. 1-20, 21-40, 41-60, etc. Since the range of "x" is
# 1-100, and we have a range of 20, this results into 5
# groups, and thus is for this particular case identical
# to the previous result.
table(categorize(x, split = "equal_range", range = 20))

# return factor with value labels instead of numeric value
set.seed(123)
x <- sample(1:10, size = 30, replace = TRUE)
categorize(x, "equal_length", n_groups = 3)
categorize(x, "equal_length", n_groups = 3, labels = c("low", "mid", "high"))

# cut numeric into groups with the mean or median as a label name
x <- sample(1:10, size = 30, replace = TRUE)
categorize(x, "equal_length", n_groups = 3, labels = "mean")
categorize(x, "equal_length", n_groups = 3, labels = "median")
```

---

**center**  
**Centering (Grand-Mean Centering)**

**Description**

Performs a grand-mean centering of data.
Usage

center(x, ...)

centre(x, ...)

## S3 method for class 'numeric'
center(
  x,
  robust = FALSE,
  weights = NULL,
  reference = NULL,
  center = NULL,
  verbose = TRUE,
  ...
)

## S3 method for class 'data.frame'
center(
  x,
  select = NULL,
  exclude = NULL,
  robust = FALSE,
  weights = NULL,
  reference = NULL,
  center = NULL,
  force = FALSE,
  remove_na = c("none", "selected", "all"),
  append = FALSE,
  ignore_case = FALSE,
  verbose = TRUE,
  regex = FALSE,
  ...
)

Arguments

x A (grouped) data frame, a (numeric or character) vector or a factor.

... Currently not used.

robust Logical, if TRUE, centering is done by subtracting the median from the variables. If FALSE, variables are centered by subtracting the mean.

weights Can be NULL (for no weighting), or:
  • For data frames: a numeric vector of weights, or a character of the name of a column in the data.frame that contains the weights.
  • For numeric vectors: a numeric vector of weights.

reference A data frame or variable from which the centrality and deviation will be computed instead of from the input variable. Useful for standardizing a subset or new data according to another data frame.
center

Numeric value, which can be used as alternative to reference to define a reference centrality. If center is of length 1, it will be recycled to match the length of selected variables for centering. Else, center must be of same length as the number of selected variables. Values in center will be matched to selected variables in the provided order, unless a named vector is given. In this case, names are matched against the names of the selected variables.

verbose

Toggle warnings and messages.

select

Variables that will be included when performing the required tasks. Can be either

- a variable specified as a literal variable name (e.g., column_name),
- a string with the variable name (e.g., "column_name"), or a character vector of variable names (e.g., c("col1", "col2", "col3")),
- a formula with variable names (e.g., ~column_1 + column_2),
- a vector of positive integers, giving the positions counting from the left (e.g., 1 or c(1, 3, 5)),
- a vector of negative integers, giving the positions counting from the right (e.g., -1 or -1:-3),
- one of the following select-helpers: starts_with(), ends_with(), contains(), a range using : or regex(""), starts_with(), ends_with(), and contains() accept several patterns, e.g starts_with("Sep", "Petal")
- or a function testing for logical conditions, e.g. is.numeric() (or is.numeric), or any user-defined function that selects the variables for which the function returns TRUE (like: foo <- function(x) mean(x) > 3),
- ranges specified via literal variable names, select-helpers (except regex()) and (user-defined) functions can be negated, i.e. return non-matching elements, when prefixed with a ~, e.g. ~ends_with(""), ~is.numeric or ~(Sepal.Width:Petal.Length). **Note:** Negation means that matches are excluded, and thus, the exclude argument can be used alternatively. For instance, select=~ends_with("Length") (with ~) is equivalent to exclude=ends_with("Length") (no ~). In case negation should not work as expected, use the exclude argument instead.

If NULL, selects all columns. Patterns that found no matches are silently ignored, e.g. find_columns(iris, select = c("Species", "Test")) will just return "Species".

exclude

See select, however, column names matched by the pattern from exclude will be excluded instead of selected. If NULL (the default), excludes no columns.

force

Logical, if TRUE, forces centering of factors as well. Factors are converted to numerical values, with the lowest level being the value 1 (unless the factor has numeric levels, which are converted to the corresponding numeric value).

remove_na

How should missing values (NA) be treated: if "none" (default): each column’s standardization is done separately, ignoring NAs. Else, rows with NA in the columns selected with select/exclude ("selected") or in all columns ("all") are dropped before standardization, and the resulting data frame does not include these cases.
append Logical or string. If TRUE, centered variables get new column names (with the suffix "/c") and are appended (column bind) to \(x\), thus returning both the original and the centered variables. If FALSE, original variables in \(x\) will be overwritten by their centered versions. If a character value, centered variables are appended with new column names (using the defined suffix) to the original data frame.

ignore_case Logical, if TRUE and when one of the select-helpers or a regular expression is used in select, ignores lower/upper case in the search pattern when matching against variable names.

regex Logical, if TRUE, the search pattern from select will be treated as regular expression. When regex = TRUE, select must be a character string (or a variable containing a character string) and is not allowed to be one of the supported select-helpers or a character vector of length > 1. regex = TRUE is comparable to using one of the two select-helpers, select = contains(""), or select = regex(""), however, since the select-helpers may not work when called from inside other functions (see 'Details'), this argument may be used as workaround.

Value The centered variables.

Selection of variables - the select argument

For most functions that have a select argument (including this function), the complete input data frame is returned, even when select only selects a range of variables. That is, the function is only applied to those variables that have a match in select, while all other variables remain unchanged. In other words: for this function, select will not omit any non-included variables, so that the returned data frame will include all variables from the input data frame.

Note

Difference between centering and standardizing: Standardized variables are computed by subtracting the mean of the variable and then dividing it by the standard deviation, while centering variables involves only the subtraction.

See Also

If centering within-clusters (instead of grand-mean centering) is required, see demean(). For standardizing, see standardize(), and makepredictcall.dw_transformer() for use in model formulas.

Examples

data(iris)

# entire data frame or a vector
head(iris$Sepal.Width)
head(center(iris$Sepal.Width))
head(center(iris))
head(center(iris, force = TRUE))
# only the selected columns from a data frame
center(anscombe, select = c("x1", "x3"))
center(anscombe, exclude = c("x1", "x3"))

# centering with reference center and scale
d <- data.frame(
  a = c(-2, -1, 0, 1, 2),
  b = c(3, 4, 5, 6, 7)
)

center(d)

center(d, center = 0)

center(d, center = -5)

---

**coef_var**

*Compute the coefficient of variation*

---

**Description**

Compute the coefficient of variation (CV, ratio of the standard deviation to the mean, \( \sigma / \mu \)) for a set of numeric values.

**Usage**

```r
c coef_var(x, ...)
d distribution_coef_var(x, ...)
```

## S3 method for class 'numeric'

```r
c coef_var(
  x,
  mu = NULL,
  sigma = NULL,
  method = c("standard", "unbiased", "median_mad", "qcd"),
  trim = 0,
  remove_na = FALSE,
  n = NULL,
  na.rm = FALSE,
  ...
)
```
Arguments

\( x \) A numeric vector of ratio scale (see details), or vector of values than can be coerced to one.

\( \ldots \) Further arguments passed to computation functions.

\( \text{mu} \) A numeric vector of mean values to use to compute the coefficient of variation. If supplied, \( x \) is not used to compute the mean.

\( \text{sigma} \) A numeric vector of standard deviation values to use to compute the coefficient of variation. If supplied, \( x \) is not used to compute the SD.

\( \text{method} \) Method to use to compute the CV. Can be "standard" to compute by dividing the standard deviation by the mean, "unbiased" for the unbiased estimator for normally distributed data, or one of two robust alternatives: "median_mad" to divide the median by the \text{stats::mad()}, or "qcd" (quartile coefficient of dispersion, interquartile range divided by the sum of the quartiles [twice the midhinge]: \( (Q_3 - Q_1)/(Q_3 + Q_1) \)).

\( \text{trim} \) the fraction (0 to 0.5) of values to be trimmed from each end of \( x \) before the mean and standard deviation (or other measures) are computed. Values of \( \text{trim} \) outside the range of (0 to 0.5) are taken as the nearest endpoint.

\( \text{remove_na} \) Logical. Should \text{NA} values be removed before computing (TRUE) or not (FALSE, default)?

\( n \) If \( \text{method} = \) "unbiased" and both \text{mu} and \text{sigma} are provided (not computed from \( x \)), what sample size to use to adjust the computed CV for small-sample bias?

\( \text{na.rm} \) Deprecated. Please use \text{remove_na} instead.

Details

CV is only applicable of values taken on a ratio scale: values that have a \text{fixed} meaningfully defined 0 (which is either the lowest or highest possible value), and that ratios between them are interpretable For example, how many sandwiches have I eaten this week? 0 means "none" and 20 sandwiches is 4 times more than 5 sandwiches. If I were to center the number of sandwiches, it will no longer be on a ratio scale (0 is no "none" it is the mean, and the ratio between 4 and -2 is not meaningful). Scaling a ratio scale still results in a ratio scale. So I can re define "how many half sandwiches did I eat this week ( = sandwiches * 0.5) and 0 would still mean "none", and 20 half-sandwiches is still 4 times more than 5 half-sandwiches.

This means that CV is \text{NOT} invariant to shifting, but it is to scaling:

```r
sandwiches <- c(0, 4, 15, 0, 0, 5, 2, 7)
coef_var(sandwiches)
#> [1] 1.239094

coef_var(sandwiches / 2)  # same
#> [1] 1.239094

coef_var(sandwiches + 4)  # different! 0 is no longer meaningful!
#> [1] 0.6290784
```
Value

The computed coefficient of variation for x.

Examples

```r
coeff_var(1:10)
coeff_var(c(1:10, 100), method = "median_mad")
coeff_var(c(1:10, 100), method = "qcd")
coeff_var(mu = 10, sigma = 20)
coeff_var(mu = 10, sigma = 20, method = "unbiased", n = 30)
```

coerce_to_numeric

Convert to Numeric (if possible)

Description

Tries to convert vector to numeric if possible (if no warnings or errors). Otherwise, leaves it as is.

Usage

```r
coerce_to_numeric(x)
```

Arguments

- **x**: A vector to be converted.

Value

Numeric vector (if possible)

Examples

```r
coerce_to_numeric(c("1", "2"))
coerce_to_numeric(c("1", "2", "A"))
```
contr.deviation

Description

Build a deviation contrast matrix, a type of effects contrast matrix.

Usage

```r
contr.deviation(n, base = 1, contrasts = TRUE, sparse = FALSE)
```

Arguments

- `n` a vector of levels for a factor, or the number of levels.
- `base` an integer specifying which group is considered the baseline group. Ignored if `contrasts` is `FALSE`.
- `contrasts` a logical indicating whether contrasts should be computed.
- `sparse` logical indicating if the result should be sparse (of class `dgCMatrix`), using package `Matrix`.

Details

In effects coding, unlike treatment/dummy coding (`stats::contr.treatment()`), each contrast sums to 0. In regressions models, this results in an intercept that represents the (unweighted) average of the group means. In ANOVA settings, this also guarantees that lower order effects represent main effects (and not simple or conditional effects, as is the case when using R’s default `stats::contr.treatment()`).

Deviation coding (`contr.deviation`) is a type of effects coding. With deviation coding, the coefficients for factor variables are interpreted as the difference of each factor level from the base level (this is the same interpretation as with treatment/dummy coding). For example, for a factor group with levels "A", "B", and "C", with `contr.deviation`, the intercept represents the overall mean (average of the group means for the 3 groups), and the coefficients `groupB` and `groupC` represent the differences between the A group mean and the B and C group means, respectively.

Sum coding (`stats::contr.sum()`) is another type of effects coding. With sum coding, the coefficients for factor variables are interpreted as the difference of each factor level from the grand (across-groups) mean. For example, for a factor group with levels "A", "B", and "C", with `contr.sum`, the intercept represents the overall mean (average of the group means for the 3 groups), and the coefficients `group1` and `group2` represent the differences the A and B group means from the overall mean, respectively.

See Also

`stats::contr.sum()`
Contrasts deviates

Examples

data("mtcars")

mtcars <- data_modify(mtcars, cyl = factor(cyl))

c.treatment <- cbind(Intercept = 1, contrasts(mtcars$cyl))
solve(c.treatment)
#> 4 6 8
#> Intercept 1 0 0 # mean of the 1st level
#> 6 -1 1 0 # 2nd level - 1st level
#> 8 -1 0 1 # 3rd level - 1st level

contrasts(mtcars$cyl) <- contr.sum
c.sum <- cbind(Intercept = 1, contrasts(mtcars$cyl))
solve(c.sum)
#> 4 6 8
#> Intercept 0.333 0.333 0.333 # overall mean
#> 0.667 -0.333 -0.333 # deviation of 1st from overall mean
#> -0.333 0.667 -0.333 # deviation of 2nd from overall mean

contrasts(mtcars$cyl) <- contr.deviation
c.deviation <- cbind(Intercept = 1, contrasts(mtcars$cyl))
solve(c.deviation)
#> 4 6 8
#> Intercept 0.333 0.333 0.333 # overall mean
#> 6 -1.000 1.000 0.000 # 2nd level - 1st level
#> 8 -1.000 0.000 1.000 # 3rd level - 1st level

## With Interactions -----------------------------------------

mtcars <- data_modify(mtcars, am = C(am, contr = contr.deviation))
mtcars <- data_arrange(mtcars, select = c("cyl", "am"))

mm <- unique(model.matrix(~ cyl * am, data = mtcars))
rownames(mm) <- c("cyl4.am0", "cyl4.am1", "cyl6.am0", 
  "cyl6.am1", "cyl8.am0", "cyl8.am1"
)
solve(mm)
#>   cyl4.am0  cyl4.am1  cyl6.am0  cyl6.am1  cyl8.am0  cyl8.am1
#> (Intercept) 0.167 0.167 0.167 0.167 0.167 0.167 # overall mean
#>  cyl6  -0.500 -0.500 0.500 0.500 0.000 0.000 # cyl MAIN eff: 2nd - 1st
#>  cyl8  -0.500 -0.500 0.000 0.000 0.500 0.500 # cyl MAIN eff: 2nd - 1st
#>  am1   -0.333 0.333 -0.333 0.333 -0.333 0.333 # am MAIN eff
#>  cyl6:am1  1.000 -1.000 -1.000 1.000 0.000 0.000
#>  cyl8:am1  1.000 -1.000 0.000 0.000 -1.000 1.000
convert_na_to

Replace missing values in a variable or a data frame.

Description

Replace missing values in a variable or a data frame.

Usage

convert_na_to(x, ...)

## S3 method for class 'numeric'
convert_na_to(x, replacement = NULL, verbose = TRUE, ...)

## S3 method for class 'character'
convert_na_to(x, replacement = NULL, verbose = TRUE, ...)

## S3 method for class 'data.frame'
convert_na_to(
  x,
  select = NULL,
  exclude = NULL,
  replacement = NULL,
  replace_num = replacement,
  replace_char = replacement,
  replace_fac = replacement,
  ignore_case = FALSE,
  regex = FALSE,
  verbose = TRUE,
  ...)

Arguments

x A numeric, factor, or character vector, or a data frame.

... Not used.

replacement Numeric or character value that will be used to replace NA.

verbose Toggle warnings.

select Variables that will be included when performing the required tasks. Can be either
  • a variable specified as a literal variable name (e.g., column_name),
  • a string with the variable name (e.g., "column_name"), or a character vector of variable names (e.g., c("col1", "col2", "col3")),
  • a formula with variable names (e.g., ~column_1 + column_2).
• a vector of positive integers, giving the positions counting from the left (e.g. 1 or c(1, 3, 5)),
• a vector of negative integers, giving the positions counting from the right (e.g., -1 or -1:-3),
• one of the following select-helpers: starts_with(), ends_with(), contains(), a range using : or regex(""). starts_with(), ends_with(), and contains() accept several patterns, e.g starts_with("Sep", "Petal").
• or a function testing for logical conditions, e.g. is.numeric() (or is.numeric), or any user-defined function that selects the variables for which the function returns TRUE (like: foo <- function(x) mean(x) > 3),
• ranges specified via literal variable names, select-helpers (except regex()) and (user-defined) functions can be negated, i.e. return non-matching elements, when prefixed with a -, e.g. -ends_with(""), -is.numeric or -(Sepal.Width:Petal.Length). Note: Negation means that matches are excluded, and thus, the exclude argument can be used alternatively. For instance, select=-ends_with("Length") (with -) is equivalent to exclude=ends_with("Length") (no -). In case negation should not work as expected, use the exclude argument instead.

If NULL, selects all columns. Patterns that found no matches are silently ignored, e.g. find_columns(iris, select = c("Species", "Test")) will just return "Species".

exclude
See select, however, column names matched by the pattern from exclude will be excluded instead of selected. If NULL (the default), excludes no columns.

replace_num
Value to replace NA when variable is of type numeric.

replace_char
Value to replace NA when variable is of type character.

replace_fac
Value to replace NA when variable is of type factor.

ignore_case
Logical, if TRUE and when one of the select-helpers or a regular expression is used in select, ignores lower/upper case in the search pattern when matching against variable names.

regex
Logical, if TRUE, the search pattern from select will be treated as regular expression. When regex = TRUE, select must be a character string (or a variable containing a character string) and is not allowed to be one of the supported select-helpers or a character vector of length > 1. regex = TRUE is comparable to using one of the two select-helpers, select = contains("") or select = regex(""), however, since the select-helpers may not work when called from inside other functions (see 'Details'), this argument may be used as workaround.

Value
x, where NA values are replaced by replacement.

Selection of variables - the select argument
For most functions that have a select argument (including this function), the complete input data frame is returned, even when select only selects a range of variables. That is, the function is only applied to those variables that have a match in select, while all other variables remain unchanged.
In other words: for this function, \texttt{select} will not omit any non-included variables, so that the returned data frame will include all variables from the input data frame.

Examples

\begin{verbatim}
# Convert NA to 0 in a numeric vector
convert_na_to(
  c(9, 3, NA, 2, 3, 1, NA, 8),
  replacement = 0
)

# Convert NA to "missing" in a character vector
convert_na_to(
  c("a", NA, "d", "z", NA, "t"),
  replacement = "missing"
)

### For data frames
test_df <- data.frame(
  x = c(1, 2, NA),
  x2 = c(4, 5, NA),
  y = c("a", "b", NA)
)

# Convert all NA to 0 in numeric variables, and all NA to "missing" in
# character variables
convert_na_to(
  test_df,
  replace_num = 0,
  replace_char = "missing"
)

# Convert a specific variable in the data frame
convert_na_to(
  test_df,
  replace_num = 0,
  replace_char = "missing",
  select = "x"
)

# Convert all variables starting with "x"
convert_na_to(
  test_df,
  replace_num = 0,
  replace_char = "missing",
  select = starts_with("x")
)

# Convert NA to 1 in variable 'x2' and to 0 in all other numeric
# variables
convert_na_to(
  test_df,
  replace_num = 0,
  replace_char = "missing",
  select = starts_with("x")
)
\end{verbatim}
convert_to_na

```r
replace_num = 0,
select = list(x2 = 1)
)
```

Convert non-missing values in a variable into missing values.

**Description**

Convert non-missing values in a variable into missing values.

**Usage**

```r
convert_to_na(x, ...)
```

```r
## S3 method for class 'numeric'
convert_to_na(x, na = NULL, verbose = TRUE, ...)
```

```r
## S3 method for class 'factor'
convert_to_na(x, na = NULL, drop_levels = FALSE, verbose = TRUE, ...)
```

