Package ‘fabletools’

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Title Core Tools for Packages in the ‘fable’ Framework

Version 0.4.1

Description Provides tools, helpers and data structures for developing models and time series functions for ‘fable’ and extension packages. These tools support a consistent and tidy interface for time series modelling and analysis.

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BugReports https://github.com/tidyverts/fabletools/issues

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fabletools-package  fabletools: Core Tools for Packages in the 'fable' Framework

Description

Provides tools, helpers and data structures for developing models and time series functions for 'fable' and extension packages. These tools support a consistent and tidy interface for time series modelling and analysis.
Accuracy of a forecast or model

**Description**

Summarise the performance of the model using accuracy measures. Accuracy measures can be computed directly from models as the one-step-ahead fitted residuals are available. When evaluating accuracy on forecasts, you will need to provide a complete dataset that includes the future data and data used to train the model.

**Usage**

```r
## S3 method for class 'mdl_df'
accuracy(object, measures = point_accuracy_measures, ...)

## S3 method for class 'mdl_ts'
accuracy(object, measures = point_accuracy_measures, ...)

## S3 method for class 'fbl_ts'
accuracy(object, data, measures = point_accuracy_measures, ..., by = NULL)
```

**Arguments**

- **object**
  A model or forecast object

- **measures**
  A list of accuracy measure functions to compute (such as `point_accuracy_measures`, `interval_accuracy_measures`, or `distribution_accuracy_measures`)

- **...**
  Additional arguments to be passed to measures that use it.
aggregate_index

A dataset containing the complete model dataset (both training and test data). The training portion of the data will be used in the computation of some accuracy measures, and the test data is used to compute the forecast errors.

by

Variables over which the accuracy is computed (useful for computing across forecast horizons in cross-validation). If by is NULL, groups will be chosen automatically from the key structure.

See Also

Evaluating forecast accuracy

Examples

library(fable)
library(tsibble)
library(tsibbledata)
library(dplyr)

fit <- aus_production %>%
  filter(Quarter < yearquarter("2006 Q1")) %>%
  model(ets = ETS(log(Beer) ~ error("M") + trend("Ad") + season("A")))

# In-sample training accuracy does not require extra data provided.
accuracy(fit)

# Out-of-sample forecast accuracy requires the future values to compare with.
# All available future data will be used, and a warning will be given if some
# data for the forecast window is unavailable.
fc <- fit %>%
  forecast(h = "5 years")
fc %>%
  accuracy(aus_production)

# It is also possible to compute interval and distributional measures of
# accuracy for models and forecasts which give forecast distributions.
fc %>%
  accuracy(
    aus_production,
    measures = list(interval_accuracy_measures, distribution_accuracy_measures)
  )
Arguments

- `.data` A tsibble.
- `.window` Temporal aggregations to include. The default (NULL) will automatically identify appropriate temporal aggregations. This can be specified in several ways (see details).
- `...` <data-masking> Name-value pairs of summary functions. The name will be the name of the variable in the result. The value can be:
  - A vector of length 1, e.g. `min(x)`, `n()`, or `sum(is.na(y))`.
  - A data frame, to add multiple columns from a single expression.
- `.offset` Offset the temporal aggregation windows to align with the start or end of the data. If FALSE, no offset will be applied (giving common breakpoints for temporal bins.)
- `.bin_size` Temporary. Define the number of observations in each temporal bucket

Details

This feature is very experimental. It currently allows for temporal aggregation of daily data as a proof of concept.

The aggregation `.window` can be specified in several ways:

- A character string, containing one of "day", "week", "month", "quarter" or "year". This can optionally be preceded by a (positive or negative) integer and a space, or followed by "s".
- A number, taken to be in days.
- A `difftime` object.

Examples

```r
library(tsibble)
pedestrian %>%
  # Currently only supports daily data
  index_by(Date) %>%
  dplyr::summarise(Count = sum(Count)) %>%
  # Compute weekly aggregates
  fabletools:::aggregate_index("1 week", Count = sum(Count))
```

Description

Uses the structural specification given in `.spec` to aggregate a time series. A grouped structure is specified using `grp1 * grp2`, and a nested structure is specified via `parent / child`. Aggregating the key structure is commonly used with forecast reconciliation to produce coherent forecasts over some hierarchy.
agg_vec

Usage

`aggregate_key(.data, .spec, ...)