```r
## S3 method for class 'data.frame'
convert_to_na(
  x,
  select = NULL,
  exclude = NULL,
  na = NULL,
  drop_levels = FALSE,
  ignore_case = FALSE,
  regex = FALSE,
  verbose = TRUE,
  ...
)
```

**Arguments**

- `x` A vector, factor or a data frame.
- `...` Not used.
- `na` Numeric, character vector or logical (or a list of numeric, character vectors or logicals) with values that should be converted to NA. Numeric values applied to numeric vectors, character values are used for factors, character vectors or date variables, and logical values for logical vectors.
- `verbose` Toggle warnings.
- `drop_levels` Logical, for factors, when specific levels are replaced by NA, should unused levels be dropped?
Variables that will be included when performing the required tasks. Can be either

- a variable specified as a literal variable name (e.g., \texttt{column\_name}),
- a string with the variable name (e.g., \texttt{"column\_name"}), or a character vector of variable names (e.g., \texttt{c("col1", "col2", "col3")}),
- a formula with variable names (e.g., \texttt{~column\_1 + column\_2}),
- a vector of positive integers, giving the positions counting from the left (e.g. \texttt{c(1, 3, 5)}),
- a vector of negative integers, giving the positions counting from the right (e.g., \texttt{-1} or \texttt{-1:-3}),
- one of the following select-helpers: \texttt{starts\_with()}, \texttt{ends\_with()}, \texttt{contains()},
  a range using : or \texttt{regex("\")}. \texttt{starts\_with()}, \texttt{ends\_with()}, and \texttt{contains()} accept several patterns, e.g \texttt{starts\_with("Sep", "Petal")}.
- or a function testing for logical conditions, e.g. \texttt{is.numeric()} (or \texttt{is.numeric}),
  or any user-defined function that selects the variables for which the function returns \texttt{TRUE} (like: \texttt{foo <- function(x) mean(x) > 3}),
- ranges specified via literal variable names, select-helpers (except \texttt{regex()}) and (user-defined) functions can be negated, i.e. return non-matching elements, when prefixed with a \texttt{-}, e.g. \texttt{-ends\_with("")}, \texttt{-is.numeric} or \texttt{-\texttt{(Sepal.Width:Petal.Length)}}. \textbf{Note:} Negation means that matches are \textit{excluded}, and thus, the exclude argument can be used alternatively. For instance, \texttt{select=-ends\_with("Length")} (with \texttt{-}) is equivalent to \texttt{exclude=ends\_with("Length")} (no \texttt{-}). In case negation should not work as expected, use the \texttt{exclude} argument instead.

If \texttt{NULL}, selects all columns. Patterns that found no matches are silently ignored, e.g. \texttt{find\_columns(iris, select = c("Species", "Test"))} will just return "Species".

See \texttt{select}, however, column names matched by the pattern from \texttt{exclude} will be excluded instead of selected. If \texttt{NULL} (the default), excludes no columns.

Logical, if \texttt{TRUE} and when one of the select-helpers or a regular expression is used in \texttt{select}, ignores lower/upper case in the search pattern when matching against variable names.

Logical, if \texttt{TRUE}, the search pattern from \texttt{select} will be treated as regular expression. When \texttt{regex = TRUE}, select \textit{must} be a character string (or a variable containing a character string) and is not allowed to be one of the supported select-helpers or a character vector of length > 1. \texttt{regex = TRUE} is comparable to using one of the two select-helpers, \texttt{select = contains("" )} or \texttt{select = regex("")}, however, since the select-helpers may not work when called from inside other functions (see 'Details'), this argument may be used as workaround.

\textbf{Value}
\begin{itemize}
  \item \texttt{x}, where all values in \texttt{na} are converted to \texttt{NA}.
\end{itemize}

\textbf{Examples}
\begin{itemize}
  \item \texttt{x <- sample(1:6, size = 30, replace = TRUE)}
x
# values 4 and 5 to NA
convert_to_na(x, na = 4:5)

# data frames
set.seed(123)
x <- data.frame(
a = sample(1:6, size = 20, replace = TRUE),
b = sample(letters[1:6], size = 20, replace = TRUE),
c = sample(c(30:33, 99), size = 20, replace = TRUE)
)
# for all numerics, convert 5 to NA. Character/factor will be ignored.
convert_to_na(x, na = 5)

# for numerics, 5 to NA, for character/factor, "f" to NA
convert_to_na(x, na = list(6, "f"))

# select specific variables
convert_to_na(x, select = c("a", "b"), na = list(6, "f"))

data_addprefix

Rename columns and variable names

Description
Safe and intuitive functions to rename variables or rows in data frames. data_rename() will rename column names, i.e. it facilitates renaming variables data_addprefix() or data_addsuffix() add prefixes or suffixes to column names. data_rename_rows() is a convenient shortcut to add or rename row names of a data frame, but unlike row.names(), its input and output is a data frame, thus, integrating smoothly into a possible pipe-workflow.

Usage
data_addprefix(  
data,  
    pattern,  
    select = NULL,  
    exclude = NULL,  
    ignore_case = FALSE,  
    regex = FALSE,  
    verbose = TRUE,  
    ...
)

data_addsuffix(  
data,  
    pattern,  
    select = NULL,  
    exclude = NULL,  

ignore_case = FALSE,
regex = FALSE,
verbose = TRUE,

)  

data_rename(
data,
pattern = NULL,
replacement = NULL,
safe = TRUE,
verbose = TRUE,

)  

data_rename_rows(data, rows = NULL)

Arguments

data  A data frame, or an object that can be coerced to a data frame.

pattern  Character vector. For data_rename(), indicates columns that should be selected for renaming. Can be NULL (in which case all columns are selected). For data_addprefix() or data_addsuffix(), a character string, which will be added as prefix or suffix to the column names.

select  Variables that will be included when performing the required tasks. Can be either

- a variable specified as a literal variable name (e.g., column_name),
- a string with the variable name (e.g., "column_name"), or a character vector of variable names (e.g., c("col1", "col2", "col3")),
- a formula with variable names (e.g., ~column_1 + column_2),
- a vector of positive integers, giving the positions counting from the left (e.g. 1 or c(1, 3, 5)),
- a vector of negative integers, giving the positions counting from the right (e.g., -1 or -1:-3),
- one of the following select-helpers: starts_with(), ends_with(), contains(), a range using : or regex(""), starts_with(), ends_with(), and contains() accept several patterns, e.g starts_with("Sep", "Petal").
- or a function testing for logical conditions, e.g. is.numeric() (or is.numeric), or any user-defined function that selects the variables for which the function returns TRUE (like: foo <- function(x) mean(x) > 3),
- ranges specified via literal variable names, select-helpers (except regex()) and (user-defined) functions can be negated, i.e. return non-matching elements, when prefixed with a -, e.g. -ends_with(""), -is.numeric or -(Sepal.Width:Petal.Length). Note: Negation means that matches are excluded, and thus, the exclude argument can be used alternatively. For instance, select=-ends_with("Length") (with -) is equivalent to
exclude=ends_with("Length") (no `-`). In case negation should not work as expected, use the exclude argument instead.

If NULL, selects all columns. Patterns that found no matches are silently ignored, e.g. find_columns(iris, select = c("Species", "Test")) will just return "Species".

exclude
See select, however, column names matched by the pattern from exclude will be excluded instead of selected. If NULL (the default), excludes no columns.

ignore_case
Logical, if TRUE and when one of the select-helpers or a regular expression is used in select, ignores lower/upper case in the search pattern when matching against variable names.

regex
Logical, if TRUE, the search pattern from select will be treated as regular expression. When regex = TRUE, select must be a character string (or a variable containing a character string) and is not allowed to be one of the supported select-helpers or a character vector of length > 1. regex = TRUE is comparable to using one of the two select-helpers, select = contains("" or select = regex(""), however, since the select-helpers may not work when called from inside other functions (see ’Details’), this argument may be used as workaround.

verbose
Toggle warnings and messages.

... Other arguments passed to or from other functions.

replacement
Character vector. Indicates the new name of the columns selected in pattern. Can be NULL (in which case column are numbered in sequential order). If not NULL, pattern and replacement must be of the same length.

safe
Do not throw error if for instance the variable to be renamed/removed doesn’t exist.

rows
Vector of row names.

Value
A modified data frame.

See Also
• Functions to rename stuff: data_rename(), data_rename_rows(), data_addprefix(), data_addsuffix()
• Functions to reorder or remove columns: data_reorder(), data_relocate(), data_remove()
• Functions to reshape, pivot or rotate data frames: data_to_long(), data_to_wide(), data_rotate()
• Functions to recode data: rescale(), reverse(), categorize(), recode_values(), slide()
• Functions to standardize, normalize, rank-transform: center(), standardize(), normalize(), ranktransform(), winsorize()
• Split and merge data frames: data_partition(), data_merge()
• Functions to find or select columns: data_select(), data_find()
• Functions to filter rows: data_match(), data_filter()
Examples

# Add prefix / suffix to all columns
head(data_addprefix(iris, "NEW_"))
head(data_addsuffix(iris, "_OLD"))

# Rename columns
head(data_rename(iris, "Sepal.Length", "length"))
# data_rename(iris, "FakeCol", "length", safe=FALSE) # This fails
head(data_rename(iris, "FakeCol", "length")) # This doesn't
head(data_rename(iris, c("Sepal.Length", "Sepal.Width"), c("length", "width")))

# Reset names
head(data_rename(iris, NULL))

# Change all
head(data_rename(iris, replacement = paste0("Var", 1:5)))

data_arrange

Arrange rows by column values

data_arrange() orders the rows of a data frame by the values of selected columns.

Usage

data_arrange(data, select = NULL, safe = TRUE)

Arguments

data A data frame, or an object that can be coerced to a data frame.
select Character vector of column names. Use a dash just before column name to
arrange in decreasing order, for example "-x1".
safe Do not throw an error if one of the variables specified doesn’t exist.

Value

A data frame.

Examples

# Arrange using several variables
data_arrange(head(mtcars), c("gear", "carb"))

# Arrange in decreasing order
data_arrange(head(mtcars), "-carb")
data_codebook

Generate a codebook of a data frame.

Description

data_codebook() generates codebooks from data frames, i.e. overviews of all variables and some more information about each variable (like labels, values or value range, frequencies, amount of missing values).

Usage

data_codebook(
  data,
  select = NULL,
  exclude = NULL,
  variable_label_width = NULL,
  value_label_width = NULL,
  max_values = 10,
  range_at = 6,
  ignore_case = FALSE,
  regex = FALSE,
  verbose = TRUE,
  ...
)

## S3 method for class 'data_codebook'
print_html(
  x,
  font_size = "100%",
  line_padding = 3,
  row_color = "#eeeeee",
  ...
)

Arguments

data A data frame, or an object that can be coerced to a data frame.
select Variables that will be included when performing the required tasks. Can be either
  • a variable specified as a literal variable name (e.g., column_name),
  • a string with the variable name (e.g., "column_name"), or a character vector
    of variable names (e.g., c("col1", "col2", "col3")),
• a formula with variable names (e.g., `~column_1 + column_2`),
• a vector of positive integers, giving the positions counting from the left (e.g., 1 or `c(1, 3, 5)`),
• a vector of negative integers, giving the positions counting from the right (e.g., `-1` or `-1:-3`),
• one of the following select-helpers: `starts_with()`, `ends_with()`, `contains()`,
  a range using `:` or `regex(""`). `starts_with()`, `ends_with()`, and `contains()` accept several patterns, e.g `starts_with("Sep", "Petal")`.
• or a function testing for logical conditions, e.g. `is.numeric()` (or `is.numeric`),
  or any user-defined function that selects the variables for which the function returns TRUE (like: `foo <- function(x) mean(x) > 3`),
• ranges specified via literal variable names, select-helpers (except `regex()`)
  and (user-defined) functions can be negated, i.e. return non-matching elements, when prefixed with a `-`, e.g. `-ends_with(""), -is.numeric or -(Sepal.Width:Petal.Length). **Note:** Negation means that matches are excluded, and thus, the exclude argument can be used alternatively. For instance, `select=-ends_with("Length")` (with `-`) is equivalent to `exclude=ends_with("Length")` (no `-`). In case negation should not work as expected, use the exclude argument instead.

If NULL, selects all columns. Patterns that found no matches are silently ignored, e.g. `find_columns(iris, select = c("Species", "Test"))` will just return "Species".

**exclude**
See select, however, column names matched by the pattern from exclude will be excluded instead of selected. If NULL (the default), excludes no columns.

**variable_label_width**
Length of variable labels. Longer labels will be wrapped at `variable_label_width` chars. If NULL, longer labels will not be split into multiple lines. Only applies to labelled data.

**value_label_width**
Length of value labels. Longer labels will be shortened, where the remaining part is truncated. Only applies to labelled data or factor levels.

**max_values**
Number of maximum values that should be displayed. Can be used to avoid too many rows when variables have lots of unique values.

**range_at**
Indicates how many unique values in a numeric vector are needed in order to print a range for that variable instead of a frequency table for all numeric values. Can be useful if the data contains numeric variables with only a few unique values and where full frequency tables instead of value ranges should be displayed.

**ignore_case**
Logical, if TRUE and when one of the select-helpers or a regular expression is used in select, ignores lower/upper case in the search pattern when matching against variable names.

**regex**
Logical, if TRUE, the search pattern from select will be treated as regular expression. When `regex = TRUE`, select **must** be a character string (or a variable containing a character string) and is not allowed to be one of the supported select-helpers or a character vector of length > 1. `regex = TRUE` is comparable to using one of the two select-helpers, `select = contains(""")` or `select = regex(""`), however, since the select-helpers may not work when called from inside other functions (see 'Details'), this argument may be used as workaround.
verbose    Toggle warnings and messages on or off.
...        Arguments passed to or from other methods.
x          A (grouped) data frame, a vector or a statistical model (for unstandardize() cannot be a model).
font_size  For HTML tables, the font size.
line_padding  For HTML tables, the distance (in pixel) between lines.
row_color  For HTML tables, the fill color for odd rows.

Value

A formatted data frame, summarizing the content of the data frame. Returned columns include the column index of the variables in the original data frame (ID), column name, variable label (if data is labelled), type of variable, number of missing values, unique values (or value range), value labels (for labelled data), and a frequency table (N for each value). Most columns are formatted as character vectors.

Note

There are methods to print() the data frame in a nicer output, as well methods for printing in markdown or HTML format (print_md() and print_html()).

Examples

data(iris)
data_codebook(iris, select = starts_with("Sepal"))

data(efc)
data_codebook(efc)

# shorten labels
data_codebook(efc, variable_label_width = 20, value_label_width = 15)

# automatic range for numerics at more than 5 unique values
data(mtcars)
data_codebook(mtcars, select = starts_with("c"))

# force all values to be displayed
data_codebook(mtcars, select = starts_with("c"), range_at = 100)

---

**data_duplicated**  

Extract all duplicates

Description

Extract all duplicates, for visual inspection. Note that it also contains the first occurrence of future duplicates, unlike duplicated() or dplyr::distinct(). Also contains an additional column reporting the number of missing values for that row, to help in the decision-making when selecting which duplicates to keep.
data_duplicated

Usage

data_duplicated(
  data,
  select = NULL,
  exclude = NULL,
  ignore_case = FALSE,
  regex = FALSE,
  verbose = TRUE
)

Arguments

data A data frame.

select Variables that will be included when performing the required tasks. Can be either

• a variable specified as a literal variable name (e.g., column_name),
• a string with the variable name (e.g., "column_name"), or a character vector of variable names (e.g., c("col1", "col2", "col3")),
• a formula with variable names (e.g., ~column_1 + column_2),
• a vector of positive integers, giving the positions counting from the left (e.g. 1 or c(1, 3, 5)),
• a vector of negative integers, giving the positions counting from the right (e.g., -1 or -1:-3),
• one of the following select-helpers: starts_with(), ends_with(), contains(),
  a range using or regex(""). starts_with(), ends_with(), and contains()
  accept several patterns, e.g starts_with("Sep", "Petal").
• or a function testing for logical conditions, e.g. is.numeric() (or is.numeric),
  or any user-defined function that selects the variables for which the function returns TRUE (like: foo <- function(x) mean(x) > 3),
• ranges specified via literal variable names, select-helpers (except regex())
  and (user-defined) functions can be negated, i.e. return non-matching elements, when prefixed with a -, e.g. -ends_with(""), -is.numeric or -(Sepal.Width:Petal.Length). Note: Negation means that matches are excluded, and thus, the exclude argument can be used alternatively. For instance, select=-ends_with("Length") (with -) is equivalent to exclude=ends_with("Length") (no -). In case negation should not work as expected, use the exclude argument instead.

If NULL, selects all columns. Patterns that found no matches are silently ignored, e.g. find_columns(iris, select = c("Species", "Test")) will just return "Species".

exclude See select, however, column names matched by the pattern from exclude will be excluded instead of selected. If NULL (the default), excludes no columns.

ignore_case Logical, if TRUE and when one of the select-helpers or a regular expression is used in select, ignores lower/upper case in the search pattern when matching against variable names.
**regex**

Logical, if TRUE, the search pattern from select will be treated as regular expression. When regex = TRUE, select must be a character string (or a variable containing a character string) and is not allowed to be one of the supported select-helpers or a character vector of length > 1. regex = TRUE is comparable to using one of the two select-helpers, select = contains("") or select = regex(""), however, since the select-helpers may not work when called from inside other functions (see 'Details'), this argument may be used as workaround.

**verbose**

Toggle warnings.

**Value**

A dataframe, containing all duplicates.

**See Also**

data_unique()

**Examples**

```r
df1 <- data.frame(
  id = c(1, 2, 3, 1, 3),
  year = c(2022, 2022, 2022, 2022, 2000),
  item1 = c(NA, 1, 1, 2, 3),
  item2 = c(NA, 1, 1, 2, 3),
  item3 = c(NA, 1, 1, 2, 3)
)

data_duplicated(df1, select = "id")

data_duplicated(df1, select = c("id", "year"))

# Filter to exclude duplicates
df2 <- df1[-c(1, 5), ]
df2
```

**data_extract**

*Extract one or more columns or elements from an object*

**Description**

data_extract() (or its alias extract()) is similar to $. It extracts either a single column or element from an object (e.g., a data frame, list), or multiple columns resp. elements.
Usage

\texttt{data\_extract(data, select, ...)}

\#\# S3 method for class 'data.frame'
\texttt{data\_extract(
  data,
  select,
  name = NULL,
  extract = "all",
  \texttt{as\_data\_frame} = \texttt{FALSE},
  ignore\_case = \texttt{FALSE},
  \texttt{regex} = \texttt{FALSE},
  \texttt{verbose} = \texttt{TRUE},
  ...)

Arguments

\texttt{data} \hspace{1cm} The object to subset. Methods are currently available for data frames and data frame extensions (e.g., tibbles).

\texttt{select} \hspace{1cm} Variables that will be included when performing the required tasks. Can be either

- a variable specified as a literal variable name (e.g., \texttt{column\_name}),
- a string with the variable name (e.g., "\texttt{column\_name}")
- a character vector of variable names (e.g., \texttt{c("col1", "col2", "col3")}),
- a formula with variable names (e.g., \texttt{~column\_1 + column\_2}),
- a vector of positive integers, giving the positions counting from the left (e.g. \texttt{1} or \texttt{c(1, 3, 5)}),
- a vector of negative integers, giving the positions counting from the right (e.g., \texttt{-1} or \texttt{-1:-3}),
- one of the following select-helpers: \texttt{starts\_with()}, \texttt{ends\_with()}, \texttt{contains()}, a range using : or \texttt{regex("\")}. \texttt{starts\_with()}, \texttt{ends\_with()}, and \texttt{contains()} accept several patterns, e.g \texttt{starts\_with("Sep", "Petal")}.
- or a function testing for logical conditions, e.g. \texttt{is.numeric()} (or \texttt{is.numeric}), or any user-defined function that selects the variables for which the function returns \texttt{TRUE} (like: \texttt{foo <- function(x) mean(x) > 3}),
- ranges specified via literal variable names, select-helpers (except \texttt{regex()}) and (user-defined) functions can be negated, i.e. return non-matching elements, when prefixed with a \texttt{-}, e.g. \texttt{~ends\_with("")}, \texttt{~is.numeric} or \texttt{~(Sepal\_Width:Petal\_Length)}. \textbf{Note}: Negation means that matches are \textit{excluded}, and thus, the exclude argument can be used alternatively. For instance, \texttt{select=-ends\_with("Length")} (with \texttt{-}) is equivalent to \texttt{exclude=ends\_with("Length")} (no \texttt{-}). In case negation should not work as expected, use the exclude argument instead.

If \texttt{NULL}, selects all columns. Patterns that found no matches are silently ignored, e.g. \texttt{find\_columns(iris, select = c("Species", "Test"))} will just return "Species".
... For use by future methods.

name An optional argument that specifies the column to be used as names for the vector elements after extraction. Must be specified either as literal variable name (e.g., column_name) or as string ("column_name"). name will be ignored when a data frame is returned.

extract String, indicating which element will be extracted when select matches multiple variables. Can be "all" (the default) to return all matched variables, "first" or "last" to return the first or last match, or "odd" and "even" to return all odd-numbered or even-numbered matches. Note that "first" or "last" return a vector (unless as_data_frame = TRUE), while "all" can return a vector (if only one match was found) or a data frame (for more than one match). Type safe return values are only possible when extract is "first" or "last" (will always return a vector) or when as_data_frame = TRUE (always returns a data frame).

as_data_frame Logical, if TRUE, will always return a data frame, even if only one variable was matched. If FALSE, either returns a vector or a data frame. See extract for details.

ignore_case Logical, if TRUE and when one of the select-helpers or a regular expression is used in select, ignores lower/upper case in the search pattern when matching against variable names.

regex Logical, if TRUE, the search pattern from select will be treated as regular expression. When regex = TRUE, select must be a character string (or a variable containing a character string) and is not allowed to be one of the supported select-helpers or a character vector of length > 1. regex = TRUE is comparable to using one of the two select-helpers, select = contains("") or select = regex(""), however, since the select-helpers may not work when called from inside other functions (see 'Details'), this argument may be used as workaround.

verbose Toggle warnings.

Details
data_extract() can be used to select multiple variables or pull a single variable from a data frame. Thus, the return value is by default not type safe - data_extract() either returns a vector or a data frame.

Extracting single variables (vectors): When select is the name of a single column, or when select only matches one column, a vector is returned. A single variable is also returned when extract is either "first" or "last". Setting as_data_frame to TRUE overrides this behaviour and always returns a data frame.

Extracting a data frame of variables: When select is a character vector containing more than one column name (or a numeric vector with more than one valid column indices), or when select uses one of the supported select-helpers that match multiple columns, a data frame is returned. Setting as_data_frame to TRUE always returns a data frame.

Value

A vector (or a data frame) containing the extracted element, or NULL if no matching variable was found.
Examples

# single variable
data_extract(mtcars, cyl, name = gear)
data_extract(mtcars, "cyl", name = gear)
data_extract(mtcars, -1, name = gear)
data_extract(mtcars, cyl, name = 0)
data_extract(mtcars, cyl, name = "row.names")

# selecting multiple variables
head(data_extract(iris, starts_with("Sepal")))
head(data_extract(iris, ends_with("Width")))
head(data_extract(iris, 2:4))

# select first of multiple variables
data_extract(iris, starts_with("Sepal"), extract = "first")

# select first of multiple variables, return as data frame
head(data_extract(iris, starts_with("Sepal"), extract = "first", as_data_frame = TRUE))

data_group

Create a grouped data frame

Description

This function is comparable to dplyr::group_by(), but just following the datawizard function design. data_ungroup() removes the grouping information from a grouped data frame.

Usage

data_group(
  data,
  select = NULL,
  exclude = NULL,
  ignore_case = FALSE,
  regex = FALSE,
  verbose = TRUE,
  ...
)
data_ungroup(data, verbose = TRUE, ...)

Arguments

data A data frame
select Variables that will be included when performing the required tasks. Can be either
  • a variable specified as a literal variable name (e.g., column_name),
• a string with the variable name (e.g., "column_name"), or a character vector of variable names (e.g., c("col1", "col2", "col3")),
• a formula with variable names (e.g., -~column_1 + column_2),
• a vector of positive integers, giving the positions counting from the left (e.g., 1 or c(1, 3, 5)),
• a vector of negative integers, giving the positions counting from the right (e.g., -1 or -1:-3),
• one of the following select-helpers: starts_with(), ends_with(), contains(), a range using : or regex(""), starts_with(), ends_with(), and contains() accept several patterns, e.g. starts_with("Sep", "Petal").
• or a function testing for logical conditions, e.g. is.numeric() (or is.numeric), or any user-defined function that selects the variables for which the function returns TRUE (like: foo <- function(x) mean(x) > 3),
• ranges specified via literal variable names, select-helpers (except regex()) and (user-defined) functions can be negated, i.e. return non-matching elements, when prefixed with a -, e.g. -ends_with(""), -is.numeric or -(Sepal.Width: Petal.Length). Note: Negation means that matches are excluded, and thus, the exclude argument can be used alternatively. For instance, select=-ends_with("Length") (with -) is equivalent to exclude=ends_with("Length") (no -). In case negation should not work as expected, use the exclude argument instead.

If NULL, selects all columns. Patterns that found no matches are silently ignored, e.g. find_columns(iris, select = c("Species", "Test")) will just return "Species".

exclude See select, however, column names matched by the pattern from exclude will be excluded instead of selected. If NULL (the default), excludes no columns.

ignore_case Logical, if TRUE and when one of the select-helpers or a regular expression is used in select, ignores lower/upper case in the search pattern when matching against variable names.

regex Logical, if TRUE, the search pattern from select will be treated as regular expression. When regex = TRUE, select must be a character string (or a variable containing a character string) and is not allowed to be one of the supported select-helpers or a character vector of length > 1. regex = TRUE is comparable to using one of the two select-helpers, select = contains("") or select = regex(""), however, since the select-helpers may not work when called from inside other functions (see 'Details'), this argument may be used as workaround.

verbose Toggle warnings.

Arguments passed down to other functions. Mostly not used yet.

Value

A grouped data frame, i.e. a data frame with additional information about the grouping structure saved as attributes.
data_match

Examples

data(efc)
suppressPackageStartupMessages(library(poorman, quietly = TRUE))

# total mean
efc %>%
  summarize(mean_hours = mean(c12hour, na.rm = TRUE))

# mean by educational level
efc %>%
  data_group(c172code) %>%
  summarize(mean_hours = mean(c12hour, na.rm = TRUE))

data_match

Description

Return a filtered (or sliced) data frame or row indices of a data frame that match a specific condition. 
data_filter() works like data_match(), but works with logical expressions or row indices of a data frame to specify matching conditions.

Usage

data_match(x, to, match = "and", return_indices = FALSE, drop_na = TRUE, ...)
data_filter(x, ...)

Arguments

x
A data frame.

to
A data frame matching the specified conditions. Note that if match is a value other than "and", the original row order might be changed. See 'Details'.

match
String, indicating with which logical operation matching conditions should be combined. Can be "and" (or "&"), "or" (or "|") or "not" (or "!").

return_indices
Logical, if FALSE, return the vector of rows that can be used to filter the original data frame. If FALSE (default), returns directly the filtered data frame instead of the row indices.

drop_na
Logical, if TRUE, missing values (NAs) are removed before filtering the data. This is the default behaviour, however, sometimes when row indices are requested (i.e. return_indices=TRUE), it might be useful to preserve NA values, so returned row indices match the row indices of the original data frame.
A sequence of logical expressions indicating which rows to keep, or a numeric vector indicating the row indices of rows to keep. Can also be a string representation of a logical expression (e.g. "x > 4"), a character vector (e.g. c("x > 4", "y == 2")) or a variable that contains the string representation of a logical expression. These might be useful when used in packages to avoid defining undefined global variables.

Details

For `data_match()`, if `match` is either "or" or "not", the original row order from `x` might be changed. If preserving row order is required, use `data_filter()` instead.

```r
# mimics subset() behaviour, preserving original row order
head(data_filter(mtcars[c("mpg", "vs", "am")], vs == 0 | am == 1))
#>   mpg vs am
#> Mazda RX4 21.0 0 1
#> Mazda RX4 Wag 21.0 0 1
#> Datsun 710 22.8 1 1
#> Hornet Sportabout 18.7 0 0
#> Duster 360 14.3 0 0
#> Merc 450SE 16.4 0 0

# re-sorting rows
head(data_match(mtcars[c("mpg", "vs", "am")],
          data.frame(vs = 0, am = 1),
          match = "or"))
#>   mpg vs am
#> Mazda RX4 21.0 0 1
#> Mazda RX4 Wag 21.0 0 1
#> Datsun 710 22.8 1 1
#> Hornet Sportabout 18.7 0 0
#> Duster 360 14.3 0 0
#> Merc 450SE 16.4 0 0
#> Merc 450SL 17.3 0 0
```

While `data_match()` works with data frames to match conditions against, `data_filter()` is basically a wrapper around `subset(subset = <filter>).` However, unlike `subset()`, it preserves label attributes and is useful when working with labelled data.

Value

A filtered data frame, or the row indices that match the specified configuration.

See Also

- Functions to rename stuff: `data_rename()`, `data_rename_rows()`, `data_addprefix()`, `data_addsuffix()
- Functions to reorder or remove columns: `data_reorder()`, `data_relocate()`, `data_remove()
- Functions to reshape, pivot or rotate data frames: `data_to_long()`, `data_to_wide()`, `data_rotate()
- Functions to recode data: `rescale()`, `reverse()`, `categorize()`, `recode_values()`, `slide()`
• Functions to standardize, normalize, rank-transform: \texttt{center()}, \texttt{standardize()}, \texttt{normalize()}, \texttt{ranktransform()}, \texttt{winsorize()}

• Split and merge data frames: \texttt{data_partition()}, \texttt{data_merge()}

• Functions to find or select columns: \texttt{data_select()}, \texttt{data_find()}

• Functions to filter rows: \texttt{data_match()}, \texttt{data_filter()}

Examples

\begin{verbatim}
data_match(mtcars, data.frame(vs = 0, am = 1))
data_match(mtcars, data.frame(vs = 0, am = c(0, 1)))
# observations where "vs" is NOT 0 AND "am" is NOT 1
data_match(mtcars, data.frame(vs = 0, am = 1), match = "not")
# equivalent to
data_filter(mtcars, vs != 0 & am != 1)

# observations where EITHER "vs" is 0 OR "am" is 1
data_match(mtcars, data.frame(vs = 0, am = 1), match = "or")
# equivalent to
data_filter(mtcars, vs == 0 | am == 1)

# slice data frame by row indices
data_filter(mtcars, 5:10)

# Define a custom function containing data_filter()
my_filter <- function(data, variable)
  data_filter(data, variable)
my_filter(mtcars, "cyl == 6")

# Pass complete filter-condition as string.
my_filter <- function(data, condition)
  data_filter(data, condition)
my_filter(mtcars, "am != 0")
# string can also be used directly as argument
data_filter(mtcars, "am != 0")

# or as variable
fl <- "am != 0"
data_filter(mtcars, fl)
\end{verbatim}

\section*{data_merge}

\textit{Merge (join) two data frames, or a list of data frames}

\section*{Description}

Merge (join) two data frames, or a list of data frames. However, unlike base R’s \texttt{merge()}, \texttt{data_merge()} offers a few more methods to join data frames, and it does not drop data frame nor column attributes.
Usage

data_merge(x, ...)  
data_join(x, ...)

## S3 method for class 'data.frame'
data_merge(x, y, join = "left", by = NULL, id = NULL, verbose = TRUE, ...)

## S3 method for class 'list'
data_merge(x, join = "left", by = NULL, id = NULL, verbose = TRUE, ...)

Arguments

x, y          A data frame to merge. x may also be a list of data frames that will be merged.  
              Note that the list-method has no y argument.

...          Not used.

join         Character vector, indicating the method of joining the data frames. Can be  
              "full", "left" (default), "right", "inner", "anti", "semi" or "bind". See  
              details below.

by           Specifications of the columns used for merging.

id           Optional name for ID column that will be created to indicate the source data  
              frames for appended rows. Only applies if join = "bind".

verbose      Toggle warnings.

Details

Merger data frames: Merging data frames is performed by adding rows (cases), columns  
(variables) or both from the source data frame (y) to the target data frame (x). This usually requires  
one or more variables which are included in both data frames and that are used for merging,  
typically indicated with the by argument. When by contains a variable present in both data frames,  
cases are matched and filtered by identical values of by in x and y.

Left- and right-joins: Left- and right joins usually don’t add new rows (cases), but only new  
columns (variables) for existing cases in x. For join = "left" or join = "right" to work, by  
must indicate one or more columns that are included in both data frames. For join = "left", if  
by is an identifier variable, which is included in both x and y, all variables from y are copied to x,  
but only those cases from y that have matching values in their identifier variable in x (i.e. all cases  
in x that are also found in y get the related values from the new columns in y). If there is no match  
between identifiers in x and y, the copied variable from y will get a NA value for this particular  
case. Other variables that occur both in x and y, but are not used as identifiers (with by), will be  
renamed to avoid multiple identical variable names. Cases in y where values from the identifier  
have no match in x’s identifier are removed. join = "right" works in a similar way as join =  
"left", just that only cases from x that have matching values in their identifier variable in y are  
chosen.

In base R, these are equivalent to merge(x, y, all.x = TRUE) and merge(x, y, all.y = TRUE).
**Full joins:** Full joins copy all cases from \(y\) to \(x\). For matching cases in both data frames, values for new variables are copied from \(y\) to \(x\). For cases in \(y\) not present in \(x\), these will be added as new rows to \(x\). Thus, full joins not only add new columns (variables), but also might add new rows (cases).

In base R, this is equivalent to \texttt{merge(x, y, all = TRUE)}.

**Inner joins:** Inner joins merge two data frames, however, only those rows (cases) are kept that are present in both data frames. Thus, inner joins usually add new columns (variables), but also remove rows (cases) that only occur in one data frame.

In base R, this is equivalent to \texttt{merge(x, y)}.

**Binds:** \texttt{join = "bind"} row-binds the complete second data frame \(y\) to \(x\). Unlike simple \texttt{rbind()}, which requires the same columns for both data frames, \texttt{join = "bind"} will bind shared columns from \(y\) to \(x\), and add new columns from \(y\) to \(x\).

**Value**

A merged data frame.

**See Also**

- Functions to rename stuff: \texttt{data_rename()}, \texttt{data_rename_rows()}, \texttt{data_addprefix()}, \texttt{data_addsuffix()}
- Functions to reorder or remove columns: \texttt{data_reorder()}, \texttt{data_relocate()}, \texttt{data_remove()}
- Functions to reshape, pivot or rotate data frames: \texttt{data_to_long()}, \texttt{data_to_wide()}, \texttt{data_rotate()}
- Functions to recode data: \texttt{rescale()}, \texttt{reverse()}, \texttt{categorize()}, \texttt{recode_values()}, \texttt{slide()}
- Functions to standardize, normalize, rank-transform: \texttt{center()}, \texttt{standardize()}, \texttt{normalize()}, \texttt{ranktransform()}, \texttt{winsorize()}
- Split and merge data frames: \texttt{data_partition()}, \texttt{data_merge()}
- Functions to find or select columns: \texttt{data_select()}, \texttt{data_find()}
- Functions to filter rows: \texttt{data_match()}, \texttt{data_filter()}

**Examples**

```r
x <- data.frame(a = 1:3, b = c("a", "b", "c"), c = 5:7, id = 1:3)
y <- data.frame(c = 6:8, d = c("f", "g", "h"), e = 100:102, id = 2:4)
x
y

# "by" will default to all shared columns, i.e. "c" and "id". new columns
# "d" and "e" will be copied from "y" to "x", but there are only two cases
# in "x" that have the same values for "c" and "id" in "y". only those cases
# have values in the copied columns, the other case gets "NA".
data_merge(x, y, join = "left")
```
# we change the id-value here
x <- data.frame(a = 1:3, b = c("a", "b", "c"), c = 5:7, id = 1:3)
y <- data.frame(c = 6:8, d = c("f", "g", "h"), e = 100:102, id = 3:5)

x
y

# no cases in "y" have the same matching "c" and "id" as in "x", thus
# copied variables from "y" to "x" copy no values, all get NA.
data_merge(x, y, join = "left")

# one case in "y" has a match in "id" with "x", thus values for this
# case from the remaining variables in "y" are copied to "x", all other
# values (cases) in those remaining variables get NA
data_merge(x, y, join = "left", by = "id")

data(mtcars)
x <- mtcars[1:5, 1:3]
y <- mtcars[28:32, 4:6]

# add ID common column
x$id <- 1:5
y$id <- 3:7

# left-join, add new variables and copy values from y to x,
# where "id" values match
data_merge(x, y)

# right-join, add new variables and copy values from x to y,
# where "id" values match
data_merge(x, y, join = "right")

# full-join
data_merge(x, y, join = "full")

data(mtcars)
x <- mtcars[1:5, 1:3]
y <- mtcars[28:32, c(1, 4:5)]

# add ID common column
x$id <- 1:5
y$id <- 3:7

# left-join, no matching rows (because columns "id" and "disp" are used)
# new variables get all NA values
data_merge(x, y)

# one common value in "mpg", so one row from y is copied to x
data_merge(x, y, by = "mpg")

# only keep rows with matching values in by-column
data_merge(x, y, join = "semi", by = "mpg")
# only keep rows with non-matching values in by-column
data_merge(x, y, join = "anti", by = "mpg")

# merge list of data frames. can be of different rows
x <- mtcars[1:5, 1:3]
y <- mtcars[28:31, 3:5]
z <- mtcars[11:18, c(1, 3:4, 6:8)]
x$id <- 1:5
y$id <- 4:7
z$id <- 3:10
data_merge(list(x, y, z), join = "bind", by = "id", id = "source")

data_modify

Create new variables in a data frame

Description

Create new variables or modify existing variables in a data frame. Unlike base::transform(), data_modify() can be used on grouped data frames, and newly created variables can be directly used.

Usage

data_modify(data, ...)

Arguments

data
A data frame

...
One or more expressions that define the new variable name and the values or recoding of those new variables. These expressions can be one of:

• A sequence of named, literal expressions, where the left-hand side refers to the name of the new variable, while the right-hand side represent the values of the new variable. Example: Sepal.Width = center(Sepal.Width).

• A sequence of string values, representing expressions.

• A variable that contains a string representation of the expression. Example: a <- "2 * Sepal.Width"
data_modify(iris, a)

• A character vector of expressions. Example: c("SW_double = 2 * Sepal.Width", "SW_fraction = SW_double / 10"). This type of expression cannot be mixed with other expressions, i.e. if a character vector is provided, you may not add further elements to ....

• Using NULL as right-hand side removes a variable from the data frame. Example: Petal.Width = NULL.

Note that newly created variables can be used in subsequent expressions. See also 'Examples'.
**Note**

data_modify() can also be used inside functions. However, it is recommended to pass the recode-expression as character vector or list of characters.

**Examples**

data(efc)
new_efc <- data_modify(
  efc,
  c12hour_c = center(c12hour),
  c12hour_z = c12hour_c / sd(c12hour, na.rm = TRUE),
  c12hour_z2 = standardize(c12hour)
)
head(new_efc)

# using strings instead of literal expressions
new_efc <- data_modify(
  efc,
  "c12hour_c = center(c12hour)",
  "c12hour_z = c12hour_c / sd(c12hour, na.rm = TRUE)",
  "c12hour_z2 = standardize(c12hour)"
)
head(new_efc)

# using character strings, provided as variable
stand <- "c12hour_c / sd(c12hour, na.rm = TRUE)"
new_efc <- data_modify(
  efc,
  c12hour_c = center(c12hour),
  c12hour_z = stand
)
head(new_efc)

# providing expressions as character vector
new_exp <- c(
  "c12hour_c = center(c12hour)",
  "c12hour_z = c12hour_c / sd(c12hour, na.rm = TRUE)"
)
new_efc <- data_modify(efc, new_exp)
head(new_efc)

# attributes - in this case, value and variable labels - are preserved
str(new_efc)

# overwrite existing variable, remove old variable
out <- data_modify(iris, Petal.Length = 1 / Sepal.Length, Sepal.Length = NULL)
head(out)

# works on grouped data
grouped_efc <- data_group(efc, "c172code")
new_efc <- data_modify(
  grouped_efc,
c12hour_c = center(c12hour),
c12hour_z = c12hour_c / sd(c12hour, na.rm = TRUE),
c12hour_z2 = standardize(c12hour)
)
head(new_efc)

# works from inside functions
foo <- function(data, z) {
  head(data_modify(data, z))
}
foo(iris, "var_a = Sepal.Width / 10")

new_exp <- c("SW_double = 2 * Sepal.Width", "SW_fraction = SW_double / 10")
foo(iris, new_exp)

data_partition

Description

Creates data partitions (for instance, a training and a test set) based on a data frame that can also be stratified (i.e., evenly spread a given factor) using the group argument.

Usage

data_partition(
  data,
  proportion = 0.7,
  group = NULL,
  seed = NULL,
  row_id = ".row_id",
  verbose = TRUE,
  training_proportion = proportion,
  ...
)

Arguments

data A data frame, or an object that can be coerced to a data frame.
proportion Scalar (between 0 and 1) or numeric vector, indicating the proportion(s) of the training set(s). The sum of proportion must not be greater than 1. The remaining part will be used for the test set.
group A character vector indicating the name(s) of the column(s) used for stratified partitioning.
seed A random number generator seed. Enter an integer (e.g. 123) so that the random sampling will be the same each time you run the function.
row_id Character string, indicating the name of the column that contains the row-id's.
**data_partition**

- **verbose**  
  Toggle messages and warnings.
- **training_proportion**  
  Deprecated, please use proportion.
- **...**  
  Other arguments passed to or from other functions.

**Value**

A list of data frames. The list includes one training set per given proportion and the remaining data as test set. List elements of training sets are named after the given proportions (e.g., $p_{0.7}$), the test set is named $test$.

**See Also**

- Functions to rename stuff: `data_rename()`, `data_rename_rows()`, `data_addprefix()`, `data_addsuffix()`
- Functions to reorder or remove columns: `data_reorder()`, `data_relocate()`, `data_remove()`
- Functions to reshape, pivot or rotate data frames: `data_to_long()`, `data_to_wide()`, `data_rotate()`
- Functions to recode data: `rescale()`, `reverse()`, `categorize()`, `recode_values()`, `slide()`
- Functions to standardize, normalize, rank-transform: `center()`, `standardize()`, `normalize()`, `ranktransform()`, `winsorize()`
- Split and merge data frames: `data_partition()`, `data_merge()`
- Functions to find or select columns: `data_select()`, `data_find()`
- Functions to filter rows: `data_match()`, `data_filter()`

**Examples**

```r
data(iris)
out <- data_partition(iris, proportion = 0.9)
out$test
nrow(out$p_0.9)

# Stratify by group (equal proportions of each species)
out <- data_partition(iris, proportion = 0.9, group = "Species")
out$test

# Create multiple partitions
out <- data_partition(iris, proportion = c(0.3, 0.3))
lapply(out, head)

# Create multiple partitions, stratified by group - 30% equally sampled
# from species in first training set, 50% in second training set and
# remaining 20% equally sampled from each species in test set.
out <- data_partition(iris, proportion = c(0.3, 0.5), group = "Species")
lapply(out, function(i) table(i$Species))
```
datapeek

Peek at values and type of variables in a data frame

Description

This function creates a table a data frame, showing all column names, variable types and the first values (as many as fit into the screen).

Usage

datapeek(x, ...)

## S3 method for class 'data.frame'
datapeek(
x, select = NULL, exclude = NULL, ignore_case = FALSE, regex = FALSE, width = NULL, verbose = TRUE, ...
)

Arguments

x A data frame.

... not used.

select Variables that will be included when performing the required tasks. Can be either

- a variable specified as a literal variable name (e.g., column_name),
- a string with the variable name (e.g., "column_name"), or a character vector of variable names (e.g., c("col1", "col2", "col3")),
- a formula with variable names (e.g., -column_1 + column_2),
- a vector of positive integers, giving the positions counting from the left (e.g. 1 or c(1, 3, 5)),
- a vector of negative integers, giving the positions counting from the right (e.g., -1 or -1:-3),
- one of the following select-helpers: starts_with(), ends_with(), contains(), a range using : or regex(""). starts_with(), ends_with(), and contains() accept several patterns, e.g starts_with("Sep", "Petal"),
- or a function testing for logical conditions, e.g. is.numeric() (or is.numeric), or any user-defined function that selects the variables for which the function returns TRUE (like: foo <- function(x) mean(x) > 3),
• ranges specified via literal variable names, select-helpers (except `regex()`) and (user-defined) functions can be negated, i.e. return non-matching elements, when prefixed with a -, e.g. `-ends_with(""), `-is.numeric` or `- (Sepal.Width: Petal.Length). **Note:** Negation means that matches are excluded, and thus, the exclude argument can be used alternatively. For instance, `select=-ends_with("Length")` (with `=`) is equivalent to `exclude=ends_with("Length")` (no `=`). In case negation should not work as expected, use the exclude argument instead.

If NULL, selects all columns. Patterns that found no matches are silently ignored, e.g. `find_columns(iris, select = c("Species", "Test"))` will just return "Species".

`exclude`  See select, however, column names matched by the pattern from exclude will be excluded instead of selected. If NULL (the default), excludes no columns.

`ignore_case` Logical, if TRUE and when one of the select-helpers or a regular expression is used in select, ignores lower/upper case in the search pattern when matching against variable names.

`regex` Logical, if TRUE, the search pattern from select will be treated as regular expression. When `regex = TRUE`, select must be a character string (or a variable containing a character string) and is not allowed to be one of the supported select-helpers or a character vector of length > 1. `regex = TRUE` is comparable to using one of the two select-helpers, `select = contains("")` or `select = regex("")`, however, since the select-helpers may not work when called from inside other functions (see 'Details'), this argument may be used as workaround.

`width` Maximum width of line length to display. If NULL, width will be determined using `options()$width`.

`verbose` Toggle warnings.

**Value**

A data frame with three columns, containing information about the name, type and first values of the input data frame.

**Note**

To show only specific or a limited number of variables, use the select argument, e.g. `select = 1:5` to show only the first five variables.

**Examples**

```
data(efc)
data_peek(efc)
# show variables two to four
data_peek(efc, select = 2:4)
```
data_read

Description

This function imports data from various file types. It is a small wrapper around haven::read_spss(), haven::read_stata(), haven::read_sas(), readxl::read_excel() and data.table::fread() resp. readr::read_delim() (the latter if package data.table is not installed). Thus, supported file types for importing data are data files from SPSS, SAS or Stata, Excel files or text files (like `.csv` files). All other file types are passed to rio::import(). data_write() works in a similar way.

Usage

```r
data_read(
  path,
  path_catalog = NULL,
  encoding = NULL,
  convert_factors = TRUE,
  verbose = TRUE,
  ...
)
```

```r
data_write(
  data,
  path,
  delimiter = ",",
  convert_factors = FALSE,
  save_labels = FALSE,
  verbose = TRUE,
  ...
)
```

Arguments

- **path**: Character string, the file path to the data file.
- **path_catalog**: Character string, path to the catalog file. Only relevant for SAS data files.
- **encoding**: The character encoding used for the file. Usually not needed.
- **convert_factors**: If TRUE (default), numeric variables, where all values have a value label, are assumed to be categorical and converted into factors. If FALSE, no variable types are guessed and no conversion of numeric variables into factors will be performed. See also section 'Differences to other packages'. For data_write(), this argument only applies to the text (e.g. .txt or .csv) or spreadsheet file formats (like .xlsx). Converting to factors might be useful for these formats because labelled numeric variables are then converted into factors and exported as character columns - else, value labels would be lost and only numeric values are written to the file.
data_read

verbose

Arguments passed to the related read_*() or write_*() functions.

data

The data frame that should be written to a file.

delimiter

For CSV-files, specifies the delimiter. Defaults to ",", but in particular in European regions, ";" might be a useful alternative, especially when exported CSV-files should be opened in Excel.

save_labels

Only applies to CSV files. If TRUE, value and variable labels (if any) will be saved as additional CSV file. This file has the same file name as the exported CSV file, but includes a "_labels" suffix (i.e. when the file name is "mydat.csv", the additional file with value and variable labels is named "mydat_labels.csv").

Value

A data frame.

Supported file types

• data_read() is a wrapper around the haven, data.table, readr readxl and rio packages. Currently supported file types are .txt, .csv, .xls, .xlsx, .sav, .por, .dta and .sas (and related files). All other file types are passed to rio::import().

• data_write() is a wrapper around haven, readr and rio packages, and supports writing files into all formats supported by these packages.

Compressed files (zip) and URLs

data_read() can also read the above mentioned files from URLs or from inside zip-compressed files. Thus, path can also be a URL to a file like "http://www.url.com/file.csv". When path points to a zip-compressed file, and there are multiple files inside the zip-archive, then the first supported file is extracted and loaded.

General behaviour

data_read() detects the appropriate read_*() function based on the file-extension of the data file. Thus, in most cases it should be enough to only specify the path argument. However, if more control is needed, all arguments in ... are passed down to the related read_*() function. The same applies to data_write(), i.e. based on the file extension provided in path, the appropriate write_*() function is used automatically.

SPSS specific behaviour

data_read() does not import user-defined ("tagged") NA values from SPSS, i.e. argument user_na is always set to FALSE when importing SPSS data with the haven package. Use convert_to_na() to define missing values in the imported data, if necessary. Furthermore, data_write() compresses SPSS files by default. If this causes problems with (older) SPSS versions, use compress = "none", for example data_write(data, "myfile.sav", compress = "none").
Differences to other packages that read foreign data formats

data_read() is most comparable to rio::import(). For data files from SPSS, SAS or Stata, which support labelled data, variables are converted into their most appropriate type. The major difference to rio::import() is that data_read() automatically converts fully labelled numeric variables into factors, where imported value labels will be set as factor levels. If a numeric variable has no value labels or less value labels than values, it is not converted to factor. In this case, value labels are preserved as “labels” attribute. Character vectors are preserved. Use convert_factors = FALSE to remove the automatic conversion of numeric variables to factors.

---

data_relocate

Relocate (reorder) columns of a data frame

Description

data_relocate() will reorder columns to specific positions, indicated by before or after. data_reorder() will instead move selected columns to the beginning of a data frame. Finally, data_remove() removes columns from a data frame. All functions support select-helpers that allow flexible specification of a search pattern to find matching columns, which should be reordered or removed.

Usage

data_relocate(
  data,
  select,
  before = NULL,
  after = NULL,
  ignore_case = FALSE,
  regex = FALSE,
  verbose = TRUE,
  ...
)

data_reorder(
  data,
  select,
  exclude = NULL,
  ignore_case = FALSE,
  regex = FALSE,
  verbose = TRUE,
  ...
)

data_remove(
  data,
  select = NULL,
  exclude = NULL,
  ...
\begin{verbatim}
  ignore_case = FALSE,
  regex = FALSE,
  verbose = FALSE,
  ...
)

Arguments

data
  A data frame.

select
  Variables that will be included when performing the required tasks. Can be
  either
  • a variable specified as a literal variable name (e.g., column_name),
  • a string with the variable name (e.g., "column_name"), or a character vector
    of variable names (e.g., c("col1", "col2", "col3")),
  • a formula with variable names (e.g., ~column_1 + column_2),
  • a vector of positive integers, giving the positions counting from the left (e.g.
    1 or c(1, 3, 5)),
  • a vector of negative integers, giving the positions counting from the right
    (e.g., -1 or -1:-3),
  • one of the following select-helpers: starts_with(), ends_with(), contains(),
    a range using : or regex(""), starts_with(), ends_with(), and contains()
    accept several patterns, e.g starts_with("Sep", "Petal").
  • or a function testing for logical conditions, e.g. is.numeric() (or is.numeric),
    or any user-defined function that selects the variables for which the function
    returns TRUE (like: foo <- function(x) mean(x) > 3),
  • ranges specified via literal variable names, select-helpers (except regex())
    and (user-defined) functions can be negated, i.e. return non-matching ele-
    ments, when prefixed with a -, e.g. -ends_with(""), -is.numeric or
    -(Sepal.Width:Petal.Length). Note: Negation means that matches
    are excluded, and thus, the exclude argument can be used alternatively.
    For instance, select=-ends_with("Length") (with -) is equivalent to
    exclude=ends_with("Length") (no -). In case negation should not work
    as expected, use the exclude argument instead.
  If NULL, selects all columns. Patterns that found no matches are silently ignored,
  e.g. find_columns(iris, select = c("Species", "Test")) will just return
  "Species".

before, after
  Destination of columns. Supplying neither will move columns to the left-hand
  side; specifying both is an error. Can be a character vector, indicating the name
  of the destination column, or a numeric value, indicating the index number of
  the destination column. If -1, will be added before or after the last column.

ignore_case
  Logical, if TRUE and when one of the select-helpers or a regular expression is
  used in select, ignores lower/upper case in the search pattern when matching
  against variable names.

regex
  Logical, if TRUE, the search pattern from select will be treated as regular ex-
  pression. When regex = TRUE, select must be a character string (or a variable
  containing a character string) and is not allowed to be one of the supported
\end{verbatim}
select-helpers or a character vector of length > 1. regex = TRUE is comparable to using one of the two select-helpers, select = contains("") or select = regex(""), however, since the select-helpers may not work when called from inside other functions (see 'Details'), this argument may be used as workaround.

verbose
Toggle warnings.

Arguments passed down to other functions. Mostly not used yet.

exclude
See select, however, column names matched by the pattern from exclude will be excluded instead of selected. If NULL (the default), excludes no columns.

Value
A data frame with reordered columns.

See Also
- Functions to rename stuff: data_rename(), data_rename_rows(), data_addprefix(), data_addsuffix()
- Functions to reorder or remove columns: data_reorder(), data_relocate(), data_remove()
- Functions to reshape, pivot or rotate data frames: data_to_long(), data_to_wide(), data_rotate()
- Functions to recode data: rescale(), reverse(), categorize(), recode_values(), slide()
- Functions to standardize, normalize, rank-transform: center(), standardize(), normalize(), ranktransform(), winsorize()
- Split and merge data frames: data_partition(), data_merge()
- Functions to find or select columns: data_select(), data_find()
- Functions to filter rows: data_match(), data_filter()

Examples

# Reorder columns
head(data_relocate(iris, select = "Species", before = "Sepal.Length"))
head(data_relocate(iris, select = "Species", before = "Sepal.Width"))
head(data_relocate(iris, select = "Sepal.Width", after = "Species"))
# which is same as
head(data_relocate(iris, select = "Sepal.Width", after = -1))

# Reorder multiple columns
head(data_relocate(iris, select = c("Species", "Petal.Length"), after = "Sepal.Width"))
# which is same as
head(data_relocate(iris, select = c("Species", "Petal.Length"), after = 2))

# Reorder columns
head(data_reorder(iris, c("Species", "Sepal.Length")))

# Remove columns
head(data_remove(iris, "Sepal.Length"))
head(data_remove(iris, starts_with("Sepal")))
**data_restoretype**  
*Restore the type of columns according to a reference data frame*

**Description**

Restore the type of columns according to a reference data frame

**Usage**

```r
data_restoretype(data, reference = NULL, ...)
```

**Arguments**

- `data`  
  A data frame to pivot.
- `reference`  
  A reference data frame from which to find the correct column types. If NULL, each column is converted to numeric if it doesn’t generate NAs. For example, `c("1", "2")` can be converted to numeric but not `c("Sepal.Length")`.
- `...`  
  Currently not used.

**Value**

A data frame with columns whose types have been restored based on the reference data frame.

**Examples**

```r
data <- data.frame(  
  Sepal.Length = c("1", "3", "2"),  
  Species = c("setosa", "versicolor", "setosa"),  
  New = c("1", "3", "4")
)
fixed <- data_restoretype(data, reference = iris)
summary(fixed)
```

---

**data_rotate**  
*Rotate a data frame*

**Description**

This function rotates a data frame, i.e. columns become rows and vice versa. It’s the equivalent of using `t()` but restores the `data.frame` class, preserves attributes and prints a warning if the data type is modified (see example).
Usage

data_rotate(data, rownames = NULL, colnames = FALSE, verbose = TRUE)
data_transpose(data, rownames = NULL, colnames = FALSE, verbose = TRUE)

Arguments

data  A data frame.
rownames  Character vector (optional). If not NULL, the data frame’s rownames will be added as (first) column to the output, with rownames being the name of this column.
colnames  Logical or character vector (optional). If TRUE, the values of the first column in x will be used as column names in the rotated data frame. If a character vector, values from that column are used as column names.
verbose  Toggle warnings.

Value

A (rotated) data frame.

See Also

• Functions to rename stuff: data_rename(), data_rename_rows(), data_addprefix(), data_addsuffix()
• Functions to reorder or remove columns: data_reorder(), data_relocate(), data_remove()
• Functions to reshape, pivot or rotate data frames: data_to_long(), data_to_wide(), data_rotate()
• Functions to recode data: rescale(), reverse(), categorize(), recode_values(), slide()
• Functions to standardize, normalize, rank-transform: center(), standardize(), normalize(), ranktransform(), winsorize()
• Split and merge data frames: data_partition(), data_merge()
• Functions to find or select columns: data_select(), data_find()
• Functions to filter rows: data_match(), data_filter()

Examples

x <- mtcars[1:3, 1:4]
x

data_rotate(x)
data_rotate(x, rownames = "property")

# use values in 1. column as column name
data_rotate(x, colnames = TRUE)
data_rotate(x, rownames = "property", colnames = TRUE)

# use either first column or specific column for column names
x <- data.frame(a = 1:5, b = 11:15, c = 21:25)
data_seek

data_rotate(x, colnames = TRUE)
data_rotate(x, colnames = "c")

data_seek

Find variables by their names, variable or value labels

Description

This function seeks variables in a data frame, based on patterns that either match the variable name (column name), variable labels, value labels or factor levels. Matching variable and value labels only works for "labelled" data, i.e. when the variables either have a label attribute or labels attribute.

data_seek() is particularly useful for larger data frames with labelled data - finding the correct variable name can be a challenge. This function helps to find the required variables, when only certain patterns of variable names or labels are known.

Usage

data_seek(data, pattern, seek = c("names", "labels"), fuzzy = FALSE)

Arguments

data A data frame.
pattern Character string (regular expression) to be matched in data. May also be a character vector of length > 1. pattern is searched for in column names, variable label and value labels attributes, or factor levels of variables in data.
seek Character vector, indicating where pattern is sought. Use one or more of the following options:
  • "names": Searches in column names. "column_names" and "columns" are aliases for "names".
  • "labels": Searches in variable labels. Only applies when a label attribute is set for a variable.
  • "values": Searches in value labels or factor levels. Only applies when a labels attribute is set for a variable, or if a variable is a factor. "levels" is an alias for "values".
  • "all": Searches in all of the above.
fuzzy Logical. If TRUE, "fuzzy matching" (partial and close distance matching) will be used to find pattern.

Value

A data frame with three columns: the column index, the column name and - if available - the variable label of all matched variables in data.
Examples

# seek variables with "Length" in variable name or labels
data_seek(iris, "Length")

# seek variables with "dependency" in names or labels
# column "e42dep" has a label-attribute "elder's dependency"
data(efc)
data_seek(efc, "dependency")

# "female" only appears as value label attribute - default search is in
# variable names and labels only, so no match
data_seek(efc, "female")
# when we seek in all sources, we find the variable "e16sex"
data_seek(efc, "female", seek = "all")

# typo, no match
data_seek(iris, "Lenght")
# typo, fuzzy match
# data_seek(iris, "Lenght", fuzzy = TRUE)

---

**data_separate**  
*Separate single variable into multiple variables*

**Description**

Separates a single variable into multiple new variables.

**Usage**

data_separate(
  data,
  select = NULL,
  new_columns = NULL,
  separator = "[^[:alnum:]]+",
  guess_columns = NULL,
  merge_multiple = FALSE,
  merge_separator = "",
  fill = "right",
  extra = "drop_right",
  convert_na = TRUE,
  exclude = NULL,
  append = FALSE,
  ignore_case = FALSE,
  verbose = TRUE,
  regex = FALSE,
  ...
)

...
Arguments

data A data frame.

select Variables that will be included when performing the required tasks. Can be either
• a variable specified as a literal variable name (e.g., column_name),
• a string with the variable name (e.g., "column_name"), or a character vector
  of variable names (e.g., c("col1", "col2", "col3")),
• a formula with variable names (e.g., ~column_1 + column_2),
• a vector of positive integers, giving the positions counting from the left (e.g.
  1 or c(1, 3, 5)),
• a vector of negative integers, giving the positions counting from the right
  (e.g., -1 or -1:-3),
• one of the following select-helpers: starts_with(), ends_with(), contains(),
  a range using : or regex(""). starts_with(), ends_with(), and contains()
  accept several patterns, e.g starts_with("Sep", "Petal").
• or a function testing for logical conditions, e.g. is.numeric() (or is.numeric)
  or any user-defined function that selects the variables for which the function
  returns TRUE (like: foo <- function(x) mean(x) > 3),
• ranges specified via literal variable names, select-helpers (except regex())
  and (user-defined) functions can be negated, i.e. return non-matching ele-
  ments, when prefixed with a -, e.g. -ends_with(""), -is.numeric or
  -(Sepal.Width:Petal.Length). Note: Negation means that matches
  are excluded, and thus, the exclude argument can be used alternatively.
  For instance, select=-ends_with("Length") (with -) is equivalent to
  exclude=ends_with("Length") (no -). In case negation should not work
  as expected, use the exclude argument instead.

If NULL, selects all columns. Patterns that found no matches are silently ignored,
  e.g. find_columns(iris, select = c("Species", "Test")) will just return
  "Species".

new_columns The names of the new columns, as character vector. If more than one variable
  was selected (in select), the new names are prefixed with the name of the
  original column. new_columns can also be a list of (named) character vectors
  when multiple variables should be separated. See 'Examples'.

separator Separator between columns. Can be a character vector, which is then treated
  as regular expression, or a numeric vector that indicates at which positions the
  string values will be split.

guess_columns If new_columns is not given, the required number of new columns is guessed
  based on the results of value splitting. For example, if a variable is split into three
  new columns, this will be considered as the required number of new columns,
  and columns are named "split_1", "split_2" and "split_3". When values
  from a variable are split into different amount of new columns, the guess_column
  can be either "mode" (number of new columns is based on the most common
  number of splits), "min" or "max" to use the minimum resp. maximum number
  of possible splits as required number of columns.
merge_multiple Logical, if TRUE and more than one variable is selected for separating, new columns can be merged. Value pairs of all split variables are merged.

merge_separator Separator string when merge_multiple = TRUE. Defines the string that is used to merge values together.

fill How to deal with values that return fewer new columns after splitting? Can be "left" (fill missing columns from the left with NA), "right" (fill missing columns from the right with NA) or "value_left" or "value_right" to fill missing columns from left or right with the left-most or right-most values.

extra How to deal with values that return too many new columns after splitting? Can be "drop_left" or "drop_right" to drop the left-most or right-most values, or "merge_left" or "merge_right" to merge the left- or right-most value together, and keeping all remaining values as is.

convert_na Logical, if TRUE, character "NA" values are converted into real NA values.

exclude See select, however, column names matched by the pattern from exclude will be excluded instead of selected. If NULL (the default), excludes no columns.

append Logical, if FALSE (default), removes original columns that were separated. If TRUE, all columns are preserved and the new columns are appended to the data frame.

ignore_case Logical, if TRUE and when one of the select-helpers or a regular expression is used in select, ignores lower/upper case in the search pattern when matching against variable names.

verbose Toggle warnings.

regex Logical, if TRUE, the search pattern from select will be treated as regular expression. When regex = TRUE, select must be a character string (or a variable containing a character string) and is not allowed to be one of the supported select-helpers or a character vector of length > 1. regex = TRUE is comparable to using one of the two select-helpers, select = contains("") or select = regex(""), however, since the select-helpers may not work when called from inside other functions (see 'Details'), this argument may be used as workaround.

Value
A data frame with the newly created variable(s), or - when append = TRUE - data including new variables.

See Also

data_unite()

Examples

# simple case
d <- data.frame(
  x = c("1.a.6", "2.b.7", "3.c.8"),
...
stringsAsFactors = FALSE
)
d
# guess number of columns
data.separate(d, guess.columns = "mode")
data.separate(d, guess.columns = "max")

# drop left-most column
data.separate(d, guess.columns = "mode", extra = "drop_left")

# merge right-most column
data.separate(d, guess.columns = "mode", extra = "merge_right")

# fill columns with fewer values with left-most values
data.separate(d, guess.columns = "mode", fill = "value_left")

# fill and merge
data.separate(
  d,
  guess.columns = "mode",
  fill = "value_left",
  extra = "merge_right"
)

# multiple columns to split
data <- data.frame(
  x = c("1.a.6", "2.b.7", "3.c.8"),
  y = c("x.y.z", "10.11.12", "m.n.o"),
  stringsAsFactors = FALSE
)
d
# split two columns, default column names
data.separate(d, guess.columns = "mode")

# split into new named columns, repeating column names
data.separate(d, new.columns = c("a", "b", "c"))

# split selected variable new columns
data.separate(d, select = "y", new.columns = c("a", "b", "c"))

# merge multiple split columns
data.separate(
  d,
  new.columns = c("a", "b", "c"),
  merge_multiple = TRUE
)
# merge multiple split columns
data_separate(
  d,
  new_columns = c("a", "b", "c"),
  merge_multiple = TRUE,
  merge_separator = "-"
)

# separate multiple columns, give proper column names

d_sep <- data.frame(
  x = c("1.a.6", "2.b.7.d", "3.c.8", "5.j"),
  y = c("m.n.99.22", "77.f.g.34", "44.9", NA),
  stringsAsFactors = FALSE
)

data_separate(
  d_sep,
  select = c("x", "y"),
  new_columns = list(
    x = c("A", "B", "C"), # separate "x" into three columns
    y = c("EE", "FF", "GG", "HH") # separate "y" into four columns
  ),
  verbose = FALSE
)

---

**data_tabulate**  
Create frequency tables of variables

**Description**

This function creates frequency tables of variables, including the number of levels/values as well as the distribution of raw, valid and cumulative percentages.

**Usage**

data_tabulate(x, ...)

## Default S3 method:
data_tabulate(x, drop_levels = FALSE, name = NULL, verbose = TRUE, ...)

## S3 method for class 'data.frame'
data_tabulate(
  x,
  select = NULL,
  exclude = NULL,
  ignore_case = FALSE,
  regex = FALSE,
collapse = FALSE,
drop_levels = FALSE,
verbose = TRUE,

Arguments

x A (grouped) data frame, a vector or factor.

... not used.

drop_levels Logical, if TRUE, factor levels that do not occur in the data are included in the table (with frequency of zero), else unused factor levels are dropped from the frequency table.

name Optional character string, which includes the name that is used for printing.

verbose Toggle warnings.

select Variables that will be included when performing the required tasks. Can be either

- a variable specified as a literal variable name (e.g., column_name),
- a string with the variable name (e.g., "column_name"), or a character vector of variable names (e.g., c("col1", "col2", "col3")),
- a formula with variable names (e.g., ~column_1 + column_2),
- a vector of positive integers, giving the positions counting from the left (e.g., 1 or c(1, 3, 5)),
- a vector of negative integers, giving the positions counting from the right (e.g., -1 or -1:-3),
- one of the following select-helpers: starts_with(), ends_with(), contains(), a range using : or regex("'"). starts_with(), ends_with(), and contains() accept several patterns, e.g starts_with("Sep", "Petal").
- or a function testing for logical conditions, e.g. is.numeric() (or is.numeric),
  or any user-defined function that selects the variables for which the function returns TRUE (like: foo <- function(x) mean(x) > 3),
- ranges specified via literal variable names, select-helpers (except regex()) and (user-defined) functions can be negated, i.e. return non-matching elements, when prefixed with a - , e.g. -ends_with("'"), -is.numeric or -(Sepal.Width:Petal.Length). Note: Negation means that matches are excluded, and thus, the exclude argument can be used alternatively. For instance, select=-ends_with("Length") (with -) is equivalent to exclude=-ends_with("Length") (no -). In case negation should not work as expected, use the exclude argument instead.

If NULL, selects all columns. Patterns that found no matches are silently ignored, e.g. find_columns(iris, select = c("Species", "Test")) will just return "Species".

exclude See select, however, column names matched by the pattern from exclude will be excluded instead of selected. If NULL (the default), excludes no columns.
**ignore_case** Logical, if TRUE and when one of the select-helpers or a regular expression is used in select, ignores lower/upper case in the search pattern when matching against variable names.

**regex** Logical, if TRUE, the search pattern from select will be treated as regular expression. When regex = TRUE, select must be a character string (or a variable containing a character string) and is not allowed to be one of the supported select-helpers or a character vector of length > 1. regex = TRUE is comparable to using one of the two select-helpers, select = contains(""), or select = regex(""), however, since the select-helpers may not work when called from inside other functions (see 'Details'), this argument may be used as workaround.

**collapse** Logical, if TRUE collapses multiple tables into one larger table for printing. This affects only printing, not the returned object.

**Value**

A data frame, or a list of data frames, with one frequency table as data frame per variable.

**Examples**