Arguments

.data A tsibble.
.spec The specification of aggregation structure.
... <data-masking> Name-value pairs of summary functions. The name will be
the name of the variable in the result.
The value can be:
  * A vector of length 1, e.g. `min(x)`, `n()`, or `sum(is.na(y))`.
  * A data frame, to add multiple columns from a single expression.

[Deprecated] Returning values with size 0 or >1 was deprecated as of 1.1.0.
Please use `reframe()` for this instead.

details

This function is experimental, and is subject to change in the future.
The way in which the measured variables are aggregated is specified in a similar way to how
`dplyr::summarise()` is used.

See Also

`reconcile()`, `is_aggregated()`

Examples

```r
library(tsibble)
tourism %>%
  aggregate_key(Purpose * (State / Region), Trips = sum(Trips))
```

---

agg vec

Create an aggregation vector

Description

[Maturing]

Usage

`agg_vec(x = character(), aggregated = logical(vec_size(x)))`

Arguments

.x The vector of values.
.aggregated A logical vector to identify which values are <aggregated>.
Details

An aggregation vector extends usual vectors by adding <aggregated> values. These vectors are typically produced via the `aggregate_key()` function, however it can be useful to create them manually to produce more complicated hierarchies (such as unbalanced hierarchies).

Examples

```r
detailed_vec(  
  x = c(NA, "A", "B"),  
  aggregated = c(TRUE, FALSE, FALSE)  
)
```

---

**as_dable**

*Coerce to a dable object*

Description

Coerce to a dable object

Usage

```r
as_dable(x, ...)
```

```r
## S3 method for class 'tbl_df'
as_dable(x, response, method = NULL, seasons = list(), aliases = list(), ...)
```

```r
## S3 method for class 'tbl_ts'
as_dable(x, response, method = NULL, seasons = list(), aliases = list(), ...)
```

Arguments

- `x` Object to be coerced to a dable (dcmp_ts)
- `...` Additional arguments passed to methods
- `response` The character vector of response variable(s).
- `method` The name of the decomposition method.
- `seasons` A named list describing the structure of seasonal components (such as period, and base).
- `aliases` A named list of calls describing common aliases computed from components.
as_fable

Coerce to a fable object

Description
Coerce to a fable object

Usage

as_fable(x, ...)

## S3 method for class 'tbl_ts'
as_fable(x, response, distribution, ...)

## S3 method for class 'grouped_ts'
as_fable(x, response, distribution, ...)

## S3 method for class 'tbl_df'
as_fable(x, response, distribution, ...)

## S3 method for class 'fbl_ts'
as_fable(x, response, distribution, ...)

## S3 method for class 'grouped_df'
as_fable(x, response, distribution, ...)

## S3 method for class 'forecast'
as_fable(x, ..., point_forecast = list(.mean = mean))

Arguments

x  Object to be coerced to a fable (fbl_ts)
...
response  The character vector of response variable(s).
distribution  The name of the distribution column (can be provided using a bare expression).
point_forecast  The point forecast measure(s) which should be returned in the resulting fable. Specified as a named list of functions which accept a distribution and return a vector. To compute forecast medians, you can use list(.median = median).

as_mable

Coerce a dataset to a mable

Description
Coerce a dataset to a mable
Usage

```
as_mable(x, ...)
```  

```
## S3 method for class 'data.frame'
as_mable(x, key = NULL, model = NULL, ...)
```

Arguments

- `x`: A dataset containing a list model column.
- `...`: Additional arguments passed to other methods.
- `key`: Structural variable(s) that identify each model.
- `model`: Identifiers for the columns containing model(s).

Description

Uses a fitted model to augment the response variable with fitted values and residuals. Response residuals (back-transformed) are stored in the `.resid` column, while innovation residuals (transformed) are stored in the `.innov` column.

Usage

```
## S3 method for class 'mdl_df'
augment(x, ...)
```

```
## S3 method for class 'mdl_ts'
augment(x, type = NULL, ...)
```

Arguments

- `x`: A mable.
- `...`: Arguments for model methods.
- `type`: Deprecated.