```r
data(efc)

# vector/factor
data_tabulate(efc$c172code)

# data frame
data_tabulate(efc, c("e42dep", "c172code"))

# grouped data frame
suppressPackageStartupMessages(library(poorman, quietly = TRUE))
ecf <->
  group_by(c172code) ->
  data_tabulate("e16sex")

# collapse tables
efc <->
  group_by(c172code) ->
  data_tabulate("e16sex", collapse = TRUE)

# for larger N's (> 100000), a big mark is automatically added
set.seed(123)
x <- sample(1:3, 1e6, TRUE)
data_tabulate(x, name = "Large Number")

# to remove the big mark, use "print(..., big_mark = "")"
print(data_tabulate(x), big_mark = "")
```
data_to_long  

Reshape (pivot) data from wide to long

Description

This function "lengthens" data, increasing the number of rows and decreasing the number of columns. This is a dependency-free base-R equivalent of tidyr::pivot_longer().

Usage

data_to_long(
data,
  select = "all",
  names_to = "name",
  names_prefix = NULL,
  names_sep = NULL,
  names_pattern = NULL,
  values_to = "value",
  values_drop_na = FALSE,
  rows_to = NULL,
  ignore_case = FALSE,
  regex = FALSE,
  ...,
  cols,
  colnames_to
)

reshape_longer(
data,
  select = "all",
  names_to = "name",
  names_prefix = NULL,
  names_sep = NULL,
  names_pattern = NULL,
  values_to = "value",
  values_drop_na = FALSE,
  rows_to = NULL,
  ignore_case = FALSE,
  regex = FALSE,
  ...,
  cols,
  colnames_to
)

Arguments

data  A data frame to pivot.
Variables that will be included when performing the required tasks. Can be either

- a variable specified as a literal variable name (e.g., column_name),
- a string with the variable name (e.g., "column_name"), or a character vector of variable names (e.g., c("col1", "col2", "col3")),
- a formula with variable names (e.g., ~column_1 + column_2),
- a vector of positive integers, giving the positions counting from the left (e.g., 1 or c(1, 3, 5)),
- a vector of negative integers, giving the positions counting from the right (e.g., -1 or -1:-3),
- one of the following select-helpers: starts_with(), ends_with(), contains(), a range using : or regex(""). starts_with(), ends_with(), and contains() accept several patterns, e.g starts_with("Sep", "Petal").
- or a function testing for logical conditions, e.g. is.numeric() (or is.numeric), or any user-defined function that selects the variables for which the function returns TRUE (like: foo <- function(x) mean(x) > 3),
- ranges specified via literal variable names, select-helpers (except regex()) and (user-defined) functions can be negated, i.e. return non-matching elements, when prefixed with a -, e.g. -ends_with(""), -is.numeric or -(Sepal.Width:Petal.Length). Note: Negation means that matches are excluded, and thus, the exclude argument can be used alternatively. For instance, select=-ends_with("Length") (with -) is equivalent to exclude=ends_with("Length") (no -). In case negation should not work as expected, use the exclude argument instead.

If NULL, selects all columns. Patterns that found no matches are silently ignored, e.g. find_columns(iris, select = c("Species", "Test")) will just return "Species".

The name of the new column that will contain the column names.

A regular expression used to remove matching text from the start of each variable name.

If names_to contains multiple values, this argument controls how the column name is broken up. names_pattern takes a regular expression containing matching groups, i.e. "()".

The name of the new column that will contain the values of the pivoted variables.

If TRUE, will drop rows that contain only NA in the values_to column. This effectively converts explicit missing values to implicit missing values, and should generally be used only when missing values in data were created by its structure.

The name of the column that will contain the row names or row numbers from the original data. If NULL, will be removed.

Logical, if TRUE and when one of the select-helpers or a regular expression is used in select, ignores lower/upper case in the search pattern when matching against variable names.

Logical, if TRUE, the search pattern from select will be treated as regular expression. When regex = TRUE, select must be a character string (or a variable
containing a character string) and is not allowed to be one of the supported
select-helpers or a character vector of length > 1. \texttt{regex = TRUE} is compara-
tible to using one of the two select-helpers, \texttt{select = contains("")} or \texttt{select
= regex("")}, however, since the select-helpers may not work when called from
inside other functions (see ‘Details’), this argument may be used as workaround.

... Currently not used.

\texttt{cols} Identical to \texttt{select}. This argument is here to ensure compatibility with \texttt{tidyr::pivot_longer()}. If both \texttt{select} and \texttt{cols} are provided, \texttt{cols} is used.

\texttt{colnames_to} Deprecated. Use \texttt{names_to} instead.

Value

If a tibble was provided as input, \texttt{reshape_longer()} also returns a tibble. Otherwise, it returns a
data frame.

See Also

- Functions to rename stuff: \texttt{data_rename()}, \texttt{data_rename_rows()}, \texttt{data_addprefix()}, \texttt{data_addsuffix()}
- Functions to reorder or remove columns: \texttt{data_reorder()}, \texttt{data_relocate()}, \texttt{data_remove()}
- Functions to reshape, pivot or rotate data frames: \texttt{data_to_long()}, \texttt{data_to_wide()}, \texttt{data_rotate()}
- Functions to recode data: \texttt{rescale()}, \texttt{reverse()}, \texttt{categorize()}, \texttt{recode_values()}, \texttt{slide()}
- Functions to standardize, normalize, rank-transform: \texttt{center()}, \texttt{standardize()}, \texttt{normalize()},
  \texttt{ranktransform()}, \texttt{winsorize()}
- Split and merge data frames: \texttt{data_partition()}, \texttt{data_merge()}
- Functions to find or select columns: \texttt{data_select()}, \texttt{data_find()}
- Functions to filter rows: \texttt{data_match()}, \texttt{data_filter()}

Examples

```r
data_to_long()

---

### Examples

\begin{verbatim}
wide_data <- data.frame(replicate(5, rnorm(10)))
# Default behaviour (equivalent to tidyr::pivot_longer(wide_data, cols = 1:5))
data_to_long(wide_data)

# Customizing the names
data_to_long(wide_data,
  select = c(1, 2),
  names_to = "Column",
  values_to = "Numbers",
  rows_to = "Row"
)

# Full example
# ------------------
data <- psych::bfi # Wide format with one row per participant's personality test

# Pivot long format
```

data_to_wide

Reshape (pivot) data from long to wide

Description

This function "widens" data, increasing the number of columns and decreasing the number of rows. This is a dependency-free base-R equivalent of tidyr::pivot_wider().

Usage

data_to_wide(
  data,
  id_cols = NULL,
  values_from = "Value",
  names_from = "Name",
  names_sep = "-",
  names_prefix = "",
  names_glue = NULL,
  values_fill = NULL,
  verbose = TRUE,
  ...
)

reshape_wider(
  data,
  id_cols = NULL,
  values_from = "Value",
  names_from = "Name",
  names_sep = "-",
  ...
names_prefix = "", names_glue = NULL, values_fill = NULL, verbose = TRUE, ...
    colnames_from,
    rows_from,
    sep
)  

Arguments

data A data frame to pivot.

id_cols The name of the column that identifies the rows. If NULL, it will use all the unique rows.

values_from The name of the column that contains the values to be used as future variable values.

names_from The name of the column that contains the levels to be used as future column names.

names_sep If names_from or values_from contains multiple variables, this will be used to join their values together into a single string to use as a column name.

names_prefix String added to the start of every variable name. This is particularly useful if names_from is a numeric vector and you want to create syntactic variable names.

names_glue Instead of names_sep and names_prefix, you can supply a glue specification that uses the names_from columns to create custom column names. Note that the only delimiters supported by names_glue are curly brackets, { and }.

values_fill Optionally, a (scalar) value that will be used to replace missing values in the new columns created.

verbose Toggle warnings.

... Not used for now.

colnames_from Deprecated. Use names_from instead.

rows_from Deprecated. Use id_cols instead.

sep Deprecated. Use names_sep instead.

Value

If a tibble was provided as input, reshape_wider() also returns a tibble. Otherwise, it returns a data frame.

See Also

• Functions to rename stuff: data_rename(), data_rename_rows(), data_addprefix(), data_addsuffix()
• Functions to reorder or remove columns: data_reorder(), data_relocate(), data_remove()
• Functions to reshape, pivot or rotate data frames: data_to_long(), data_to_wide(), data_rotate()
• Functions to recode data: `rescale()`, `reverse()`, `categorize()`, `recode_values()`, `slide()`
• Functions to standardize, normalize, rank-transform: `center()`, `standardize()`, `normalize()`, `ranktransform()`, `winsorize()`
• Split and merge data frames: `data_partition()`, `data_merge()`
• Functions to find or select columns: `data_select()`, `data_find()`
• Functions to filter rows: `data_match()`, `data_filter()`

Examples

```r
# Read data
data_long <- read.table(header = TRUE, text = 
"subject sex condition measurement
1 M control 7.9
1 M cond1 12.3
1 M cond2 10.7
2 F control 6.3
2 F cond1 10.6
2 F cond2 11.1
3 F control 9.5
3 F cond1 13.1
3 F cond2 13.8
4 M control 11.5
4 M cond1 13.4
4 M cond2 12.9")

data_to_wide(
  data_long,
  id_cols = "subject",
  names_from = "condition",
  values_from = "measurement"
)

data_to_wide(
  data_long,
  id_cols = "subject",
  names_from = "condition",
  values_from = "measurement",
  names_prefix = "Var.",
  names_sep = "."
)

# Prepare production data
production <- expand.grid(
  product = c("A", "B"),
  country = c("AI", "EI"),
  year = 2000:2014
)
production <- data_filter(production, (product == "A" & country == "AI") | product == "B")

production$production <- rnorm(nrow(production))

data_to_wide(
  production,
  id_cols = "product",
  names_from = "country",
  values_from = "year"
)
```

From all rows with at least one duplicated ID, keep only one. Methods for selecting the duplicated row are either the first duplicate, the last duplicate, or the "best" duplicate (default), based on the duplicate with the smallest number of NA. In case of ties, it picks the first duplicate, as it is the one most likely to be valid and authentic, given practice effects.

Contrarily to dplyr::distinct(), data_unique() keeps all columns.

Usage

data_unique(
  data,
  select = NULL,
  keep = "best",
  exclude = NULL,
  ignore_case = FALSE,
  regex = FALSE,
  verbose = TRUE
)

Arguments

data A data frame.
select Variables that will be included when performing the required tasks. Can be either

- a variable specified as a literal variable name (e.g., column_name),
- a string with the variable name (e.g., "column_name"), or a character vector of variable names (e.g., c("col1", "col2", "col3")),
- a formula with variable names (e.g., ~column_1 + column_2),
- a vector of positive integers, giving the positions counting from the left (e.g. 1 or c(1, 3, 5)),
- a vector of negative integers, giving the positions counting from the right (e.g., -1 or -1:-3),
- one of the following select-helpers: starts_with(), ends_with(), contains(), a range using : or regex(""), starts_with(), ends_with(), and contains() accept several patterns, e.g starts_with("Sep", "Petal").
or a function testing for logical conditions, e.g. `is.numeric()` (or `is.numeric`), or any user-defined function that selects the variables for which the function returns TRUE (like: `foo <- function(x) mean(x) > 3`),

- ranges specified via literal variable names, select-helpers (except `regex()`) and (user-defined) functions can be negated, i.e. return non-matching elements, when prefixed with a `-`, e.g. `-ends_with("\""), -is.numeric or -(Sepal.Width:Petal.Length). **Note:** Negation means that matches are excluded, and thus, the exclude argument can be used alternatively. For instance, `select=-ends_with("Length")` (with `-`) is equivalent to `exclude=ends_with("Length")` (no `-`). In case negation should not work as expected, use the exclude argument instead.

If NULL, selects all columns. Patterns that found no matches are silently ignored, e.g. `find_columns(iris, select = c("Species", "Test"))` will just return "Species".

**keep** The method to be used for duplicate selection, either "best" (the default), "first", or "last".

**exclude** See select, however, column names matched by the pattern from exclude will be excluded instead of selected. If NULL (the default), excludes no columns.

**ignore_case** Logical, if TRUE and when one of the select-helpers or a regular expression is used in select, ignores lower/upper case in the search pattern when matching against variable names.

**regex** Logical, if TRUE, the search pattern from select will be treated as regular expression. When regex = TRUE, select must be a character string (or a variable containing a character string) and is not allowed to be one of the supported select-helpers or a character vector of length > 1. regex = TRUE is comparable to using one of the two select-helpers, select = contains("\"") or select = regex("\""), however, since the select-helpers may not work when called from inside other functions (see 'Details'), this argument may be used as workaround.

**verbose** Toggle warnings.

**Value**

A data frame, containing only the chosen duplicates.

**See Also**

data_duplicated()

**Examples**

df1 <- data.frame(
  id = c(1, 2, 3, 1, 3),
  item1 = c(NA, 1, 1, 2, 3),
  item2 = c(NA, 1, 1, 2, 3),
  item3 = c(NA, 1, 1, 2, 3)
)

data_unique(df1, select = "id")
Unite ("merge") multiple variables

Description
Merge values of multiple variables per observation into one new variable.

Usage

```r
data_unite(
  data,
  new_column = NULL,
  select = NULL,
  exclude = NULL,
  separator = " ",
  append = FALSE,
  remove_na = FALSE,
  ignore_case = FALSE,
  verbose = TRUE,
  regex = FALSE,
  ...
)
```

Arguments

- `data`: A data frame.
- `new_column`: The name of the new column, as a string.
- `select`: Variables that will be included when performing the required tasks. Can be either
  - a variable specified as a literal variable name (e.g., `column_name`),
  - a string with the variable name (e.g., "column_name"), or a character vector of variable names (e.g., `c("col1", "col2", "col3")`),
  - a formula with variable names (e.g., `~column_1 + column_2`),
  - a vector of positive integers, giving the positions counting from the left (e.g. `1` or `c(1, 3, 5)`),
  - a vector of negative integers, giving the positions counting from the right (e.g., `-1` or `-1:-3`),
  - one of the following select-helpers: `starts_with()`, `ends_with()`, `contains()`, a range using `:` or `regex(""`). `starts_with()`, `ends_with()`, and `contains()` accept several patterns, e.g `starts_with("Sep", "Petal")`.
  - or a function testing for logical conditions, e.g. `is.numeric()` (or `is.numeric`), or any user-defined function that selects the variables for which the function returns TRUE (like: `foo <- function(x) mean(x) > 3`).

...
ranges specified via literal variable names, select-helpers (except regex()) and (user-defined) functions can be negated, i.e. return non-matching elements, when prefixed with a -, e.g. -ends_with(""), -is.numeric or -(Sepal.Width:Petal.Length). **Note:** Negation means that matches are excluded, and thus, the exclude argument can be used alternatively. For instance, select=-ends_with("Length") (with -) is equivalent to exclude=ends_with("Length") (no -). In case negation should not work as expected, use the exclude argument instead.

If NULL, selects all columns. Patterns that found no matches are silently ignored, e.g. find_columns(iris, select = c("Species", "Test")) will just return "Species".

**exclude**

See select, however, column names matched by the pattern from exclude will be excluded instead of selected. If NULL (the default), excludes no columns.

**separator**

A character to use between values.

**append**

Logical, if FALSE (default), removes original columns that were united. If TRUE, all columns are preserved and the new column is appended to the data frame.

**remove_na**

Logical, if TRUE, missing values (NA) are not included in the united values. If FALSE, missing values are represented as "NA" in the united values.

**ignore_case**

Logical, if TRUE and when one of the select-helpers or a regular expression is used in select, ignores lower/upper case in the search pattern when matching against variable names.

**verbose**

Toggle warnings.

**regex**

Logical, if TRUE, the search pattern from select will be treated as regular expression. When regex = TRUE, select must be a character string (or a variable containing a character string) and is not allowed to be one of the supported select-helpers or a character vector of length > 1. regex = TRUE is comparable to using one of the two select-helpers, select = contains("") or select = regex(""), however, since the select-helpers may not work when called from inside other functions (see ‘Details’), this argument may be used as workaround.

... Currently not used.

**Value**

data, with a newly created variable.

**See Also**

data_separate()

**Examples**

d <- data.frame(
  x = 1:3,
  y = letters[1:3],
  z = 6:8
)
d
demean

Compute group-meaned and de-meaned variables

demean() computes group- and de-meaned versions of a variable that can be used in regression analysis to model the between- and within-subject effect. degroup() is more generic in terms of the centering-operation. While demean() always uses mean-centering, degroup() can also use the mode or median for centering.

Usage

demean(
  x,
  select,  # Select the columns
  group,   # Grouping variable
  suffix_demean = "_within",
  suffix_groupmean = "_between",
  add_attributes = TRUE,
  verbose = TRUE
)

degroup(
  x,
  select,  # Select the columns
  group,   # Grouping variable
  center = "mean",  # Centering method
  suffix_demean = "_within",
  suffix_groupmean = "_between",
  add_attributes = TRUE,
  verbose = TRUE
)

detrend(
  x,
  select,  # Select the columns
  group,   # Grouping variable
  center = "mean",  # Centering method
  suffix_demean = "_within",
  suffix_groupmean = "_between",
  add_attributes = TRUE,
  verbose = TRUE
)
Arguments

x 
A data frame.

select 
Character vector (or formula) with names of variables to select that should be group- and de-meaned.

group 
Character vector (or formula) with the name of the variable that indicates the group- or cluster-ID.

suffix_demean, suffix_groupmean 
String value, will be appended to the names of the group-meaned and de-meaned variables of x. By default, de-meaned variables will be suffixed with "_within" and grouped-meaned variables with "_between".

add_attributes 
Logical, if TRUE, the returned variables gain attributes to indicate the within- and between-effects. This is only relevant when printing model_parameters() - in such cases, the within- and between-effects are printed in separated blocks.

verbose 
Toggle warnings and messages.

center 
Method for centering. demean() always performs mean-centering, while degroup() can use center = "median" or center = "mode" for median- or mode-centering, and also "min" or "max".

Details

**Heterogeneity Bias:** Mixed models include different levels of sources of variability, i.e. error terms at each level. When macro-indicators (or level-2 predictors, or higher-level units, or more general: *group-level predictors that vary within and across groups*) are included as fixed effects (i.e. treated as covariate at level-1), the variance that is left unaccounted for this covariate will be absorbed into the error terms of level-1 and level-2 (Bafumi and Gelman 2006; Gelman and Hill 2007, Chapter 12.6): “Such covariates contain two parts: one that is specific to the higher-level entity that does not vary between occasions, and one that represents the difference between occasions, within higher-level entities” (Bell et al. 2015). Hence, the error terms will be correlated with the covariate, which violates one of the assumptions of mixed models (iid, independent and identically distributed error terms). This bias is also called the *heterogeneity bias* (Bell et al. 2015). To resolve this problem, level-2 predictors used as (level-1) covariates should be separated into their "within" and "between" effects by "de-meaning" and "group-meaning": After demeaning time-varying predictors, “at the higher level, the mean term is no longer constrained by Level 1 effects, so it is free to account for all the higher-level variance associated with that variable” (Bell et al. 2015).

**Panel data and correlating fixed and group effects:** demean() is intended to create group- and de-meaned variables for panel regression models (fixed effects models), or for complex random-effect-within-between models (see Bell et al. 2015, 2018), where group-effects (random effects) and fixed effects correlate (see Bafumi and Gelman 2006). This can happen, for instance, when analyzing panel data, which can lead to *Heterogeneity Bias*. To control for correlating predictors and group effects, it is recommended to include the group-meaned and de-meaned version of *time-varying covariates* (and group-meaned version of *time-invariant covariates* that are on a higher level, e.g. level-2 predictors) in the model. By this, one can fit complex multilevel models for panel data, including time-varying predictors, time-invariant predictors and random effects.
Why mixed models are preferred over fixed effects models: A mixed models approach can model the causes of endogeneity explicitly by including the (separated) within- and between-effects of time-varying fixed effects and including time-constant fixed effects. Furthermore, mixed models also include random effects, thus a mixed models approach is superior to classic fixed-effects models, which lack information of variation in the group-effects or between-subject effects. Furthermore, fixed effects regression cannot include random slopes, which means that fixed effects regressions are neglecting "cross-cluster differences in the effects of lower-level controls (which) reduces the precision of estimated context effects, resulting in unnecessarily wide confidence intervals and low statistical power" (Heisig et al. 2017).

Terminology: The group-meaned variable is simply the mean of an independent variable within each group (or id-level or cluster) represented by group. It represents the cluster-mean of an independent variable. The regression coefficient of a group-meaned variable is the between-subject-effect. The de-meaned variable is then the centered version of the group-meaned variable. De-meaning is sometimes also called person-mean centering or centering within clusters. The regression coefficient of a de-meaned variable represents the within-subject-effect.

De-meaning with continuous predictors: For continuous time-varying predictors, the recommendation is to include both their de-meaned and group-meaned versions as fixed effects, but not the raw (untransformed) time-varying predictors themselves. The de-meaned predictor should also be included as random effect (random slope). In regression models, the coefficient of the de-meaned predictors indicates the within-subject effect, while the coefficient of the group-meaned predictor indicates the between-subject effect.

De-meaning with binary predictors: For binary time-varying predictors, there are two recommendations. First is to include the raw (untransformed) binary predictor as fixed effect only and the de-meaned variable as random effect (random slope). The alternative would be to add the de-meaned version(s) of binary time-varying covariates as additional fixed effect as well (instead of adding it as random slope). Centering time-varying binary variables to obtain within-effects (level 1) isn’t necessary. They have a sensible interpretation when left in the typical 0/1 format (Hoffmann 2015, chapter 8-2.I). demean() will thus coerce categorical time-varying predictors to numeric to compute the de- and group-meaned versions for these variables, where the raw (untransformed) binary predictor and the de-meaned version should be added to the model.

De-meaning of factors with more than 2 levels: Factors with more than two levels are demeaned in two ways: first, these are also converted to numeric and de-meaned; second, dummy variables are created (binary, with 0/1 coding for each level) and these binary dummy-variables are de-meaned in the same way (as described above). Packages like panelr internally convert factors to dummies before demeaning, so this behaviour can be mimicked here.

De-meaning interaction terms: There are multiple ways to deal with interaction terms of within- and between-effects. A classical approach is to simply use the product term of the demeaned variables (i.e. introducing the de-meaned variables as interaction term in the model formula, e.g. \( y \sim x_{\text{within}} \times \text{time}_{\text{within}} \)). This approach, however, might be subject to bias (see Gieselmann & Schmidt-Catran 2020).

Another option is to first calculate the product term and then apply the de-meaning to it. This approach produces an estimator “that reflects unit-level differences of interacted variables whose moderators vary within units”, which is desirable if no within interaction of two time-dependent variables is required.
A third option, when the interaction should result in a genuine within estimator, is to "double de-mean" the interaction terms (Giesselmann & Schmidt-Catran 2018), however, this is currently not supported by demean(). If this is required, the wmb() function from the panelr package should be used.

To de-mean interaction terms for within-between models, simply specify the term as interaction for the select-argument, e.g. select = "a*b" (see 'Examples').

**Analysing panel data with mixed models using lme4:** A description of how to translate the formulas described in Bell et al. 2018 into R using lmer() from lme4 can be found in this vignette.

### Value

A data frame with the group-/de-meaned variables, which get the suffix "_between" (for the group-meaned variable) and "_within" (for the de-meaned variable) by default.

### References


### See Also

If grand-mean centering (instead of centering within-clusters) is required, see center(). See performance::check_heterogeneity_bias() to check for heterogeneity bias.

### Examples

```r
data(iris)
iris$ID <- sample(1:4, nrow(iris), replace = TRUE) # fake-ID
iris$binary <- as.factor(rbinom(150, 1, .35)) # binary variable
```
```
x <- demean(iris, select = c("Sepal.Length", "Petal.Length"), group = "ID")
head(x)

x <- demean(iris, select = c("Sepal.Length", "binary", "Species"), group = "ID")
head(x)

# demean interaction term x*y
dat <- data.frame(
  a = c(1, 2, 3, 4, 1, 2, 3, 4),
  x = c(4, 3, 3, 4, 1, 2, 1, 2),
  y = c(1, 2, 1, 2, 4, 3, 2, 1),
  ID = c(1, 2, 3, 1, 2, 3, 1, 2)
)
demean(dat, select = c("a", "x*y"), group = "ID")

# or in formula-notation
demean(dat, select = ~ a + x * y, group = ~ID)
```

describe_distribution  Describe a distribution

**Description**

This function describes a distribution by a set of indices (e.g., measures of centrality, dispersion, range, skewness, kurtosis).

**Usage**

```
describe_distribution(x, ...)
```

## S3 method for class 'numeric'
describe_distribution(
  x,
  centrality = "mean",
  dispersion = TRUE,
  iqr = TRUE,
  range = TRUE,
  quartiles = FALSE,
  ci = NULL,
  iterations = 100,
  threshold = 0.1,
  verbose = TRUE,
  ...
)

## S3 method for class 'factor'

describe_distribution(x, dispersion = TRUE, range = TRUE, verbose = TRUE, ...)

## S3 method for class 'data.frame'
describe_distribution(
  x,
  select = NULL,
  exclude = NULL,
  centrality = "mean",
  dispersion = TRUE,
  iqr = TRUE,
  range = TRUE,
  quartiles = FALSE,
  include_factors = FALSE,
  ci = NULL,
  iterations = 100,
  threshold = 0.1,
  ignore_case = FALSE,
  regex = FALSE,
  verbose = TRUE,
  ...
)

Arguments

x
A numeric vector, a character vector, a data frame, or a list. See Details.

... Additional arguments to be passed to or from methods.

centrality The point-estimates (centrality indices) to compute. Character (vector) or list with one or more of these options: "median", "mean", "MAP" (see map_estimate()), "trimmed" (which is just mean(x, trim = threshold)), "mode" or "all".

dispersion Logical, if TRUE, computes indices of dispersion related to the estimate(s) (SD and MAD for mean and median, respectively). Dispersion is not available for "MAP" or "mode" centrality indices.

iqr Logical, if TRUE, the interquartile range is calculated (based on stats::IQR(), using type = 6).

range Return the range (min and max).

quartiles Return the first and third quartiles (25th and 75th percentiles).

ci Confidence Interval (CI) level. Default is NULL, i.e. no confidence intervals are computed. If not NULL, confidence intervals are based on bootstrap replicates (see iterations). If centrality = "all", the bootstrapped confidence interval refers to the first centrality index (which is typically the median).

iterations The number of bootstrap replicates for computing confidence intervals. Only applies when ci is not NULL.

threshold For centrality = "trimmed" (i.e. trimmed mean), indicates the fraction (0 to 0.5) of observations to be trimmed from each end of the vector before the mean is computed.

verbose Toggle warnings and messages.
Variables that will be included when performing the required tasks. Can be either

- a variable specified as a literal variable name (e.g., column_name),
- a string with the variable name (e.g., "column_name"), or a character vector of variable names (e.g., c("col1", "col2", "col3")),
- a formula with variable names (e.g., ~column_1 + column_2),
- a vector of positive integers, giving the positions counting from the left (e.g., 1 or c(1, 3, 5)),
- a vector of negative integers, giving the positions counting from the right (e.g., -1 or -1:-3),
- one of the following select-helpers: starts_with(), ends_with(), contains(), a range using : or regex(""), starts_with(), ends_with(), and contains() accept several patterns, e.g starts_with("Sep", "Petal").
- or a function testing for logical conditions, e.g. is.numeric() (or is.numeric), or any user-defined function that selects the variables for which the function returns TRUE (like: foo <- function(x) mean(x) > 3),
- ranges specified via literal variable names, select-helpers (except regex()) and (user-defined) functions can be negated, i.e. return non-matching elements, when prefixed with a ~, e.g. ~ends_with(""), ~is.numeric or ~(Sepal.Width:Petal.Length). Note: Negation means that matches are excluded, and thus, the exclude argument can be used alternatively. For instance, select=-ends_with("Length") (with ~) is equivalent to exclude=ends_with("Length") (no ~). In case negation should not work as expected, use the exclude argument instead.

If NULL, selects all columns. Patterns that found no matches are silently ignored, e.g. find_columns(iris, select = c("Species", "Test")) will just return "Species".

patterns that matched no columns are silently ignored, e.g. find_columns(iris, select = c("Species", "Test")) will just return "Species". If NULL, selects all columns. Patterns that found no matches are silently ignored, e.g. find_columns(iris, select = c("Species", "Test")) will just return "Species".

Logical, if TRUE, factors are included in the output, however, only columns for range (first and last factor levels) as well as n and missing will contain information.

Logical, if TRUE and when one of the select-helpers or a regular expression is used in select, ignores lower/upper case in the search pattern when matching against variable names.

Logical, if TRUE, the search pattern from select will be treated as regular expression. When regex = TRUE, select must be a character string (or a variable containing a character string) and is not allowed to be one of the supported select-helpers or a character vector of length > 1. regex = TRUE is comparable to using one of the two select-helpers, select = contains("" ) or select = regex("" ), however, since the select-helpers may not work when called from inside other functions (see 'Details'), this argument may be used as workaround.

If x is a data frame, only numeric variables are kept and will be displayed in the summary.
If x is a list, the behavior is different whether x is a stored list. If x is stored (for example, describe_distribution(mylist) where mylist was created before), artificial variable names are used in the summary (Var_1, Var_2, etc.). If x is an unstored list (for example, describe_distribution(list(mtcars$mpg)) then “mtcars$mpg” is used as variable name.

Value
A data frame with columns that describe the properties of the variables.

Note
There is also a plot()-method implemented in the see-package.

Examples

describe_distribution(rnorm(100))

data(iris)
describe_distribution(iris)
describe_distribution(iris, include_factors = TRUE, quartiles = TRUE)
describe_distribution(list(mtcars$mpg, mtcars$cyl))

---

distribution_mode  Compute mode for a statistical distribution

Description
Compute mode for a statistical distribution

Usage

distribution_mode(x)

Arguments

x  An atomic vector, a list, or a data frame.

Value
The value that appears most frequently in the provided data. The returned data structure will be the same as the entered one.

See Also
For continuous variables, the Highest Maximum a Posteriori probability estimate (MAP) may be a more useful way to estimate the most commonly-observed value than the mode. See bayestestR::map_estimate().
Examples

distribution_mode(c(1, 2, 3, 3, 4, 5))
distribution_mode(c(1.5, 2.3, 3.7, 3.7, 4.0, 5))

Description

Selected variables from the EUROFAMCARE survey. Useful when testing on "real-life" data sets, including random missing values. This data set also has value and variable label attributes.

find_columns

Find or get columns in a data frame based on search patterns

Description

find_columns() returns column names from a data set that match a certain search pattern, while get_columns() returns the found data. data_select() is an alias for get_columns(), and data_find() is an alias for find_columns().

Usage

find_columns(
  data,
  select = NULL,
  exclude = NULL,
  ignore_case = FALSE,
  regex = FALSE,
  verbose = TRUE,
  ...
)

data_find(
  data,
  select = NULL,
  exclude = NULL,
  ignore_case = FALSE,
  regex = FALSE,
  verbose = TRUE,
  ...
)
get_columns(
  data,
  select = NULL,
  exclude = NULL,
  ignore_case = FALSE,
  regex = FALSE,
  verbose = TRUE,
  ...
)

data_select(
  data,
  select = NULL,
  exclude = NULL,
  ignore_case = FALSE,
  regex = FALSE,
  verbose = TRUE,
  ...
)

Arguments

data

A data frame.

select

Variables that will be included when performing the required tasks. Can be either

- a variable specified as a literal variable name (e.g., column_name),
- a string with the variable name (e.g., "column_name"), or a character vector
  of variable names (e.g., c("col1", "col2", "col3")),
- a formula with variable names (e.g., ~column_1 + column_2),
- a vector of positive integers, giving the positions counting from the left (e.g. 1 or c(1, 3, 5)),
- a vector of negative integers, giving the positions counting from the right (e.g., -1 or -1:-3),
- one of the following select-helpers: starts_with(), ends_with(), contains(),
  a range using : or regex(""). starts_with(), ends_with(), and contains() accept several patterns,
  e.g starts_with("Sep", "Petal").
- or a function testing for logical conditions, e.g. is.numeric() or is.numeric,
  or any user-defined function that selects the variables for which the function returns TRUE (like: foo <- function(x) mean(x) > 3),
- ranges specified via literal variable names, select-helpers (except regex())
  and (user-defined) functions can be negated, i.e. return non-matching elements, when prefixed with a &, e.g. ~ends_with(""), ~is.numeric or
  ~(Sepal.Width:Petal.Length). Note: Negation means that matches are excluded, and thus, the exclude argument can be used alternatively.
  For instance, select=~ends_with("Length") (with ~) is equivalent to exclude=ends_with("Length") (no ~). In case negation should not work as expected, use the exclude argument instead.
If NULL, selects all columns. Patterns that found no matches are silently ignored, e.g. `find_columns(iris, select = c("Species", "Test"))` will just return "Species".

**exclude**

See select, however, column names matched by the pattern from exclude will be excluded instead of selected. If NULL (the default), excludes no columns.

**ignore_case**

Logical, if TRUE and when one of the select-helpers or a regular expression is used in select, ignores lower/upper case in the search pattern when matching against variable names.

**regex**

Logical, if TRUE, the search pattern from select will be treated as regular expression. When regex = TRUE, select must be a character string (or a variable containing a character string) and is not allowed to be one of the supported select-helpers or a character vector of length > 1. regex = TRUE is comparable to using one of the two select-helpers, select = contains("") or select = regex(""), however, since the select-helpers may not work when called from inside other functions (see 'Details'), this argument may be used as workaround.

**verbose**

Toggle warnings.

... Arguments passed down to other functions. Mostly not used yet.

**Details**

Note that it is possible to either pass an entire select helper or only the pattern inside a select helper as a function argument:

```r
foo <- function(data, pattern) {
  find_columns(data, select = starts_with(pattern))
}
foo(iris, pattern = "Sep")

foo2 <- function(data, pattern) {
  find_columns(data, select = pattern)
}
foo2(iris, pattern = starts_with("Sep"))
```

This means that it is also possible to use loop values as arguments or patterns:

```r
for (i in c("Sepal", "Sp")) {
  head(iris) |> find_columns(select = starts_with(i)) |> print()
}
```

However, this behavior is limited to a "single-level function". It will not work in nested functions, like below:

```r
inner <- function(data, arg) {
  find_columns(data, select = arg)
}
```
outer <- function(data, arg) {
  inner(data, starts_with(arg))
}
outer(iris, "Sep")

In this case, it is better to pass the whole select helper as the argument of outer():

outer <- function(data, arg) {
  inner(data, arg)
}
outer(iris, starts_with("Sep"))

Value

find_columns() returns a character vector with column names that matched the pattern in select
and exclude, or NULL if no matching column name was found. get_columns() returns a data frame
with matching columns.

See Also

• Functions to rename stuff: data_rename(), data_rename_rows(), data_addprefix(), data_addsuffix()
• Functions to reorder or remove columns: data_reorder(), data_relocate(), data_remove()
• Functions to reshape, pivot or rotate data frames: data_to_long(), data_to_wide(), data_rotate()
• Functions to recode data: rescale(), reverse(), categorize(), recode_values(), slide()
• Functions to standardize, normalize, rank-transform: center(), standardize(), normalize(),
  ranktransform(), winsorize()
• Split and merge data frames: data_partition(), data_merge()
• Functions to find or select columns: data_select(), data_find()
• Functions to filter rows: data_match(), data_filter()

Examples

# Find columns names by pattern
find_columns(iris, starts_with("Sepal"))
find_columns(iris, ends_with("Width"))
find_columns(iris, regex("\."))
find_columns(iris, c("Petal.Width", "Sepal.Length"))

# starts with "Sepal", but not allowed to end with "width"
find_columns(iris, starts_with("Sepal"), exclude = contains("Width"))

# find numeric with mean > 3.5
numeric_mean_35 <- function(x) is.numeric(x) && mean(x, na.rm = TRUE) > 3.5
find_columns(iris, numeric_mean_35)
labels_to_levels  Convert value labels into factor levels

Description
Convert value labels into factor levels

Usage
labels_to_levels(x, verbose = TRUE, ...)  
## S3 method for class 'factor'
labels_to_levels(x, verbose = TRUE, ...)  
## S3 method for class 'data.frame'
labels_to_levels(
  x,
  select = NULL,
  exclude = NULL,
  ignore_case = FALSE,
  append = FALSE,
  regex = FALSE,
  verbose = TRUE,
  ...
)

Arguments
x          A data frame or factor. Other variable types (e.g. numerics) are not allowed.
...        Currently not used.
verbose    Toggle warnings.
select     Variables that will be included when performing the required tasks. Can be either

  • a variable specified as a literal variable name (e.g., column_name),
  • a string with the variable name (e.g., "column_name"), or a character vector
    of variable names (e.g., c("col1", "col2", "col3")),
  • a formula with variable names (e.g., ~column_1 + column_2),
  • a vector of positive integers, giving the positions counting from the left (e.g.
    1 or c(1, 3, 5)),
  • a vector of negative integers, giving the positions counting from the right
    (e.g., -1 or -1:-3),
  • one of the following select-helpers: starts_with(), ends_with(), contains(),
    a range using :, or regex(""). starts_with(), ends_with(), and contains() accepting several patterns, e.g starts_with("Sep", "Petal").
or a function testing for logical conditions, e.g. `is.numeric()` (or `is.numeric`), or any user-defined function that selects the variables for which the function returns `TRUE` (like: `foo <- function(x) mean(x) > 3`),

- ranges specified via literal variable names, select-helpers (except `regex()`) and (user-defined) functions can be negated, i.e. return non-matching elements, when prefixed with a `-`, e.g. `-ends_with("\")`, `-is.numeric` or `-(Sepal.Width:Petal.Length)`. **Note:** Negation means that matches are excluded, and thus, the exclude argument can be used alternatively. For instance, `select=-ends_with("Length")` (with `-`) is equivalent to `exclude=ends_with("Length")` (no `-`). In case negation should not work as expected, use the exclude argument instead.

If `NULL`, selects all columns. Patterns that found no matches are silently ignored, e.g. `find_columns(iris, select = c("Species", "Test"))` will just return "Species".

`exclude`  
See `select`, however, column names matched by the pattern from `exclude` will be excluded instead of selected. If `NULL` (the default), excludes no columns.

`ignore_case`  
Logical, if `TRUE` and when one of the select-helpers or a regular expression is used in `select`, ignores lower/upper case in the search pattern when matching against variable names.

`append`  
Logical or string. If `TRUE`, recoded or converted variables get new column names and are appended (column bind) to `x`, thus returning both the original and the recoded variables. The new columns get a suffix, based on the calling function: "_r" for recode functions, "_n" for `to_numeric()`, "_f" for `to_factor()`, or "_s" for `slide()`. If `append=FALSE`, original variables in `x` will be overwritten by their recoded versions. If a character value, recoded variables are appended with new column names (using the defined suffix) to the original data frame.

`regex`  
Logical, if `TRUE`, the search pattern from `select` will be treated as regular expression. When `regex = TRUE`, select must be a character string (or a variable containing a character string) and is not allowed to be one of the supported select-helpers or a character vector of length > 1. `regex = TRUE` is comparable to using one of the two select-helpers, `select = contains("\")` or `select = regex("\")`, however, since the select-helpers may not work when called from inside other functions (see 'Details'), this argument may be used as workaround.

**Details**

`labels_to_levels()` allows to use value labels of factors as their levels.

**Value**

`x`, where for all factors former levels are replaced by their value labels.

**Examples**

```r
data(efc)  
# create factor
x <- as.factor(efc$c172code)
# add value labels - these are not factor levels yet
```
```r
x <- assign_labels(x, values = c('1' = "low", '2' = "mid", '3' = "high"))
levels(x)
data_tabulate(x)

x <- labels_to_levels(x)
levels(x)
data_tabulate(x)
```

---

**makepredictcall.dw_transformer**

*Utility Function for Safe Prediction with datawizard transformers*

**Description**

This function allows for the use of (some of) datawizard’s transformers inside a model formula. See examples below.

Currently, `center()`, `standardize()`, `normalize()`, & `rescale()` are supported.

**Usage**

```r
## S3 method for class 'dw_transformer'
makepredictcall(var, call)
```

**Arguments**

- `var` A variable.
- `call` The term in the formula, as a call.

**Value**

A replacement for `call` for the `predvars` attribute of the terms.

**See Also**

`stats::makepredictcall()`

**Examples**

```r
data("mtcars")
train <- mtcars[1:30, ]
test <- mtcars[31:32, ]

m1 <- lm(mpg ~ center(hp), data = train)
predict(m1, newdata = test) # Data is "centered" before the prediction is made,
# according to the center of the old data

m2 <- lm(mpg ~ standardize(hp), data = train)
```
m3 <- lm(mpg ~ scale(hp), data = train) # same as above
predict(m2, newdata = test) # Data is "standardized" before the prediction is made.
predict(m3, newdata = test) # Data is "standardized" before the prediction is made.

m4 <- lm(mpg ~ normalize(hp), data = mtcars)
m5 <- lm(mpg ~ rescale(hp, to = c(-3, 3)), data = mtcars)

(newdata <- data.frame(hp = c(range(mtcars$hp), 400))) # 400 is outside original range!
model.frame(delete.response(terms(m4)), data = newdata)
model.frame(delete.response(terms(m5)), data = newdata)

---

**means_by_group**

**Summary of mean values by group**

### Description

Computes summary table of means by groups.

### Usage

```r
means_by_group(x, ...)
```

---

## S3 method for class 'numeric'

```r
means_by_group(x, group = NULL, ci = 0.95, weights = NULL, digits = NULL, ...)
```

## S3 method for class 'data.frame'

```r
means_by_group(
  x,
  select = NULL,
  group = NULL,
  ci = 0.95,
  weights = NULL,
  digits = NULL,
  exclude = NULL,
  ignore_case = FALSE,
  regex = FALSE,
  verbose = TRUE,
  ...
)
```

### Arguments

- `x` A vector or a data frame.
- `...` Currently not used
If \( x \) is a numeric vector, \( \text{group} \) should be a factor that indicates the group-classifying categories. If \( x \) is a data frame, \( \text{group} \) should be a character string, naming the variable in \( x \) that is used for grouping. Numeric vectors are coerced to factors. Not that \( \text{group} \) should only refer to a single variable.

\( \text{ci} \) Level of confidence interval for mean estimates. Default is 0.95. Use \( \text{ci} = \text{NA} \) to suppress confidence intervals.

\( \text{weights} \) If \( x \) is a numeric vector, \( \text{weights} \) should be a vector of weights that will be applied to weight all observations. If \( x \) is a data frame, \( \text{weights} \) can also be a character string indicating the name of the variable in \( x \) that should be used for weighting. Default is \( \text{NULL} \), so no weights are used.

\( \text{digits} \) Optional scalar, indicating the amount of digits after decimal point when rounding estimates and values.

\( \text{select} \) Variables that will be included when performing the required tasks. Can be either

- a variable specified as a literal variable name (e.g., \( \text{column\_name} \)),
- a string with the variable name (e.g., "\text{column\_name}"), or a character vector of variable names (e.g., c("\text{col1}", "\text{col2}", "\text{col3}")),
- a formula with variable names (e.g., \( \text{~column\_1 + column\_2} \)),
- a vector of positive integers, giving the positions counting from the left (e.g. 1 or c(1, 3, 5)),
- a vector of negative integers, giving the positions counting from the right (e.g., \( -1 \) or \( -1:-3 \)),
- one of the following select-helpers: \( \text{starts\_with()} \), \( \text{ends\_with()} \), \( \text{contains()} \), a range using \( : \) or \( \text{regex("")} \). \( \text{starts\_with()} \), \( \text{ends\_with()} \), and \( \text{contains()} \) accept several patterns, e.g \( \text{starts\_with("Sep", "Petal")} \).
- or a function testing for logical conditions, e.g. \( \text{is\_numeric()} \) (or \( \text{is\_numeric} \)), or any user-defined function that selects the variables for which the function returns \( \text{TRUE} \) (like: \( \text{foo <- function(x) mean(x) > 3} \)),
- ranges specified via literal variable names, select-helpers (except \( \text{regex()} \)) and (user-defined) functions can be negated, i.e. return non-matching elements, when prefixed with a \(-\), e.g. \( -\text{ends\_with("")} \), \( -\text{is\_numeric} \) or \( -(\text{Sepal\_Width:Petal\_Length}) \). \textbf{Note}: Negation means that matches are \textit{excluded}, and thus, the exclude argument can be used alternatively. For instance, \( \text{select=ends\_with("Length") (with ~) is equivalent to exclude=ends\_with("Length") (no ~). In case negation should not work as expected, use the exclude argument instead.}

If \( \text{NULL} \), selects all columns. Patterns that found no matches are silently ignored, e.g. \( \text{find\_columns(iris, select = c("Species", "Test"))} \) will just return "Species".

\( \text{exclude} \) See select, however, column names matched by the pattern from exclude will be excluded instead of selected. If \( \text{NULL} \) (the default), excludes no columns.

\( \text{ignore\_case} \) Logical, if \( \text{TRUE} \) and when one of the select-helpers or a regular expression is used in select, ignores lower/upper case in the search pattern when matching against variable names.
regex Logical, if TRUE, the search pattern from select will be treated as regular expression. When regex = TRUE, select must be a character string (or a variable containing a character string) and is not allowed to be one of the supported select-helpers or a character vector of length > 1. regex = TRUE is comparable to using one of the two select-helpers, select = contains("") or select = regex(""), however, since the select-helpers may not work when called from inside other functions (see ‘Details’), this argument may be used as workaround.

verbose Toggle warnings.

Details

This function is comparable to aggregate(x, group, mean), but provides some further information, including summary statistics from a One-Way-ANOVA using x as dependent and group as independent variable. emmeans::contrast() is used to get p-values for each sub-group. P-values indicate whether each group-mean is significantly different from the total mean.

Value

A data frame with information on mean and further summary statistics for each sub-group.

Examples

```r
data(efc)
means_by_group(efc, "c12hour", "e42dep")

data(iris)
means_by_group(iris, "Sepal.Width", "Species")

# weighting
efc$weight <- abs(rnorm(n = nrow(efc), mean = 1, sd = .5))
means_by_group(efc, "c12hour", "e42dep", weights = "weight")
```

```
mean_sd

Summary Helpers

Description

Summary Helpers

Usage

mean_sd(x, times = 1L, remove_na = TRUE, named = TRUE, na.rm = TRUE, ...)

median_mad(
  x,
  times = 1L,
  remove_na = TRUE,
  constant = 1.4826,
```
Arguments

- **x**: A numeric vector (or one that can be coerced to one via `as.numeric()`) to be summarized.
- **times**: How many SDs above and below the Mean (or MADs around the Median).
- **remove_na**: Logical. Should NA values be removed before computing (TRUE) or not (FALSE, default)?
- **named**: Should the vector be named? (E.g., c("-SD" = -1, Mean = 1, "+SD" = 2).)
- **na.rm**: Deprecated. Please use remove_na instead.
- **constant**: Scale factor.

Value

A (possibly named) numeric vector of length 2*times + 1 of SDs below the mean, the mean, and SDs above the mean (or median and MAD).

Examples

```r
mean_sd(mtcars$mpg)
mean_sd(mtcars$mpg, times = 2L)
median_mad(mtcars$mpg)
```

---

**nhanes_sample**  
Sample dataset from the National Health and Nutrition Examination Survey

**Description**

Selected variables from the National Health and Nutrition Examination Survey that are used in the example from Lumley (2010), Appendix E.

**References**

Normalizes numeric variable to 0-1 range

Description

Performs a normalization of data, i.e., it scales variables in the range 0 - 1. This is a special case of `rescale()`. `unnormalize()` is the counterpart, but only works for variables that have been normalized with `normalize()`.

Usage

```r
normalize(x, ...)
## S3 method for class 'numeric'
normalize(x, include_bounds = TRUE, verbose = TRUE, ...)
## S3 method for class 'data.frame'
normalize(
  x,
  select = NULL,
  exclude = NULL,
  include_bounds = TRUE,
  append = FALSE,
  ignore_case = FALSE,
  regex = FALSE,
  verbose = TRUE,
  ...
)

unnormalize(x, ...)
## S3 method for class 'numeric'
unnormalize(x, verbose = TRUE, ...)
## S3 method for class 'data.frame'
unnormalize(
  x,
  select = NULL,
  exclude = NULL,
  ignore_case = FALSE,
  regex = FALSE,
  verbose = TRUE,
  ...
)
## S3 method for class 'grouped_df'
unnormalize(
```
Arguments

x
A numeric vector, (grouped) data frame, or matrix. See 'Details'.

... Arguments passed to or from other methods.

include_bounds Numeric or logical. Using this can be useful in case of beta-regression, where the response variable is not allowed to include zeros and ones. If TRUE, the input is normalized to a range that includes zero and one. If FALSE, the return value is compressed, using Smithson and Verkuilen’s (2006) formula \((x \times (n - 1) + 0.5) / n\), to avoid zeros and ones in the normalized variables. Else, if numeric (e.g., 0.001), include_bounds defines the "distance" to the lower and upper bound, i.e. the normalized vectors are rescaled to a range from 0 + include_bounds to 1 - include_bounds.

verbose Toggle warnings and messages on or off.

select Variables that will be included when performing the required tasks. Can be either
- a variable specified as a literal variable name (e.g., column_name),
- a string with the variable name (e.g., "column_name"), or a character vector of variable names (e.g., c("col1", "col2", "col3")),
- a formula with variable names (e.g., ~column_1 + column_2),
- a vector of positive integers, giving the positions counting from the left (e.g., 1 or c(1, 3, 5)),
- a vector of negative integers, giving the positions counting from the right (e.g., -1 or -1:-3),
- one of the following select-helpers: starts_with(), ends_with(), contains(), a range using : or regex(""), starts_with(), ends_with(), and contains() accept several patterns, e.g starts_with("Sep", "Petal").
- or a function testing for logical conditions, e.g. is.numeric() (or is.numeric), or any user-defined function that selects the variables for which the function returns TRUE (like: foo <- function(x) mean(x) > 3),
- ranges specified via literal variable names, select-helpers (except regex()) and (user-defined) functions can be negated, i.e. return non-matching elements, when prefixed with a -, e.g. ~ends_with(""), ~is.numeric or ~(Sepal.Width:Petal.Length). **Note:** Negation means that matches are excluded, and thus, the exclude argument can be used alternatively. For instance, select=-ends_with("Length") (with ~) is equivalent to exclude=ends_with("Length") (no ~). In case negation should not work as expected, use the exclude argument instead.
If `NULL`, selects all columns. Patterns that found no matches are silently ignored, e.g. `find_columns(iris, select = c("Species", "Test"))` will just return "Species".

**exclude**

See `select`, however, column names matched by the pattern from `exclude` will be excluded instead of selected. If `NULL` (the default), excludes no columns.

**append**

Logical or string. If TRUE, standardized variables get new column names (with the suffix ".z") and are appended (column bind) to `x`, thus returning both the original and the standardized variables. If FALSE, original variables in `x` will be overwritten by their standardized versions. If a character value, standardized variables are appended with new column names (using the defined suffix) to the original data frame.

**ignore_case**

Logical, if TRUE and when one of the select-helpers or a regular expression is used in `select`, ignores lower/upper case in the search pattern when matching against variable names.

**regex**

Logical, if TRUE, the search pattern from `select` will be treated as regular expression. When `regex = TRUE`, `select` must be a character string (or a variable containing a character string) and is not allowed to be one of the supported select-helpers or a character vector of length > 1. `regex = TRUE` is comparable to using one of the two select-helpers, `select = contains("")` or `select = regex("")`, however, since the select-helpers may not work when called from inside other functions (see 'Details'), this argument may be used as workaround.

**Details**

- If `x` is a matrix, normalization is performed across all values (not column- or row-wise). For column-wise normalization, convert the matrix to a data.frame.
- If `x` is a grouped data frame (`grouped_df`), normalization is performed separately for each group.

**Value**

A normalized object.

**Selection of variables - the `select` argument**

For most functions that have a `select` argument (including this function), the complete input data frame is returned, even when `select` only selects a range of variables. That is, the function is only applied to those variables that have a match in `select`, while all other variables remain unchanged. In other words: for this function, `select` will not omit any non-included variables, so that the returned data frame will include all variables from the input data frame.

**References**

ranktransform

See Also

See `makepredictcall.dw_transformer()` for use in model formulas.

Other transform utilities: `ranktransform()`, `rescale()`, `reverse()`, `standardize()`

Examples

```r
normalize(c(0, 1, 5, -5, -2))
normalize(c(0, 1, 5, -5, -2), include_bounds = FALSE)
# use a value defining the bounds
normalize(c(0, 1, 5, -5, -2), include_bounds = .001)

head(normalize(trees))
```

---

**ranktransform**

(Signed) rank transformation

Description

Transform numeric values with the integers of their rank (i.e., 1st smallest, 2nd smallest, 3rd smallest, etc.). Setting the `sign` argument to `TRUE` will give you signed ranks, where the ranking is done according to absolute size but where the sign is preserved (i.e., 2, 1, -3, 4).

Usage

```r
ranktransform(x, ...)
```

```r
## S3 method for class 'numeric'
ranktransform(x, sign = FALSE, method = "average", verbose = TRUE, ...)
```

```r
## S3 method for class 'data.frame'
ranktransform(  
  x,  
  select = NULL,  
  exclude = NULL,  
  sign = FALSE,  
  method = "average",  
  ignore_case = FALSE,  
  regex = FALSE,  
  verbose = TRUE,  
  ...  
)
```
Arguments

x Object.
... Arguments passed to or from other methods.

sign Logical, if TRUE, return signed ranks.

method Treatment of ties. Can be one of "average" (default), "first", "last", "random", "max" or "min". See rank() for details.

verbose Toggle warnings.

select Variables that will be included when performing the required tasks. Can be either
  • a variable specified as a literal variable name (e.g., column_name),
  • a string with the variable name (e.g., "column_name"), or a character vector of variable names (e.g., c("col1", "col2", "col3")),
  • a formula with variable names (e.g., ~column_1 + column_2),
  • a vector of positive integers, giving the positions counting from the left (e.g. 1 or c(1, 3, 5)),
  • a vector of negative integers, giving the positions counting from the right (e.g., -1 or -1:-3),
  • one of the following select-helpers: starts_with(), ends_with(), contains(),
    a range using : or regex(""), starts_with(), ends_with(), and contains() accept several patterns, e.g starts_with("Sep", "Petal").
  • or a function testing for logical conditions, e.g. is.numeric() (or is.numeric),
    or any user-defined function that selects the variables for which the function returns TRUE (like: foo <- function(x) mean(x) > 3),
  • ranges specified via literal variable names, select-helpers (except regex()) and (user-defined) functions can be negated, i.e. return non-matching elements, when prefixed with a -, e.g. -ends_with(""), -is.numeric or -(Sepal.Width:Petal.Length). Note: Negation means that matches are excluded, and thus, the exclude argument can be used alternatively. For instance, select=-ends_with("Length") (with -) is equivalent to exclude=ends_with("Length") (no -). In case negation should not work as expected, use the exclude argument instead.

If NULL, selects all columns. Patterns that found no matches are silently ignored, e.g. find_columns(iris, select = c("Species", "Test")) will just return "Species".

exclude See select, however, column names matched by the pattern from exclude will be excluded instead of selected. If NULL (the default), excludes no columns.

ignore_case Logical, if TRUE and when one of the select-helpers or a regular expression is used in select, ignores lower/upper case in the search pattern when matching against variable names.

regex Logical, if TRUE, the search pattern from select will be treated as regular expression. When regex = TRUE, select must be a character string (or a variable containing a character string) and is not allowed to be one of the supported select-helpers or a character vector of length > 1. regex = TRUE is comparable to using one of the two select-helpers, select = contains(""), or select = regex(""), however, since the select-helpers may not work when called from inside other functions (see 'Details'), this argument may be used as workaround.
Value

A rank-transformed object.

Selection of variables - the select argument

For most functions that have a select argument (including this function), the complete input data frame is returned, even when select only selects a range of variables. That is, the function is only applied to those variables that have a match in select, while all other variables remain unchanged. In other words: for this function, select will not omit any non-included variables, so that the returned data frame will include all variables from the input data frame.

See Also

Other transform utilities: \texttt{normalize()}, \texttt{rescale()}, \texttt{reverse()}, \texttt{standardize()}

Examples

\begin{verbatim}
ranktransform(c(0, 1, 5, -5, -2))
# Won't work
# ranktransform(c(0, 1, 5, -5, -2), sign = TRUE)

head(ranktransform(trees))
\end{verbatim}

\begin{longtable}{ll}
\textit{recode\_into} & \textit{Recode values from one or more variables into a new variable} \\
\hline
\end{longtable}

Description

This functions recodes values from one or more variables into a new variable. It is a convenient function to avoid nested \texttt{ifelse()} statements, which is similar to \texttt{dplyr::case\_when()}.  

Usage

\begin{verbatim}
recode\_into(
    ..., 
    data = \texttt{NULL},
    default = \texttt{NA},
    overwrite = \texttt{TRUE},
    preserve\_na = \texttt{FALSE},
    verbose = \texttt{TRUE}
)
\end{verbatim}
Arguments

A sequence of two-sided formulas, where the left hand side (LHS) is a logical
matching condition that determines which values match this case. The LHS of
this formula is also called "recode pattern" (e.g., in messages). The right hand
side (RHS) indicates the replacement value.

data Optional, name of a data frame. This can be used to avoid writing the data name
multiple times in . . . . See 'Examples'.
default Indicates the default value that is chosen when no match in the formulas in . . .
is found. If not provided, NA is used as default value.
overwrite Logical, if TRUE (default) and more than one recode pattern apply to the same
case, already recoded values will be overwritten by subsequent recode patterns.
If FALSE, former recoded cases will not be altered by later recode patterns that
would apply to those cases again. A warning message is printed to alert such
situations and to avoid unintentional recodings.
preserve_na Logical, if TRUE and default is not NA, missing values in the original variable
will be set back to NA in the recoded variable (unless overwritten by other recode
patterns). If FALSE, missing values in the original variable will be recoded to
default. Setting preserve_na = TRUE prevents unintentional overwriting of
missing values with default, which means that you won't find valid values
where the original data only had missing values. See 'Examples'.
verbose Toggle warnings.

Value

A vector with recoded values.

Examples

```r
x <- 1:30
code.into(
  x > 15 ~ "a",
  x > 10 & x <= 15 ~ "b",
  default = "c"
)
x <- 1:10
# default behaviour: second recode pattern "x > 5" overwrites
# some of the formerly recoded cases from pattern "x >= 3 & x <= 7"
code.into(
  x >= 3 & x <= 7 ~ 1,
  x > 5 ~ 2,
  default = 0,
  verbose = FALSE
)
# setting "overwrite = FALSE" will not alter formerly recoded cases
code.into(
  x >= 3 & x <= 7 ~ 1,
  x > 5 ~ 2,
)```
```r
default = 0,
overwrite = FALSE,
verbose = FALSE
)

set.seed(123)
d <- data.frame(
x = sample(1:5, 30, TRUE),
y = sample(letters[1:5], 30, TRUE),
stringsAsFactors = FALSE
)

# from different variables into new vector
recode_into(
d$x %in% 1:3 & d$y %in% c("a", "b") ~ 1,
d$x > 3 ~ 2,
default = 0
)

# handling of missing values
d <- data.frame(
x = c(1, NA, 2, NA, 3, 4),
y = c(1, 11, 3, NA, 5, 6)
)

# first NA in x is overwritten by valid value from y
# we have no known value for second NA in x and y,
# thus we get one NA in the result
recode_into(
x <= 3 ~ 1,
y > 5 ~ 2,
data = d,
default = 0,
preserve_na = TRUE
)

# from different variables into new vector
recode_into(
  x %in% 1:3 & y %in% c("a", "b") ~ 1,
  x > 3 ~ 2,
  data = d,
  default = 0
)
```
recode_values

Recode old values of variables into new values

Description

This function recodes old values into new values and can be used to recode numeric or character vectors, or factors.

Usage

recode_values(x, ...)

## S3 method for class 'numeric'
recode_values(
  x,
  recode = NULL,
  default = NULL,
  preserve_na = TRUE,
  verbose = TRUE,
  ...
)

## S3 method for class 'data.frame'
recode_values(
  x,
  select = NULL,
  exclude = NULL,
  recode = NULL,
  default = NULL,
  preserve_na = TRUE,
  append = FALSE,
  ignore_case = FALSE,
  regex = FALSE,
  verbose = TRUE,
  ...
)

change_code(x, ...)

Arguments

x  A data frame, numeric or character vector, or factor.

... not used.

recode  A list of named vectors, which indicate the recode pairs. The names of the list-elements (i.e. the left-hand side) represent the new values, while the values of the list-elements indicate the original (old) values that should be replaced. When recoding numeric vectors, element names have to be surrounded in backticks. For
example, recode=list(\'0\'=1) would recode all 1 into 0 in a numeric vector. See also 'Examples' and 'Details'.

default
Defines the default value for all values that have no match in the recode-pairs. Note that, if preserve_na=FALSE, missing values (NA) are also captured by the default argument, and thus will also be recoded into the specified value. See 'Examples' and 'Details'.

preserve_na
Logical, if TRUE, NA (missing values) are preserved. This overrides any other arguments, including default. Hence, if preserve_na=TRUE, default will no longer convert NA into the specified default value.

verbose
Toggle warnings.

select
Variables that will be included when performing the required tasks. Can be either
- a variable specified as a literal variable name (e.g., column_name),
- a string with the variable name (e.g., "column_name"), or a character vector of variable names (e.g., c("col1", "col2", "col3")),
- a formula with variable names (e.g., ~column_1 + column_2),
- a vector of positive integers, giving the positions counting from the left (e.g. 1 or c(1, 3, 5)),
- a vector of negative integers, giving the positions counting from the right (e.g., -1 or -1:-3),
- one of the following select-helpers: starts_with(), ends_with(), contains(), a range using : or regex(""), starts_with(), ends_with(), and contains() accept several patterns, e.g. starts_with("Sep", "Petal"),
- or a function testing for logical conditions, e.g. is.numeric() (or is_numeric), or any user-defined function that selects the variables for which the function returns TRUE (like: foo <- function(x) mean(x) > 3),
- ranges specified via literal variable names, select-helpers (except regex()) and (user-defined) functions can be negated, i.e. return non-matching elements, when prefixed with a -, e.g. -ends_with(""), -is.numeric or -(Sepal.Width:Petal.Length). Note: Negation means that matches are excluded, and thus, the exclude argument can be used alternatively. For instance, select=-ends_with("Length") (with -) is equivalent to exclude=ends_with("Length") (no -). In case negation should not work as expected, use the exclude argument instead.

If NULL, selects all columns. Patterns that found no matches are silently ignored, e.g. find_columns(iris, select = c("Species", "Test")) will just return "Species".

exclude
See select, however, column names matched by the pattern from exclude will be excluded instead of selected. If NULL (the default), excludes no columns.

append
Logical or string. If TRUE, recoded or converted variables get new column names and are appended (column bind) to x, thus returning both the original and the recoded variables. The new columns get a suffix, based on the calling function: "_r" for recode functions, "_n" for to_numeric(), "_f" for to_factor(), or "_s" for slide(). If append=FALSE, original variables in x will be overwritten by their recoded versions. If a character value, recoded variables are appended with new column names (using the defined suffix) to the original data frame.
ignore_case Logical, if TRUE and when one of the select-helpers or a regular expression is used in select, ignores lower/upper case in the search pattern when matching against variable names.

regex Logical, if TRUE, the search pattern from select will be treated as regular expression. When regex = TRUE, select must be a character string (or a variable containing a character string) and is not allowed to be one of the supported select-helpers or a character vector of length > 1. regex = TRUE is comparable to using one of the two select-helpers, select = contains(""), or select = regex(""), however, since the select-helpers may not work when called from inside other functions (see 'Details'), this argument may be used as workaround.

Details

This section describes the pattern of the recode arguments, which also provides some shortcuts, in particular when recoding numeric values.

- **Single values**
  Single values either need to be wrapped in backticks (in case of numeric values) or "as is" (for character or factor levels). Example: recode=list('0'=1, '1'=2) would recode 1 into 0, and 2 into 1. For factors or character vectors, an example is: recode=list(x="a",y="b") (recode "a" into "x" and "b" into "y").

- **Multiple values**
  Multiple values that should be recoded into a new value can be separated with comma. Example: recode=list('1'=c(1,4), '2'=c(2,3)) would recode the values 1 and 4 into 1, and 2 and 3 into 2. It is also possible to define the old values as a character string, like: recode=list('1'="1,4", '2'="2,3") For factors or character vectors, an example is: recode=list(x=c("a", "b"), y=c("c", "d"))

- **Value range**
  Numeric value ranges can be defined using the .:. Example: recode=list('1'=1:3, '2'=4:6) would recode all values from 1 to 3 into 1, and 4 to 6 into 2.

- **min and max**
  placeholder to use the minimum or maximum value of the (numeric) variable. Useful, e.g., when recoding ranges of values. Example: recode=list('1'="min:10", '2'="11:max")

- **default values**
  The default argument defines the default value for all values that have no match in the recode-pairs. For example, recode=list('1'=c(1,2), '2'=c(3,4)), default=9 would recode values 1 and 2 into 1, 3 and 4 into 2, and all other values into 9. If preserve_na is set to FALSE, NA (missing values) will also be recoded into the specified default value.

- **Reversing and rescaling**
  See reverse() and rescale().

Value

x, where old values are replaced by new values.
Selection of variables - the `select` argument

For most functions that have a `select` argument (including this function), the complete input data frame is returned, even when `select` only selects a range of variables. That is, the function is only applied to those variables that have a match in `select`, while all other variables remain unchanged. In other words: for this function, `select` will not omit any non-included variables, so that the returned data frame will include all variables from the input data frame.

Note

You can use `options(data_recode_pattern = "old=new")` to switch the behaviour of the `recode`-argument, i.e. recode-pairs are now following the pattern old values = new values, e.g. if `getOption("data_recode_pattern")` is set to "old=new", then `recode(`'1'=0)` would recode all 1 into 0. The default for `recode(`'1'=0)` is to recode all 0 into 1.

See Also

- Functions to rename stuff: `data_rename()`, `data_rename_rows()`, `data_addprefix()`, `data_addsuffix()`
- Functions to reorder or remove columns: `data_reorder()`, `data_relocate()`, `data_remove()`
- Functions to reshape, pivot or rotate data frames: `data_to_long()`, `data_to_wide()`, `data_rotate()`
- Functions to recode data: `rescale()`, `reverse()`, `categorize()`, `recode_values()`, `slide()`
- Functions to standardize, normalize, rank-transform: `center()`, `standardize()`, `normalize()`, `ranktransform()`, `winsorize()`
- Split and merge data frames: `data_partition()`, `data_merge()`
- Functions to find or select columns: `data_select()`, `data_find()`
- Functions to filter rows: `data_match()`, `data_filter()`

Examples

```r
# numeric ---------
set.seed(123)
x <- sample(c(1:4, NA), 15, TRUE)
table(x, useNA = "always")

out <- recode_values(x, list("0" = 1, "1" = 2:3, "2" = 4))
table(out, useNA = "always")

# to recode NA values, set preserve_na to FALSE
out <- recode_values(x, list("0" = 1, "1" = 2:3, "2" = 4, "9" = NA), preserve_na = FALSE)
table(out, useNA = "always")

# preserve na ---------
out <- recode_values(x, list("0" = 1, "1" = 2:3), default = 77)
```
out

table(out, useNA = "always")

# recode na into default ----------
out <- recode_values(
  x,
  list(`0` = 1, `1` = 2:3),
  default = 77,
  preserve_na = FALSE
)
out
table(out, useNA = "always")

# factors (character vectors are similar) ----------
set.seed(123)
x <- as.factor(sample(c("a", "b", "c"), 15, TRUE))
table(x)

out <- recode_values(x, list(x = "a", y = c("b", "c")))
out
table(out)

out <- recode_values(x, list(x = "a", y = "b", z = "c"))
out
table(out)

out <- recode_values(x, list(y = "b,c"), default = 77)
# same as
# recode_values(x, list(y = c("b", "c")), default = 77)
out
table(out)

# data frames ----------
set.seed(123)
d <- data.frame(
  x = sample(c(1:4, NA), 12, TRUE),
  y = as.factor(sample(c("a", "b", "c"), 12, TRUE)),
  stringsAsFactors = FALSE
)

code_values(
  d,
  recode = list(`0` = 1, `1` = 2:3, `2` = 4, x = "a", y = c("b", "c")),
  append = TRUE
)

# switch recode pattern to "old=new" ----------
options(data_recode_pattern = "old=new")

# numeric
```r
set.seed(123)
x <- sample(c(1:4, NA), 15, TRUE)
table(x, useNA = "always")

out <- recode_values(x, list("1" = 0, "2:3" = 1, "4" = 2))
table(out, useNA = "always")

# factors (character vectors are similar)
set.seed(123)
x <- as.factor(sample(c("a", "b", "c"), 15, TRUE))
table(x)

out <- recode_values(x, list(a = "x", b, c = "y"))
table(out)

# reset options
options(data_recode_pattern = NULL)
```

---

### remove_empty

Return or remove variables or observations that are completely missing.

**Description**

These functions check which rows or columns of a data frame completely contain missing values, i.e. which observations or variables completely have missing values, and either (1) returns their indices; or (2) removes them from the data frame.

**Usage**

- `empty_columns(x)`
- `empty_rows(x)`
- `remove_empty_columns(x)`
- `remove_empty_rows(x)`
- `remove_empty(x)`

**Arguments**

- `x` A data frame.

**Details**

For character vectors, empty string values (i.e. "") are also considered as missing value. Thus, if a character vector only contains `NA` and "\"", it is considered as empty variable and will be removed. Same applies
Value

- For `empty_columns()` and `empty_rows()`, a numeric (named) vector with row or column indices of those variables that completely have missing values.
- For `remove_empty_columns()` and `remove_empty_rows()`, a data frame with "empty" columns or rows removed, respectively.
- For `remove_empty()`, both empty rows and columns will be removed.

Examples

tmp <- data.frame(
  a = c(1, 2, 3, NA, 5),
  b = c(1, NA, 3, NA, 5),
  c = c(NA, NA, NA, NA, NA),
  d = c(1, NA, 3, NA, 5)
)

tmp

# indices of empty columns or rows
empty_columns(tmp)
empty_rows(tmp)

# remove empty columns or rows
remove_empty_columns(tmp)
remove_empty_rows(tmp)

# remove empty columns and rows
remove_empty(tmp)

# also remove "empty" character vectors
tmp <- data.frame(
  a = c(1, 2, 3, NA, 5),
  b = c(1, NA, 3, NA, 5),
  c = c("", ",", ",", ","),
  stringsAsFactors = FALSE
)
empty_columns(tmp)

---

**replace_nan_inf**

Convert infinite or NaN values into NA

Description

Replaces all infinite (Inf and -Inf) or NaN values with NA.

Usage

`replace_nan_inf(x, ...)`
Arguments

- `x` A vector or a dataframe
- `...` Currently not used.

Value

Data with Inf, -Inf, and NaN converted to NA.

Examples

```r
# a vector
x <- c(1, 2, NA, 3, NaN, 4, NA, 5, Inf, -Inf, 6, 7)
replace_nan_inf(x)

# a data frame
df <- data.frame(
  x = c(1, NA, 5, Inf, 2, NA),
  y = c(3, NaN, 4, -Inf, 6, 7),
  stringsAsFactors = FALSE
)
replace_nan_inf(df)
```

Description

Rescale variables to a new range. Can also be used to reverse-score variables (change the keying/scoring direction), or to expand a range.

Usage

```r
rescale(x, ...)
change_scale(x, ...)
```

```r
## S3 method for class 'numeric'
rescale(
  x,
  to = c(0, 100),
  multiply = NULL,
  add = NULL,
  range = NULL,
  verbose = TRUE,
  ...
)
```
## S3 method for class 'data.frame'
rescale(
  x,
  select = NULL,
  exclude = NULL,
  to = c(0, 100),
  multiply = NULL,
  add = NULL,
  range = NULL,
  append = FALSE,
  ignore_case = FALSE,
  regex = FALSE,
  verbose = FALSE,
  ...
)

### Arguments

**x**
A (grouped) data frame, numeric vector or factor.

**...**
Arguments passed to or from other methods.

**to**
Numeric vector of length 2 giving the new range that the variable will have after rescaling. To reverse-score a variable, the range should be given with the maximum value first. See examples.

**multiply**
If not NULL, to is ignored and multiply will be used, giving the factor by which the actual range of x should be expanded. For example, if a vector ranges from 5 to 15 and multiply = 1.1, the current range of 10 will be expanded by the factor of 1.1, giving a new range of 11. Thus, the rescaled vector would range from 4.5 to 15.5.

**add**
A vector of length 1 or 2. If not NULL, to is ignored and add will be used, giving the amount by which the minimum and maximum of the actual range of x should be expanded. For example, if a vector ranges from 5 to 15 and add = 1, the range will be expanded from 4 to 16. If add is of length 2, then the first value is used for the lower bound and the second value for the upper bound.

**range**
Initial (old) range of values. If NULL, will take the range of the input vector (range(x)).

**verbose**
Toggle warnings.

**select**
Variables that will be included when performing the required tasks. Can be either
- a variable specified as a literal variable name (e.g., column_name),
- a string with the variable name (e.g., "column_name"), or a character vector of variable names (e.g., c("col1", "col2", "col3"),
- a formula with variable names (e.g., ~column_1 + column_2),
- a vector of positive integers, giving the positions counting from the left (e.g. 1 or c(1, 3, 5)),
- a vector of negative integers, giving the positions counting from the right (e.g., -1 or -1:-3),
• one of the following select-helpers: \texttt{starts\_with()}, \texttt{ends\_with()}, \texttt{contains()}, a range using : or \texttt{regex("\"\")}, \texttt{starts\_with()}, \texttt{ends\_with()}, and \texttt{contains()} accept several patterns, e.g \texttt{starts\_with("Sep", "Petal")},
• or a function testing for logical conditions, e.g. \texttt{is.numeric()} (or \texttt{is.numeric}), or any user-defined function that selects the variables for which the function returns \texttt{TRUE} (like: \texttt{foo <- function(x) mean(x) > 3}),
• ranges specified via literal variable names, select-helpers (except \texttt{regex()}) and (user-defined) functions can be negated, i.e. return non-matching elements, when prefixed with a -, e.g. \texttt{!ends\_with("\")}, \texttt{!is.numeric} or \texttt{!(Sepal\_Width:Petal\_Length)}. \textbf{Note:} Negation means that matches are \textit{excluded}, and thus, the exclude argument can be used alternatively. For instance, \texttt{select=-ends\_with("Length")} (with -) is equivalent to \texttt{exclude=ends\_with("Length")} (no -). In case negation should not work as expected, use the exclude argument instead.

If \texttt{NULL}, selects all columns. Patterns that found no matches are silently ignored, e.g. \texttt{find\_columns(iris, select = c("Species", "Test"))} will just return "Species".

\begin{description}
\item[exclude] See select, however, column names matched by the pattern from exclude will be excluded instead of selected. If \texttt{NULL} (the default), excludes no columns.
\item[append] Logical or string. If \texttt{TRUE}, recoded or converted variables get new column names and are appended (column bind) to \texttt{x}, thus returning both the original and the recoded variables. The new columns get a suffix, based on the calling function: 
"\_r" for \texttt{rcode} functions, "\_n" for \texttt{to\_numeric}."\_f" for \texttt{to\_factor}, or "\_s" for \texttt{slide}. If \texttt{append} = FALSE, original variables in \texttt{x} will be overwritten by their recoded versions. If a character value, recoded variables are appended with new column names (using the defined suffix) to the original data frame.
\item[ignore\_case] Logical, if \texttt{TRUE} and when one of the select-helpers or a regular expression is used in select, ignores lower/upper case in the search pattern when matching against variable names.
\item[regex] Logical, if \texttt{TRUE}, the search pattern from select will be treated as regular expression. When \texttt{regex} = \texttt{TRUE}, select \textit{must} be a character string (or a variable containing a character string) and is not allowed to be one of the supported select-helpers or a character vector of length > 1. \texttt{regex} = \texttt{TRUE} is comparable to using one of the two select-helpers, \texttt{select} = \texttt{contains(""}) or \texttt{select} = \texttt{regex(""}), however, since the select-helpers may not work when called from inside other functions (see 'Details'), this argument may be used as workaround.
\end{description}

\textbf{Value}

A rescaled object.

\textbf{Selection of variables - the select argument}

For most functions that have a select argument (including this function), the complete input data frame is returned, even when select only selects a range of variables. That is, the function is only applied to those variables that have a match in select, while all other variables remain unchanged. In other words: for this function, select will not omit any non-included variables, so that the returned data frame will include all variables from the input data frame.
See Also

See `makepredictcall.dw_transformer()` for use in model formulas.

Other transform utilities: `normalize()`, `ranktransform()`, `reverse()`, `standardize()`

Examples

```r
rescale(c(0, 1, 5, -5, -2))
rescale(c(0, 1, 5, -5, -2), to = c(-5, 5))
rescale(c(1, 2, 3, 4, 5), to = c(-2, 2))

# Specify the "theoretical" range of the input vector
rescale(c(1, 3, 4), to = c(0, 40), range = c(0, 4))

# Reverse-score a variable
rescale(c(1, 2, 3, 4, 5), to = c(5, 1))
rescale(c(1, 2, 3, 4, 5), to = c(2, -2))

# Data frames
head(rescale(iris, to = c(0, 1)))
head(rescale(iris, to = c(0, 1), select = "Sepal.Length"))

# One can specify a list of ranges
head(rescale(iris, to = list(
    "Sepal.Length" = c(0, 1),
    "Petal.Length" = c(-1, 0)
)))

# "expand" ranges by a factor or a given value
x <- 5:15
x
# both will expand the range by 10%
rescale(x, multiply = 1.1)
rescale(x, add = 0.5)

# expand range by different values
rescale(x, add = c(1, 3))

# Specify list of multipliers
d <- data.frame(x = 5:15, y = 5:15)
rescale(d, multiply = list(x = 1.1, y = 0.5))
```

---

**rescale_weights**

*Rescale design weights for multilevel analysis*

**Description**

Most functions to fit multilevel and mixed effects models only allow to specify frequency weights, but not design (i.e. sampling or probability) weights, which should be used when analyzing complex
samples and survey data. `rescale_weights()` implements an algorithm proposed by Asparouhov (2006) and Carle (2009) to rescale design weights in survey data to account for the grouping structure of multilevel models, which then can be used for multilevel modelling.

**Usage**

```r
rescale_weights(data, group, probability_weights, nest = FALSE)
```

**Arguments**

- `data`: A data frame.
- `group`: Variable names (as character vector, or as formula), indicating the grouping structure (strata) of the survey data (level-2-cluster variable). It is also possible to create weights for multiple group variables; in such cases, each created weighting variable will be suffixed by the name of the group variable.
- `probability_weights`: Variable indicating the probability (design or sampling) weights of the survey data (level-1-weight).
- `nest`: Logical, if `TRUE` and `group` indicates at least two group variables, then groups are "nested", i.e. groups are now a combination from each group level of the variables in `group`.

**Details**

Rescaling is based on two methods: For `pweights_a`, the sample weights `probability_weights` are adjusted by a factor that represents the proportion of group size divided by the sum of sampling weights within each group. The adjustment factor for `pweights_b` is the sum of sample weights within each group divided by the sum of squared sample weights within each group (see Carle (2009), Appendix B). In other words, `pweights_a" scales the weights so that the new weights sum to the cluster sample size" while `pweights_b" scales the weights so that the new weights sum to the effective cluster size".

Regarding the choice between scaling methods A and B, Carle suggests that "analysts who wish to discuss point estimates should report results based on weighting method A. For analysts more interested in residual between-group variance, method B may generally provide the least biased estimates". In general, it is recommended to fit a non-weighted model and weighted models with both scaling methods and when comparing the models, see whether the "inferential decisions converge", to gain confidence in the results.

Though the bias of scaled weights decreases with increasing group size, method A is preferred when insufficient or low group size is a concern.

The group ID and probably PSU may be used as random effects (e.g. nested design, or group and PSU as varying intercepts), depending on the survey design that should be mimicked.

**Value**

Data, including the new weighting variables: `pweights_a` and `pweights_b`, which represent the rescaled design weights to use in multilevel models (use these variables for the `weights` argument).
References


Examples

```r
if (require("lme4")) {
  data(nhanes_sample)
  head(rescale_weights(nhanes_sample, "SDMVSTRA", "WTINT2YR"))

  # also works with multiple group-variables
  head(rescale_weights(nhanes_sample, c("SDMVSTRA", "SDMVPSU"), "WTINT2YR"))

  # or nested structures.
  x <- rescale_weights(
    data = nhanes_sample,
    group = c("SDMVSTRA", "SDMVPSU"),
    probability_weights = "WTINT2YR",
    nest = TRUE
  )
  head(x)

  nhanes_sample <- rescale_weights(nhanes_sample, "SDMVSTRA", "WTINT2YR")

  glmer(
    total ~ factor(RIAGENDR) * (log(age) + factor(RIDRETH1)) + (1 | SDMVPSU),
    family = poisson(),
    data = nhanes_sample,
    weights = pweights_a
  )
}
```

---

**reshape_ci**

Reshape CI between wide/long formats

### Description

Reshape CI between wide/long formats.

### Usage

```r
reshape_ci(x, ci_type = "CI")
```
Arguments

- **x**: A data frame containing columns named `CI_low` and `CI_high` (or similar, see `ci_type`).
- **ci_type**: String indicating the "type" (i.e. prefix) of the interval columns. Per *easystats* convention, confidence or credible intervals are named `CI_low` and `CI_high`, and the related `ci_type` would be "CI". If column names for other intervals differ, `ci_type` can be used to indicate the name, e.g. `ci_type = "SI"` can be used for support intervals, where the column names in the data frame would be `SI_low` and `SI_high`.

Value

A data frame with columns corresponding to confidence intervals reshaped either to wide or long format.

Examples

```r
x <- data.frame(
  Parameter = c("Term 1", "Term 2", "Term 1", "Term 2"),
  CI = c(.8, .8, .9, .9),
  CI_low = c(.2, .3, .1, .15),
  CI_high = c(.5, .6, .8, .85),
  stringsAsFactors = FALSE
)
reshape_ci(x)
reshape_ci(reshape_ci(x))
```

---

**reverse**

Reverse-Score Variables

Description

Reverse-score variables (change the keying/scoring direction).

Usage

```r
reverse(x, ...)
reverse_scale(x, ...)
```

```r
# S3 method for class 'numeric'
reverse(x, range = NULL, verbose = TRUE, ...)
```

```r
# S3 method for class 'data.frame'
reverse(
  x,
```
reverse

```r
select = NULL,
exclude = NULL,
range = NULL,
append = FALSE,
ignore_case = FALSE,
regex = FALSE,
verbose = FALSE,
...)
```

**Arguments**

- **x**: A (grouped) data frame, numeric vector or factor.
- **range**: Range of values that is used as reference for reversing the scale. For numeric variables, can be `NULL` or a numeric vector of length two, indicating the lowest and highest value of the reference range. If `NULL`, will take the range of the input vector (`range(x)`). For factors, range can be `NULL`, a numeric vector of length two, or a (numeric) vector of at least the same length as factor levels (i.e. must be equal to or larger than `nlevels(x)`). Note that providing a range for factors usually only makes sense when factor levels are numeric, not characters.
- **select**: Variables that will be included when performing the required tasks. Can be either
  - a variable specified as a literal variable name (e.g., `column_name`),
  - a string with the variable name (e.g., "column_name"), or a character vector of variable names (e.g., `c("col1", "col2", "col3")`),
  - a formula with variable names (e.g., `~column_1 + column_2`),
  - a vector of positive integers, giving the positions counting from the left (e.g., `1` or `c(1, 3, 5)`),
  - a vector of negative integers, giving the positions counting from the right (e.g., `-1` or `-1:-3`),
  - one of the following select-helpers: `starts_with()`, `ends_with()`, `contains()`, a range using `:` or `regex("\")`. `starts_with()`, `ends_with()`, and `contains()` accept several patterns, e.g. `starts_with("Sep", "Petal")`.
  - or a function testing for logical conditions, e.g. `is.numeric()` (or `is.numeric`),
  - or any user-defined function that selects the variables for which the function returns `TRUE` (like: `foo <- function(x) mean(x) > 3`),
  - ranges specified via literal variable names, select-helpers (except `regex()`) and (user-defined) functions can be negated, i.e. return non-matching elements, when prefixed with a `-`, e.g. `-ends_with("\")`, `-is.numeric or -(Sepal.Width:Petal.Length). Note: Negation means that matches are *excluded*, and thus, the exclude argument can be used alternatively. For instance, `select=-ends_with("Length")` (with `-`) is equivalent to `exclude=ends_with("Length")` (no `-`). In case negation should not work as expected, use the `exclude` argument instead.
If NULL, selects all columns. Patterns that found no matches are silently ignored, e.g. `find_columns(iris, select = c("Species", "Test"))` will just return "Species".

### exclude
See select, however, column names matched by the pattern from exclude will be excluded instead of selected. If NULL (the default), excludes no columns.

### append
Logical or string. If TRUE, recoded or converted variables get new column names and are appended (column bind) to x, thus returning both the original and the recoded variables. The new columns get a suffix, based on the calling function: ".r" for recode functions, ".n" for `to_numeric()`, ".f" for `to_factor()`, or ".s" for `slide()`. If `append=FALSE`, original variables in x will be overwritten by their recoded versions. If a character value, recoded variables are appended with new column names (using the defined suffix) to the original data frame.

### ignore_case
Logical, if TRUE and when one of the select-helpers or a regular expression is used in select, ignores lower/upper case in the search pattern when matching against variable names.

### regex
Logical, if TRUE, the search pattern from select will be treated as regular expression. When `regex = TRUE`, select must be a character string (or a variable containing a character string) and is not allowed to be one of the supported select-helpers or a character vector of length > 1. `regex = TRUE` is comparable to using one of the two select-helpers, `select = contains("")` or `select = regex("")`, however, since the select-helpers may not work when called from inside other functions (see 'Details'), this argument may be used as workaround.

### Value
A reverse-scored object.

### Selection of variables - the `select` argument
For most functions that have a select argument (including this function), the complete input data frame is returned, even when select only selects a range of variables. That is, the function is only applied to those variables that have a match in select, while all other variables remain unchanged. In other words: for this function, select will not omit any non-included variables, so that the returned data frame will include all variables from the input data frame.

### See Also
Other transform utilities: `normalize()`, `ranktransform()`, `rescale()`, `standardize()`

### Examples
```
reverse(c(1, 2, 3, 4, 5))
reverse(c(-2, -1, 0, 2, 1))

# Specify the "theoretical" range of the input vector
reverse(c(1, 3, 4), range = c(0, 4))

# Factor variables
reverse(factor(c(1, 2, 3, 4, 5)))
```
### Tools for working with row names or row ids

**Description**

Tools for working with row names or row ids

**Usage**

```r
rownames_as_column(x, var = "rowname")
column_as_rownames(x, var = "rowname")
rowid_as_column(x, var = "rowid")
```

**Arguments**

- `x`: A data frame.
- `var`: Name of column to use for row names/ids. For `column_as_rownames()`, this argument can be the variable name or the column number. For `rownames_as_column()` and `rowid_as_column()`, the column name must not already exist in the data.

**Details**

These are similar to tibble's functions `column_to_rownames()`, `rownames_to_column()` and `rowid_to_column()`. Note that the behavior of `rowid_as_column()` is different for grouped dataframes: instead of making the rowid unique across the full dataframe, it creates rowid per group. Therefore, there can be several rows with the same rowid if they belong to different groups.

If you are familiar with `dplyr`, this is similar to doing the following:

```r
data |> group_by(grp) |> mutate(id = row_number()) |> ungroup()
```

**Value**

A data frame.
row_means 121

Examples

# Convert between row names and column --------------------------------
test <- rownames_as_column(mtcars, var = "car")
test
head(column_as_rownames(test, var = "car"))

test_data <- head(iris)
rowid_as_column(test_data)
rowid_as_column(test_data, var = "my_id")

---

row_means
Row means (optionally with minimum amount of valid values)

Description

This function is similar to the SPSS MEAN.n function and computes row means from a data frame or matrix if at least min_valid values of a row are valid (and not NA).

Usage

row_means(
  data,
  select = NULL,
  exclude = NULL,
  min_valid = NULL,
  digits = NULL,
  ignore_case = FALSE,
  regex = FALSE,
  remove_na = FALSE,
  verbose = TRUE
)

Arguments

data A data frame with at least two columns, where row means are applied.

select Variables that will be included when performing the required tasks. Can be either

• a variable specified as a literal variable name (e.g., column_name).
• a string with the variable name (e.g., "column_name"), or a character vector of variable names (e.g., c("col1", "col2", "col3")),
• a formula with variable names (e.g., ~column_1 + column_2),
• a vector of positive integers, giving the positions counting from the left (e.g. 1 or c(1, 3, 5)),
• a vector of negative integers, giving the positions counting from the right (e.g., -1 or -1:-3),
• one of the following select-helpers: `starts_with()`, `ends_with()`, `contains()`, a range using `:`, or `regex(""`)`. `starts_with()`, `ends_with()`, and `contains()` accept several patterns, e.g. `starts_with("Sep", "Petal")`.

• or a function testing for logical conditions, e.g. `is.numeric()` (or `is.numeric`), or any user-defined function that selects the variables for which the function returns `TRUE` (like: `foo <- function(x) mean(x) > 3`),

• ranges specified via literal variable names, select-helpers (except `regex()`) and (user-defined) functions can be negated, i.e. return non-matching elements, when prefixed with a `-`, e.g. `-ends_with("")`, `-is.numeric` or `-(Sepal.Width:Petal.Length)`. **Note:** Negation means that matches are excluded, and thus, the exclude argument can be used alternatively. For instance, `select=ends_with("Length")` (with `-`) is equivalent to `exclude=ends_with("Length")` (no `-`). In case negation should not work as expected, use the exclude argument instead.

If `NULL`, selects all columns. Patterns that found no matches are silently ignored, e.g. `find_columns(iris, select = c("Species", "Test"))` will just return "Species".

`exclude` See `select`, however, column names matched by the pattern from `exclude` will be excluded instead of selected. If `NULL` (the default), excludes no columns.

`min_valid` Optional, a numeric value of length 1. May either be

• a numeric value that indicates the amount of valid values per row to calculate the row mean;

• or a value between 0 and 1, indicating a proportion of valid values per row to calculate the row mean (see 'Details').

• `NULL` (default), in which all cases are considered.

If a row’s sum of valid values is less than `min_valid`, `NA` will be returned.

`digits` Numeric value indicating the number of decimal places to be used for rounding mean values. Negative values are allowed (see 'Details'). By default, `digits = NULL` and no rounding is used.

`ignore_case` Logical, if `TRUE` and when one of the select-helpers or a regular expression is used in `select`, ignores lower/upper case in the search pattern when matching against variable names.

`regex` Logical, if `TRUE`, the search pattern from `select` will be treated as regular expression. When `regex = TRUE`, `select` must be a character string (or a variable containing a character string) and is not allowed to be one of the supported select-helpers or a character vector of length > 1. `regex = TRUE` is comparable to using one of the two select-helpers, `select = contains("")` or `select = regex("")`, however, since the select-helpers may not work when called from inside other functions (see 'Details'), this argument may be used as workaround.

`remove_na` Logical, if `TRUE` (default), removes missing (NA) values before calculating row means. Only applies if `min_valid` is not specified.

`verbose` Toggle warnings.
Details

Rounding to a negative number of digits means rounding to a power of ten, for example `row_means(df, 3, digits = -2)` rounds to the nearest hundred. For `min_valid`, if not `NULL`, `min_valid` must be a numeric value from 0 to `ncol(data)`. If a row in the data frame has at least `min_valid` non-missing values, the row mean is returned. If `min_valid` is a non-integer value from 0 to 1, `min_valid` is considered to indicate the proportion of required non-missing values per row. E.g., if `min_valid = 0.75`, a row must have at least `ncol(data) * min_valid` non-missing values for the row mean to be calculated. See 'Examples'.

Value

A vector with row means for those rows with at least n valid values.

Examples

dat <- data.frame(
  c1 = c(1, 2, NA, 4),
  c2 = c(NA, 2, NA, 5),
  c3 = c(NA, 4, NA, NA),
  c4 = c(2, 3, 7, 8)
)

# default, all means are shown, if no NA values are present
row_means(dat)

# remove all NA before computing row means
row_means(dat, remove_na = TRUE)

# needs at least 4 non-missing values per row
row_means(dat, min_valid = 4) # 1 valid return value

# needs at least 3 non-missing values per row
row_means(dat, min_valid = 3) # 2 valid return values

# needs at least 2 non-missing values per row
row_means(dat, min_valid = 2)

# needs at least 1 non-missing value per row, for two selected variables
row_means(dat, select = c("c1", "c3"), min_valid = 1)

# needs at least 50% of non-missing values per row
row_means(dat, min_valid = 0.5) # 3 valid return values

# needs at least 75% of non-missing values per row
row_means(dat, min_valid = 0.75) # 2 valid return values
Description

Tools for working with column names

Usage

row_to_colnames(x, row = 1, na_prefix = "x", verbose = TRUE)

colnames_to_row(x, prefix = "x")

Arguments

x A data frame.
row Row to use as column names.
na_prefix Prefix to give to the column name if the row has an NA. Default is 'x', and it will be incremented at each NA (x1, x2, etc.).
verbose Toggle warnings.
prefix Prefix to give to the column name. Default is 'x', and it will be incremented at each column (x1, x2, etc.).

Value

row_to_colnames() and colnames_to_row() both return a data frame.

Examples

# Convert a row to column names --------------------------------
test <- data.frame(
  a = c("iso", 2, 5),
  b = c("year", 3, 6),
  c = c("value", 5, 7)
)
test
row_to_colnames(test)

# Convert column names to row --------------------------------
test <- data.frame(
  ARG = c("BRA", "FRA"),
  '1960' = c(1960, 1960),
)
test
colnames_to_row(test)
**skewness**

*Compute Skewness and (Excess) Kurtosis*

**Description**

Compute Skewness and (Excess) Kurtosis

**Usage**

```r
skewness(x, ...) 

## S3 method for class 'numeric'
skewness(
  x,
  remove_na = TRUE,
  type = "2",
  iterations = NULL,
  verbose = TRUE,
  na.rm = TRUE,
  ...
)

kurtosis(x, ...)

## S3 method for class 'numeric'
kurtosis(
  x,
  remove_na = TRUE,
  type = "2",
  iterations = NULL,
  verbose = TRUE,
  na.rm = TRUE,
  ...
)
```

# S3 method for class 'parameters_kurtosis'

```r
print(x, digits = 3, test = FALSE, ...)
```

# S3 method for class 'parameters_skewness'

```r
print(x, digits = 3, test = FALSE, ...)
```

# S3 method for class 'parameters_skewness'

```r
summary(object, test = FALSE, ...)
```

# S3 method for class 'parameters_kurtosis'

```r
summary(object, test = FALSE, ...)
```
Arguments

x
A numeric vector or data.frame.

... Arguments passed to or from other methods.

remove_na Logical. Should NA values be removed before computing (TRUE or not (FALSE, default)?

type Type of algorithm for computing skewness. May be one of 1 (or "1", "I" or "classic"), 2 (or "2", "II" or "SPSS" or "SAS") or 3 (or "3", "III" or "Minitab"). See 'Details'.

iterations The number of bootstrap replicates for computing standard errors. If NULL (default), parametric standard errors are computed.

verbose Toggle warnings and messages.

na.rm Deprecated. Please use remove_na instead.

digits Number of decimal places.

test Logical, if TRUE, tests if skewness or kurtosis is significantly different from zero.

object An object returned by skewness() or kurtosis().

Details

Skewness: Symmetric distributions have a skewness around zero, while a negative skewness values indicates a "left-skewed" distribution, and a positive skewness values indicates a "right-skewed" distribution. Examples for the relationship of skewness and distributions are:

- Normal distribution (and other symmetric distribution) has a skewness of 0
- Half-normal distribution has a skewness just below 1
- Exponential distribution has a skewness of 2
- Lognormal distribution can have a skewness of any positive value, depending on its parameters

(K sources: <https://en.wikipedia.org/wiki/Skewness>)

Types of Skewness: skewness() supports three different methods for estimating skewness, as discussed in Joanes and Gill (1988):

- Type "1" is the "classical" method, which is \( g_1 = \left( \frac{\text{sum}((x - \text{mean}(x))^3)}{n} / \left( \text{sum}((x - \text{mean}(x))^2) / n \right)^{1.5} \right) \)
- Type "2" first calculates the type-1 skewness, then adjusts the result: \( G_1 = g_1 \times \sqrt{(n \times (n - 1)) / (n - 2)} \). This is what SAS and SPSS usually return.
- Type "3" first calculates the type-1 skewness, then adjusts the result: \( b_1 = g_1 \times ((1 - 1 / n))^{1.5} \). This is what Minitab usually returns.

Kurtosis: The kurtosis is a measure of "tailedness" of a distribution. A distribution with a kurtosis values of about zero is called "mesokurtic". A kurtosis value larger than zero indicates a "leptokurtic" distribution with fatter tails. A kurtosis value below zero indicates a "platykurtic" distribution with thinner tails (https://en.wikipedia.org/wiki/Kurtosis).

Types of Kurtosis: kurtosis() supports three different methods for estimating kurtosis, as discussed in Joanes and Gill (1988):
• Type "1" is the "classical" method, which is \( g_2 = n \times \frac{\sum((x - \text{mean}(x))^4)}{\left(\sum((x - \text{mean}(x))^2)^2\right)} - 3 \).

• Type "2" first calculates the type-1 kurtosis, then adjusts the result: \( G_2 = \frac{((n + 1) \times g_2 + 6) \times (n - 1)}{((n - 2) \times (n - 3))} \). This is what SAS and SPSS usually return.

• Type "3" first calculates the type-1 kurtosis, then adjusts the result: \( b_2 = (g_2 + 3) \times (1 - 1/n)^2 - 3 \). This is what Minitab usually returns.

**Standard Errors:** It is recommended to compute empirical (bootstrapped) standard errors (via the iterations argument) than relying on analytic standard errors *(Wright & Herrington, 2011)*.

**Value**

Values of skewness or kurtosis.

**References**


**Examples**

```r
skewness(rnorm(1000))
kurtosis(rnorm(1000))
```

---

**slide**

*Shift numeric value range*

**Description**

This functions shifts the value range of a numeric variable, so that the new range starts at a given value.

**Usage**

```r
slide(x, ...)
```

```r
## S3 method for class 'numeric'
slide(x, lowest = 0, ...)
```

```r
## S3 method for class 'data.frame'
slide(
  x,
  select = NULL,
  exclude = NULL,
  lowest = 0,
```
append = FALSE,
ignore_case = FALSE,
regex = FALSE,
verbose = TRUE,
...)

Arguments

x  A data frame or numeric vector.
...
not used.
lowest Numeric, indicating the lowest (minimum) value when converting factors or character vectors to numeric values.
select Variables that will be included when performing the required tasks. Can be either
• a variable specified as a literal variable name (e.g., `column_name`),
• a string with the variable name (e.g., "column_name"), or a character vector of variable names (e.g., `c("col1", "col2", "col3")`),
• a formula with variable names (e.g., `~column_1 + column_2`),
• a vector of positive integers, giving the positions counting from the left (e.g. `1` or `c(1, 3, 5)`),
• a vector of negative integers, giving the positions counting from the right (e.g., `-1` or `-1:-3`),
• one of the following select-helpers: `starts_with()`, `ends_with()`, `contains()`, a range using : or `regex("")`. `starts_with()`, `ends_with()`, and `contains()` accept several patterns, e.g `starts_with("Sep", "Petal")`.
• or a function testing for logical conditions, e.g. `is.numeric()` (or `is.numeric`), or any user-defined function that selects the variables for which the function returns `TRUE` (like: `foo <- function(x) mean(x) > 3`),
• ranges specified via literal variable names, select-helpers (except `regex()`) and (user-defined) functions can be negated, i.e. return non-matching elements, when prefixed with a `-`, e.g. `-ends_with("")`, `-is.numeric` or `-(Sepal.Width:Petal.Length)`. **Note:** Negation means that matches are *excluded*, and thus, the exclude argument can be used alternatively. For instance, `select=-ends_with("Length")` (with `-`) is equivalent to `exclude=ends_with("Length")` (no `-`). In case negation should not work as expected, use the exclude argument instead.
If `NULL`, selects all columns. Patterns that found no matches are silently ignored, e.g. `find_columns(iris, select = c("Species", "Test"))` will just return "Species".

exclude See select, however, column names matched by the pattern from exclude will be excluded instead of selected. If `NULL` (the default), excludes no columns.
append Logical or string. If `TRUE`, recoded or converted variables get new column names and are appended (column bind) to `x`, thus returning both the original and the recoded variables. The new columns get a suffix, based on the calling function: 
"_r" for recode functions, "_n" for `to_numeric()`, "_f" for `to_factor()`, or
"_s" for slide(). If append=FALSE, original variables in x will be overwritten by their recoded versions. If a character value, recoded variables are appended with new column names (using the defined suffix) to the original data frame.

**ignore_case** Logical, if TRUE and when one of the select-helpers or a regular expression is used in select, ignores lower/upper case in the search pattern when matching against variable names.

**regex** Logical, if TRUE, the search pattern from select will be treated as regular expression. When regex = TRUE, select must be a character string (or a variable containing a character string) and is not allowed to be one of the supported select-helpers or a character vector of length > 1. regex = TRUE is comparable to using one of the two select-helpers, select = contains("") or select = regex(""), however, since the select-helpers may not work when called from inside other functions (see 'Details'), this argument may be used as workaround.

**verbose** Toggle warnings.

**Value**

x, where the range of numeric variables starts at a new value.

**Selection of variables - the select argument**

For most functions that have a select argument (including this function), the complete input data frame is returned, even when select only selects a range of variables. That is, the function is only applied to those variables that have a match in select, while all other variables remain unchanged. In other words: for this function, select will not omit any non-included variables, so that the returned data frame will include all variables from the input data frame.

**See Also**

- Functions to rename stuff: `data_rename()`, `data_rename_rows()`, `data_addprefix()`, `data_addsuffix()`
- Functions to reorder or remove columns: `data_reorder()`, `data_relocate()`, `data_remove()`
- Functions to reshape, pivot or rotate data frames: `data_to_long()`, `data_to_wide()`, `data_rotate()`
- Functions to recode data: `rescale()`, `reverse()`, `categorize()`, `recode_values()`, `slide()`
- Functions to standardize, normalize, rank-transform: `center()`, `standardize()`, `normalize()`, `ranktransform()`, `winsorize()`
- Split and merge data frames: `data_partition()`, `data_merge()`
- Functions to find or select columns: `data_select()`, `data_find()`
- Functions to filter rows: `data_match()`, `data_filter()`

**Examples**

```r
# numeric
head(mtcars$gear)
head(slide(mtcars$gear))
head(slide(mtcars$gear, lowest = 10))
```

# data frame
smoothness

Quantify the smoothness of a vector

Description
Quantify the smoothness of a vector

Usage

smoothness(x, method = "cor", lag = 1, iterations = NULL, ...)

Arguments

x Numeric vector (similar to a time series).
method Can be "diff" (the standard deviation of the standardized differences) or "cor" (default, lag-one autocorrelation).
lag An integer indicating which lag to use. If less than 1, will be interpreted as expressed in percentage of the length of the vector.
iterations The number of bootstrap replicates for computing standard errors. If NULL (default), parametric standard errors are computed.
... Arguments passed to or from other methods.

Value
Value of smoothness.

References


Examples

x <- (-10:10)^3 + rnorm(21, 0, 100)
plot(x)
smoothness(x, method = "cor")
smoothness(x, method = "diff")
**standardize**

*Standardization (Z-scoring)*

**Description**

Performs a standardization of data (z-scoring), i.e., centering and scaling, so that the data is expressed in terms of standard deviation (i.e., mean = 0, SD = 1) or Median Absolute Deviance (median = 0, MAD = 1). When applied to a statistical model, this function extracts the dataset, standardizes it, and refits the model with this standardized version of the dataset. The `normalize()` function can also be used to scale all numeric variables within the 0-1 range.

For model standardization, see `standardize.default()`.

**Usage**

```r
standardize(x, ...)
standardise(x, ...)
```

## S3 method for class `numeric`
```
standardize(
  x,
  robust = FALSE,
  two_sd = FALSE,
  weights = NULL,
  reference = NULL,
  center = NULL,
  scale = NULL,
  verbose = TRUE,
  ...
)
```

## S3 method for class `factor`
```
standardize(
  x,
  robust = FALSE,
  two_sd = FALSE,
  weights = NULL,
  force = FALSE,
  verbose = TRUE,
  ...
)
```

## S3 method for class `data.frame`
```
standardize(
  x,
  select = NULL,
  ...}
```
standardize

exclude = NULL,
robust = FALSE,
two_sd = FALSE,
weights = NULL,
reference = NULL,
center = NULL,
scale = NULL,
remove_na = c("none", "selected", "all"),
force = FALSE,
append = FALSE,
ignore_case = FALSE,
regex = FALSE,
verbose = TRUE,
...
)

unstandardize(x, ...)
unstandardise(x, ...)

## S3 method for class 'numeric'
unstandardize(
  x,
  center = NULL,
  scale = NULL,
  reference = NULL,
  robust = FALSE,
  two_sd = FALSE,
  ...  
)

## S3 method for class 'data.frame'
unstandardize(
  x,
  center = NULL,
  scale = NULL,
  reference = NULL,
  robust = FALSE,
  two_sd = FALSE,
  select = NULL,
  exclude = NULL,
  ignore_case = FALSE,
  regex = FALSE,
  verbose = TRUE,
  ...  
)
standardize

Arguments

x
A (grouped) data frame, a vector or a statistical model (for unstandardize() cannot be a model).

... Arguments passed to or from other methods.

robust
Logical, if TRUE, centering is done by subtracting the median from the variables and dividing it by the median absolute deviation (MAD). If FALSE, variables are standardized by subtracting the mean and dividing it by the standard deviation (SD).

two_sd
If TRUE, the variables are scaled by two times the deviation (SD or MAD depending on robust). This method can be useful to obtain model coefficients of continuous parameters comparable to coefficients related to binary predictors, when applied to the predictors (not the outcome) (Gelman, 2008).

weights
Can be NULL (for no weighting), or:

• For model: if TRUE (default), a weighted-standardization is carried out.
• For data.frames: a numeric vector of weights, or a character of the name of a column in the data.frame that contains the weights.
• For numeric vectors: a numeric vector of weights.

reference
A data frame or variable from which the centrality and deviation will be computed instead of from the input variable. Useful for standardizing a subset or new data according to another data frame.

center, scale
• For standardize():
  Numeric values, which can be used as alternative to reference to define a reference centrality and deviation. If scale and center are of length 1, they will be recycled to match the length of selected variables for standardization. Else, center and scale must be of same length as the number of selected variables. Values in center and scale will be matched to selected variables in the provided order, unless a named vector is given. In this case, names are matched against the names of the selected variables.
  • For unstandardize():
    center and scale correspond to the center (the mean / median) and the scale (SD / MAD) of the original non-standardized data (for data frames, should be named, or have column order correspond to the numeric column). However, one can also directly provide the original data through reference, from which the center and the scale will be computed (according to robust and two_sd). Alternatively, if the input contains the attributes center and scale (as does the output of standardize()), it will take it from there if the rest of the arguments are absent.

verbose
Toggle warnings and messages on or off.

force
Logical, if TRUE, forces recoding of factors and character vectors as well.

select
Variables that will be included when performing the required tasks. Can be either

• a variable specified as a literal variable name (e.g., column_name),
• a string with the variable name (e.g., "column_name"), or a character vector of variable names (e.g., c("col1", "col2", "col3")),


standardize

- a formula with variable names (e.g., \(~\text{column}_1 + \text{column}_2\)),
- a vector of positive integers, giving the positions counting from the left (e.g., 1 or \(c(1, 3, 5)\)),
- a vector of negative integers, giving the positions counting from the right (e.g., \(-1\) or \(-1:-3\)),
- one of the following select-helpers: \text{starts}\_with(), \text{ends}\_with(), \text{contains}(), a range using : or \text{regex("\")}. \text{starts}\_with(), \text{ends}\_with(), and \text{contains}() accept several patterns, e.g \text{starts}\_with("\text{Sep}", "\text{Petal}").
- or a function testing for logical conditions, e.g. \text{is.numeric}() (or \text{is.numeric}), or any user-defined function that selects the variables for which the function returns \text{TRUE} (like: \text{foo}<-\text{function}(x) \text{mean}(x)>3),
- ranges specified via literal variable names, select-helpers (except \text{regex}()) and (user-defined) functions can be negated, i.e. return non-matching elements, when prefixed with a -, e.g. \text{~ends}\_with(""), \text{~is.numeric} or \text{~(Sepal.Width:Petal.Length)}. \textbf{Note:} Negation means that matches are \textit{excluded}, and thus, the exclude argument can be used alternatively. For instance, \text{select=\text{~ends}\_with("Length")} (with \text{~}) is equivalent to \text{exclude=ends}\_with("\text{Length}") (no \text{~}). In case negation should not work as expected, use the \text{exclude} argument instead.

If \text{NULL}, selects all columns. Patterns that found no matches are silently ignored, e.g. \text{find}\_columns(\text{iris}, \text{select=c("Species", "Test")}) will just return "Species".

\textbf{exclude} See select, however, column names matched by the pattern from \text{exclude} will be excluded instead of selected. If \text{NULL} (the default), excludes no columns.

\textbf{remove_na} How should missing values (NA) be treated: if "none" (default): each column’s standardization is done separately, ignoring NAs. Else, rows with NA in the columns selected with \text{select} / \text{exclude} ("selected") or in all columns ("all") are dropped before standardization, and the resulting data frame does not include these cases.

\textbf{append} Logical or string. If \text{TRUE}, standardized variables get new column names (with the suffix "\_z") and are appended (column bind) to \text{x}, thus returning both the original and the standardized variables. If \text{FALSE}, original variables in \text{x} will be overwritten by their standardized versions. If a character value, standardized variables are appended with new column names (using the defined suffix) to the original data frame.

\textbf{ignore_case} Logical, if \text{TRUE} and when one of the select-helpers or a regular expression is used in \text{select}, ignores lower/upper case in the search pattern when matching against variable names.

\textbf{regex} Logical, if \text{TRUE}, the search pattern from \text{select} will be treated as regular expression. When \text{regex=TRUE}, select \textit{must} be a character string (or a variable containing a character string) and is not allowed to be one of the supported select-helpers or a character vector of length \textgreater{} 1. \text{regex=TRUE} is comparable to using one of the two select-helpers, \text{select=\text{contains("")}} or \text{select=\text{regex("")}}, however, since the select-helpers may not work when called from inside other functions (see ‘Details’), this argument may be used as workaround.
Value

The standardized object (either a standardize data frame or a statistical model fitted on standardized data).

Selection of variables - the select argument

For most functions that have a select argument (including this function), the complete input data frame is returned, even when select only selects a range of variables. That is, the function is only applied to those variables that have a match in select, while all other variables remain unchanged. In other words: for this function, select will not omit any non-included variables, so that the returned data frame will include all variables from the input data frame.

Note

When x is a vector or a data frame with remove_na = "none"), missing values are preserved, so the return value has the same length / number of rows as the original input.

See Also

See center() for grand-mean centering of variables, and makepredictcall.dw_transformer() for use in model formulas.

Other transform utilities: normalize(), ranktransform(), rescale(), reverse()

Other standardize: standardize.default()

Examples

d <- iris[1:4, ]

# vectors
standardise(d$Petal.Length)

# Data frames
# overwrite
standardise(d, select = c("Sepal.Length", "Sepal.Width"))

# append
standardise(d, select = c("Sepal.Length", "Sepal.Width"), append = TRUE)

# append, suffix
standardise(d, select = c("Sepal.Length", "Sepal.Width"), append = "_std")

# standardizing with reference center and scale
d <- data.frame(  
a = c(-2, -1, 0, 1, 2),
  b = c(3, 4, 5, 6, 7)
)

# default standardization, based on mean and sd of each variable
standardize(d) # means are 0 and 5, sd ~ 1.581139
# standardization, based on mean and sd set to the same values
standardize(d, center = c(0, 5), scale = c(1.581, 1.581))

# standardization, mean and sd for each variable newly defined
standardize(d, center = c(3, 4), scale = c(2, 4))

# standardization, taking same mean and sd for each variable
standardize(d, center = 1, scale = 3)

---

**standardize.default**  
*Re-fit a model with standardized data*

**Description**

Performs a standardization of data (z-scoring) using `standardize()` and then re-fits the model to the standardized data.

Standardization is done by completely refitting the model on the standardized data. Hence, this approach is equal to standardizing the variables before fitting the model and will return a new model object. This method is particularly recommended for complex models that include interactions or transformations (e.g., polynomial or spline terms). The `robust` (default to `FALSE`) argument enables a robust standardization of data, based on the median and the MAD instead of the mean and the SD.

**Usage**

```r
## Default S3 method:
standardize(
  x, 
  robust = FALSE, 
  two_sd = FALSE, 
  weights = TRUE, 
  verbose = TRUE, 
  include_response = TRUE, 
  ... 
)
```

**Arguments**

- `x`  
  A statistical model.

- `robust`  
  Logical, if `TRUE`, centering is done by subtracting the median from the variables and dividing it by the median absolute deviation (MAD). If `FALSE`, variables are standardized by subtracting the mean and dividing it by the standard deviation (SD).

- `two_sd`  
  If `TRUE`, the variables are scaled by two times the deviation (SD or MAD depending on `robust`). This method can be useful to obtain model coefficients of continuous parameters comparable to coefficients related to binary predictors, when applied to the predictors (not the outcome) (Gelman, 2008).
weights
If TRUE (default), a weighted-standardization is carried out.

verbose
Toggle warnings and messages on or off.

include_response
If TRUE (default), the response value will also be standardized. If FALSE, only the predictors will be standardized.

- Note that for GLMs and models with non-linear link functions, the response value will not be standardized, to make re-fitting the model work.
- If the model contains an \texttt{stats::offset()}, the offset variable(s) will be standardized only if the response is standardized. If \texttt{two_sd = TRUE}, offsets are standardized by one-sd (similar to the response).
- (For \texttt{mediate} models, the \texttt{include_response} refers to the outcome in the \texttt{y} model; \texttt{m} model’s response will always be standardized when possible).

... Arguments passed to or from other methods.

Value
A statistical model fitted on standardized data

Generalized Linear Models
Standardization for generalized linear models (GLM, GLMM, etc) is done only with respect to the predictors (while the outcome remains as-is, unstandardized) - maintaining the interpretability of the coefficients (e.g., in a binomial model: the exponent of the standardized parameter is the OR of a change of 1 SD in the predictor, etc.)

Dealing with Factors
\texttt{standardize(model)} or \texttt{standardize_parameters(model, method = "refit")} do not standardize categorical predictors (i.e. factors) / their dummy-variables, which may be a different behaviour compared to other R packages (such as \texttt{lm.beta}) or other software packages (like SPSS). To mimic such behaviours, either use \texttt{standardize_parameters(model, method = "basic")} to obtain post-hoc standardized parameters, or standardize the data with \texttt{standardize(data, force = TRUE)} before fitting the model.

Transformed Variables
When the model’s formula contains transformations (e.g. \( y \sim \exp(X) \)) the transformation effectively takes place after standardization (e.g., \( \exp(\text{scale}(X)) \)). Since some transformations are undefined for none positive values, such as \texttt{log()} and \texttt{sqrt()}, the relevel variables are shifted (post standardization) by \( Z - \min(Z) + 1 \) or \( Z - \min(Z) \) (respectively).

See Also
Other standardize: \texttt{standardize()}

\texttt{standardize.default} 137
Examples

```r
model <- lm(Infant.Mortality ~ Education * Fertility, data = swiss)
coef(standardize(model))
```

Description

Convenience functions to manipulate and format text.

Usage

```r
text_format(
  text,
  sep = "", ",",
  last = " and ",
  width = NULL,
  enclose = NULL,
  ...
)
format_text(
  text,
  sep = "", ",",
  last = " and ",
  width = NULL,
  enclose = NULL,
  ...
)
text_fullstop(text)
text_lastchar(text, n = 1)
text_concatenate(text, sep = "", ",", last = " and ", enclose = NULL)
text_paste(text, text2 = NULL, sep = "", ",", enclose = NULL, 
  ...
)
text_remove(text, pattern = "", 
  ...)  
text_wrap(text, width = NULL, 
  ...)
```
Arguments

text, text2  A character string.
sep          Separator.
last         Last separator.
width        Positive integer giving the target column width for wrapping lines in the output. Can be "auto", in which case it will select 90\ default width.
enclose      Character that will be used to wrap elements of text, so these can be, e.g., enclosed with quotes or backticks. If NULL (default), text elements will not be enclosed.
...          Other arguments to be passed to or from other functions.
n            The number of characters to find.
pattern      Character vector. For data_rename(), indicates columns that should be selected for renaming. Can be NULL (in which case all columns are selected). For data_addprefix() or data_addsuffix(), a character string, which will be added as prefix or suffix to the column names.

Value

A character string.

Examples

# Add full stop if missing
text_fullstop(c("something", "something else."))

# Find last characters
text_lastchar(c("ABC", "DEF"), n = 2)

# Smart concatenation
text_concatenate(c("First", "Second", "Last"))
text_concatenate(c("First", "Second", "Last"), last = " or ", enclose = "/grave.Var")

# Remove parts of string
text_remove(c("one!", "two", "three!"), ",")

# Wrap text
long_text <- paste(rep("abc ", 100), collapse = "")
cat(text_wrap(long_text, width = 50))

# Paste with optional separator
text_paste(c("A", ",", "B"), c("42", "42", "42"))
Description

Convert data to factors

Usage

to_factor(x, ...)

## S3 method for class 'numeric'
to_factor(x, labels_to_levels = TRUE, verbose = TRUE, ...)

## S3 method for class 'data.frame'
to_factor(
  x,
  select = NULL,
  exclude = NULL,
  ignore_case = FALSE,
  append = FALSE,
  regex = FALSE,
  verbose = TRUE,
  ...
)

Arguments

x A data frame or vector.

... Arguments passed to or from other methods.

labels_to_levels Logical, if TRUE, value labels are used as factor levels after x was converted to factor. Else, factor levels are based on the values of x (i.e. as if using as.factor()).

verbose Toggle warnings.

select Variables that will be included when performing the required tasks. Can be either

• a variable specified as a literal variable name (e.g., column_name),
• a string with the variable name (e.g., "column_name"), or a character vector of variable names (e.g., c("col1", "col2", "col3")),
• a formula with variable names (e.g., ~column_1 + column_2),
• a vector of positive integers, giving the positions counting from the left (e.g., 1 or c(1, 3, 5)),
• a vector of negative integers, giving the positions counting from the right (e.g., -1 or -1:-3),
• one of the following select-helpers: starts_with(), ends_with(), contains(), a range using : or regex("'"). starts_with(), ends_with(), and contains() accept several patterns, e.g starts_with("Sep", "Petal").

• or a function testing for logical conditions, e.g. is.numeric() (or is.numeric), or any user-defined function that selects the variables for which the function returns TRUE (like: foo <- function(x) mean(x) > 3),

• ranges specified via literal variable names, select-helpers (except regex()) and (user-defined) functions can be negated, i.e. return non-matching elements, when prefixed with a -, e.g. -ends_with(""), -is.numeric or -(Sepal.Width:Petal.Length). **Note:** Negation means that matches are excluded, and thus, the exclude argument can be used alternatively. For instance, select=-ends_with("Length") (with -) is equivalent to exclude=ends_with("Length") (no -). In case negation should not work as expected, use the exclude argument instead.

If NULL, selects all columns. Patterns that found no matches are silently ignored, e.g. find_columns(iris, select = c("Species", "Test")) will just return "Species".

exclude

See select, however, column names matched by the pattern from exclude will be excluded instead of selected. If NULL (the default), excludes no columns.

ignore_case

Logical, if TRUE and when one of the select-helpers or a regular expression is used in select, ignores lower/upper case in the search pattern when matching against variable names.

append

Logical or string. If TRUE, recoded or converted variables get new column names and are appended (column bind) to x, thus returning both the original and the recoded variables. The new columns get a suffix, based on the calling function: "_r" for recode functions, "_n" for to_numeric(), "_f" for to_factor(), or "_s" for slide(). If append=FALSE, original variables in x will be overwritten by their recoded versions. If a character value, recoded variables are appended with new column names (using the defined suffix) to the original data frame.

regex

Logical, if TRUE, the search pattern from select will be treated as regular expression. When regex = TRUE, select must be a character string (or a variable containing a character string) and is not allowed to be one of the supported select-helpers or a character vector of length > 1. regex = TRUE is comparable to using one of the two select-helpers, select = contains("") or select = regex(""), however, since the select-helpers may not work when called from inside other functions (see ‘Details’), this argument may be used as workaround.

**Details**

Convert variables or data into factors. If the data is labelled, value labels will be used as factor levels. The counterpart to convert variables into numeric is to_numeric().

**Value**

A factor, or a data frame of factors.
Selection of variables - the select argument

For most functions that have a select argument (including this function), the complete input data frame is returned, even when select only selects a range of variables. That is, the function is only applied to those variables that have a match in select, while all other variables remain unchanged. In other words: for this function, select will not omit any non-included variables, so that the returned data frame will include all variables from the input data frame.

Note

Factors are ignored and returned as is. If you want to use value labels as levels for factors, use `labels_to_levels()` instead.

Examples

```r
str(to_factor(iris))

# use labels as levels
data(efc)
str(efc$c172code)
head(to_factor(efc$c172code))
```

to_numeric  

Convert data to numeric

Description

Convert data to numeric by converting characters to factors and factors to either numeric levels or dummy variables. The "counterpart" to convert variables into factors is `to_factor()`.

Usage

```r
to_numeric(x, ...)

## S3 method for class 'data.frame'
to_numeric(
  x,
  select = NULL,
  exclude = NULL,
  dummy_factors = TRUE,
  preserve_levels = FALSE,
  lowest = NULL,
  append = FALSE,
  ignore_case = FALSE,
  regex = FALSE,
  verbose = TRUE,
  ...)
```

Arguments

x
A data frame, factor or vector.

... Arguments passed to or from other methods.

select
Variables that will be included when performing the required tasks. Can be either

• a variable specified as a literal variable name (e.g., column_name),
• a string with the variable name (e.g., "column_name"), or a character vector of variable names (e.g., c("col1", "col2", "col3")),
• a formula with variable names (e.g., ~column_1 + column_2),
• a vector of positive integers, giving the positions counting from the left (e.g. 1 or c(1, 3, 5)),
• a vector of negative integers, giving the positions counting from the right (e.g., -1 or -1:-3),
• one of the following select-helpers: starts_with(), ends_with(), contains(), a range using \( \text{or } \text{regex}() \). starts_with(), ends_with(), and contains() accept several patterns, e.g starts_with("Sep", "Petal").
• or a function testing for logical conditions, e.g. is.numeric() (or is.numeric), or any user-defined function that selects the variables for which the function returns TRUE (like: foo <- function(x) mean(x) > 3),
• ranges specified via literal variable names, select-helpers (except regex()) and (user-defined) functions can be negated, i.e. return non-matching elements, when prefixed with a - e.g. -ends_with(""), -is.numeric or -(Sepal.Width:Petal.Length). Note: Negation means that matches are excluded, and thus, the exclude argument can be used alternatively. For instance, select=-ends_with("Length") (with -) is equivalent to exclude=ends_with("Length") (no -). In case negation should not work as expected, use the exclude argument instead.

If NULL, selects all columns. Patterns that found no matches are silently ignored, e.g. find_columns(iris, select = c("Species", "Test")) will just return "Species".

exclude
See select, however, column names matched by the pattern from exclude will be excluded instead of selected. If NULL (the default), excludes no columns.

dummy_factors
Transform factors to dummy factors (all factor levels as different columns filled with a binary 0-1 value).

preserve_levels
Logical, only applies if x is a factor. If TRUE, and x has numeric factor levels, these will be converted into the related numeric values. If this is not possible, the converted numeric values will start from 1 to number of levels.

lowest
Numeric, indicating the lowest (minimum) value when converting factors or character vectors to numeric values.

append
Logical or string. If TRUE, recoded or converted variables get new column names and are appended (column bind) to x, thus returning both the original and the recoded variables. The new columns get a suffix, based on the calling function: "_r" for recode functions, "_n" for to_numeric(), "_f" for to_factor(), or
"_s" for slide(). If append=FALSE, original variables in x will be overwritten by their recoded versions. If a character value, recoded variables are appended with new column names (using the defined suffix) to the original data frame.

ignore_case Logical, if TRUE and when one of the select-helpers or a regular expression is used in select, ignores lower/upper case in the search pattern when matching against variable names.

regex Logical, if TRUE, the search pattern from select will be treated as regular expression. When regex = TRUE, select must be a character string (or a variable containing a character string) and is not allowed to be one of the supported select-helpers or a character vector of length > 1. regex = TRUE is comparable to using one of the two select-helpers, select = contains("") or select = regex(""). however, since the select-helpers may not work when called from inside other functions (see 'Details'), this argument may be used as workaround.

verbose Toggle warnings.

Value
A data frame of numeric variables.

Selection of variables - select argument
For most functions that have a select argument the complete input data frame is returned, even when select only selects a range of variables. However, for to_numeric(), factors might be converted into dummies, thus, the number of variables of the returned data frame no longer match the input data frame. Hence, when select is used, only those variables (or their dummies) specified in select will be returned. Use append=TRUE to also include the original variables in the returned data frame.

Note
By default, to_numeric() converts factors into "binary" dummies, i.e. each factor level is converted into a separate column filled with a binary 0-1 value. If only one column is required, use dummy_factors = FALSE. If you want to preserve the original factor levels (in case these represent numeric values), use preserve_levels = TRUE.

Examples
```r
to_numeric(head(ToothGrowth))
to_numeric(head(ToothGrowth), dummy_factors = FALSE)
```

# factors
```r
x <- as.factor(mtcars$gear)
to_numeric(x, dummy_factors = FALSE)
to_numeric(x, dummy_factors = FALSE, preserve_levels = TRUE)
```

# same as:
```r
coerce_to_numeric(x)
```
**visualisation_recipe**  Prepare objects for visualisation

**Description**

This function prepares objects for visualisation by returning a list of layers with data and geoms that can be easily plotted using for instance ggplot2.

If the see package is installed, the call to `visualization_recipe()` can be replaced by `plot()`, which will internally call the former and then plot it using ggplot. The resulting plot can be customized ad-hoc (by adding ggplot’s geoms, theme or specifications), or via some of the arguments of `visualization_recipe()` that control the aesthetic parameters.

See the specific documentation page for your object’s class:


**Usage**

`visualisation_recipe(x, …)`

**Arguments**

- `x`  An easystats object.
- `…`  Other arguments passed to other functions.

---

**weighted_mean**  Weighted Mean, Median, SD, and MAD

**Description**

Weighted Mean, Median, SD, and MAD

**Usage**

`weighted_mean(x, weights = NULL, remove_na = TRUE, verbose = TRUE, …)`

`weighted_median(x, weights = NULL, remove_na = TRUE, verbose = TRUE, …)`

`weighted_sd(x, weights = NULL, remove_na = TRUE, verbose = TRUE, …)`

`weighted_mad(
  x,`
weights = NULL,
constant = 1.4826,
remove_na = TRUE,
verbose = TRUE,
...
)

Arguments

x an object containing the values whose weighted mean is to be computed.
weights A numerical vector of weights the same length as x giving the weights to use for elements of x. If weights = NULL, x is passed to the non-weighted function.
remove_na Logical, if TRUE (default), removes missing (NA) and infinite values from x and weights.
verbose Show warning when weights are negative?
... arguments to be passed to or from methods.
constant scale factor.

Examples

## GPA from Siegel 1994
x <- c(3.7, 3.3, 3.5, 2.8)
wts <- c(5, 5, 4, 1) / 15

weighted_mean(x, wts)
weighted_median(x, wts)
weighted_sd(x, wts)
weighted_mad(x, wts)

winsorize

 Winsorize data

Description

Winsorize data

Usage

winsorize(data, ...)

## S3 method for class 'numeric'
winsorize(
    data,
    threshold = 0.2,
    method = "percentile",
)
winsorize

robust = FALSE,
verbose = TRUE,
...
)

Arguments
data  data frame or vector.
...  Currently not used.
threshold  The amount of winsorization, depends on the value of method:
  • For method = "percentile": the amount to winsorize from each tail. The
    value of threshold must be between 0 and 0.5 and of length 1.
  • For method = "zscore": the number of SD/MAD-deviations from the mean/median
    (see robust). The value of threshold must be greater than 0 and of length
    1.
  • For method = "raw": a vector of length 2 with the lower and upper bound
    for winsorization.
method  One of "percentile" (default), "zscore", or "raw".
robust  Logical, if TRUE, winsorizing through the "zscore" method is done via the med-
        dian and the median absolute deviation (MAD); if FALSE, via the mean and the
        standard deviation.
verbose  Not used anymore since datawizard 0.6.6.

Details

Winsorizing or winsorization is the transformation of statistics by limiting extreme values in the statistical data to reduce the effect of possibly spurious outliers. The distribution of many statistics can be heavily influenced by outliers. A typical strategy is to set all outliers (values beyond a certain threshold) to a specified percentile of the data; for example, a 90% winsorization would see all data below the 5th percentile set to the 5th percentile, and data above the 95th percentile set to the 95th percentile. Winsorized estimators are usually more robust to outliers than their more standard forms.

Value

A data frame with winsorized columns or a winsorized vector.

See Also

• Functions to rename stuff: data_rename(), data_rename_rows(), data_addprefix(), data_addsuffix()
• Functions to reorder or remove columns: data_reorder(), data_relocate(), data_remove()
• Functions to reshape, pivot or rotate data frames: data_to_long(), data_to_wide(), data_rotate()
• Functions to recode data: rescale(), reverse(), categorize(), recode_values(), slide()
• Functions to standardize, normalize, rank-transform: center(), standardize(), normalize(), ranktransform(), winsorize()
• Split and merge data frames: data_partition(), data_merge()
- Functions to find or select columns: `data_select()`, `data_find()`
- Functions to filter rows: `data_match()`, `data_filter()`

**Examples**

```r
hist(iris$Sepal.Length, main = "Original data")

hist(winsorize(iris$Sepal.Length, threshold = 0.2),
    xlim = c(4, 8), main = "Percentile Winsorization")

hist(winsorize(iris$Sepal.Length, threshold = 1.5, method = "zscore"),
    xlim = c(4, 8), main = "Mean (+/- SD) Winsorization")

hist(winsorize(iris$Sepal.Length, threshold = 1.5, method = "zscore", robust = TRUE),
    xlim = c(4, 8), main = "Median (+/- MAD) Winsorization")

hist(winsorize(iris$Sepal.Length, threshold = c(5, 7.5), method = "raw"),
    xlim = c(4, 8), main = "Raw Thresholds")

# Also works on a data frame:
winsorize(iris, threshold = 0.2)
```
Index

* datawizard-transformers
  makepredictcall.dw_transformer, 91
* data
  efc, 85
  nhanes_sample, 95
* duplicates
  data_duplicated, 33
* standardize
  standardize, 131
  standardize.default, 136
* transform utilities
  normalize, 96
  ranktransform, 99
  rescale, 111
  reverse, 117
  adjust, 3
  assign_labels, 6
  bayesestR::map_estimate(), 84
  center(), 12, 29, 41, 44, 49, 56, 58, 69, 72, 88, 107, 129, 147
  center(). 12, 29, 42, 44, 49, 56, 58, 69, 72, 80, 88, 91, 107, 129, 135, 147
  centre (center), 13
  change_code (recode_values), 104
  change_scale (rescale), 111
  coef_var, 17
  coerce_to_numeric, 19
  colnames_to_row (row_to_colnames), 124
  column_as_rownames (rownames_as_column), 120
  contr.deviation, 20
  convert_na_to, 22
  convert_to_na, 25
  data_addprefix, 27
  data_addprefix(), 12, 29, 41, 44, 49, 56, 58, 69, 71, 88, 107, 129, 147
  data_addsuffix (data_addprefix), 27
  data_addsuffix(), 12, 29, 41, 44, 49, 56, 58, 69, 71, 88, 107, 129, 147
  data_adjust (adjust), 3
  data_arrange, 30
  data_codebook, 31
  data_duplicated, 33
  data_duplicated(), 74
  data_extract, 35
  data_filter (data_match), 40
  data_filter(), 12, 29, 42, 44, 49, 56, 58, 69, 72, 88, 107, 129, 148
  data_find (find_columns), 85
  data_find(), 12, 29, 42, 44, 49, 56, 58, 69, 72, 88, 107, 129, 148
  data_group, 38
  data_join (data_merge), 42
  data_match, 40
  data_match(), 12, 29, 42, 44, 49, 56, 58, 69, 72, 88, 107, 129, 148
  data_merge, 42
  data_merge(), 12, 29, 42, 44, 49, 56, 58, 69, 72, 88, 107, 129, 147
  data_modify, 46
  data_partition, 48
  data_partition(), 12, 29, 42, 44, 49, 56, 58, 69, 72, 88, 107, 129, 147
  data.peek, 50
  data_read, 52
  data_relocate, 54
  data_relocate(), 12, 29, 41, 44, 49, 56, 58, 69, 71, 88, 107, 129, 147
  data_remove (data_relocate), 54
  data_remove(), 12, 29, 41, 44, 49, 56, 58, 69, 71, 88, 107, 129, 147
  data_rename (data_addprefix), 27
  data_rename(), 12, 29, 41, 44, 49, 56, 58, 69,
reshape_longer (data_to_long), 67
reshape_wider (data_to_wide), 70
reverse, 99, 101, 114, 117, 135
reverse(), 12, 29, 41, 44, 49, 56, 58, 69, 72, 88, 106, 107, 129, 147
reverse_scale (reverse), 117
row_means, 121
row_to_colnames, 124
rownames_as_column (rownames_as_column), 120
rownames_as_column, 120
skewness, 125
slide, 127
slide(), 12, 29, 41, 44, 49, 56, 58, 69, 72, 88, 107, 129, 147
smoothness, 130
standardise (standardize), 131
standardize, 99, 101, 114, 119, 131, 137
standardize(), 12, 16, 29, 42, 44, 49, 56, 58, 69, 72, 88, 91, 107, 129, 136, 147
standardize.default, 135, 136
standardize.default(), 131
standardize_models
  (standardize.default), 136
stats::contr.sum(), 20
stats::contr.treatment(), 20
stats::IQR(), 82
stats::mad(), 18
stats::makepredictcall(), 91
stats::offset(), 137
summary.parameters_kurtosis (skewness), 125
summary.parameters_skewness (skewness), 125
text_concatenate (text_format), 138
text_format, 138
text_fullstop (text_format), 138
text_lastchar (text_format), 138
text_paste (text_format), 138
text_remove (text_format), 138
text_wrap (text_format), 138
to_factor, 140
to_numcntric, 142
unnormalize (normalize), 96
unstandardise (standardize), 131
unstandardize (standardize), 131
visualisation_recipe, 145
weighted_mad (weighted_mean), 145
weighted_mean, 145
weighted_median (weighted_mean), 145
weighted_sd (weighted_mean), 145
winsorize, 146
winsorize(), 12, 29, 42, 44, 49, 56, 58, 69, 72, 88, 107, 129, 147