Examples

```r
library(fable)
library(tsibbledata)

# Forecasting with an ETS(M,Ad,A) model to Australian beer production
aus_production %>%
  model(ets = ETS(log(Beer) ~ error("M") + trend("Ad") + season("A"))) %>%
augment()
```
Description

Produces a faceted plot of the components used to build the response variable of the dable. Useful for visualising how the components contribute in a decomposition or model.

Usage

```r
## S3 method for class 'dcmp_ts'
autoplot(object, .vars = NULL, scale_bars = TRUE, level = c(80, 95), ...)
```

Arguments

- `object`: A dable.
- `.vars`: The column of the dable used to plot. By default, this will be the response variable of the decomposition.
- `scale_bars`: If TRUE, each facet will include a scale bar which represents the same units across each facet.
- `level`: If the decomposition contains distributions, which levels should be used to display intervals?
- `...`: Further arguments passed to `ggplot2::geom_line()`, which can be used to specify fixed aesthetics such as `colour = "red"` or `linewidth = 3`.

Examples

```r
library(feasts)
library(tsibbledata)
aus_production %>%
  model(STL(Beer)) %>%
  components() %>%
  autoplot()
```

Description

Produces a forecast plot from a fable. As the original data is not included in the fable object, it will need to be specified via the `data` argument. The `data` argument can be used to specify a shorter period of data, which is useful to focus on the more recent observations.
Usage

```r
## S3 method for class 'fbl_ts'
autoplot(object, data = NULL, level = c(80, 95), show_gap = TRUE, ...)

## S3 method for class 'fbl_ts'
autolayer(
  object,
  data = NULL,
  level = c(80, 95),
  point_forecast = list(mean = mean),
  show_gap = TRUE,
  ...
)
```

Arguments

- `object` A fable.
- `data` A tsibble with the same key structure as the fable.
- `level` The confidence level(s) for the plotted intervals.
- `show_gap` Setting this to FALSE will connect the most recent value in data with the forecasts.
- `point_forecast` The point forecast measure to be displayed in the plot.
- `...` Further arguments passed used to specify fixed aesthetics for the forecasts such as `colour = "red"` or `linewidth = 3`.

Examples

```r
library(fable)
library(tsibbledata)

fc <- aus_production %>%
  model(ets = ETS(log(Beer) ~ error("M") + trend("Ad") + season("A")))
  forecast(h = "3 years")

fc %>%
  autoplot(aus_production)

aus_production %>%
  autoplot(Beer) +
  autolayer(fc)
```

Description

Produces a time series plot of one or more variables from a tsibble. If the tsibble contains a multiple keys, separate time series will be identified by colour.
Usage

```r
## S3 method for class 'tbl_ts'
autoplot(object, .vars = NULL, ...)

## S3 method for class 'tbl_ts'
autolayer(object, .vars = NULL, ...)
```

Arguments

- `object`: A tsibble.
- `.vars`: A bare expression containing data you wish to plot. Multiple variables can be plotted using `ggplot2::vars()`.
- `...`: Further arguments passed to `ggplot2::geom_line()`, which can be used to specify fixed aesthetics such as `colour = "red"` or `linewidth = 3`.

Examples

```r
library(fable)
library(tsibbledata)
library(tsibble)

tsibbledata::gafa_stock %>%
  autoplot(vars(Close, log(Close)))
```

---

**bottom_up**

*Bottom up forecast reconciliation*

Description

[Experimental]

Usage

```r
bottom_up(models)
```

Arguments

- `models`: A column of models in a mable.

Details

Reconciles a hierarchy using the bottom up reconciliation method. The response variable of the hierarchy must be aggregated using sums. The forecasted time points must match for all series in the hierarchy.

See Also

`reconcile()`, `aggregate_key()`
box_cox  

**Box Cox Transformation**

**Description**

`box_cox()` returns a transformation of the input variable using a Box-Cox transformation. `inv_box_cox()` reverses the transformation.

**Usage**

```r
box_cox(x, lambda)
```

```r
inv_box_cox(x, lambda)
```

**Arguments**

- `x`: a numeric vector.
- `lambda`: a numeric value for the transformation parameter.

**Details**

The Box-Cox transformation is given by

\[ f_\lambda(x) = \frac{x^\lambda - 1}{\lambda} \]

if \( \lambda \neq 0 \). For \( \lambda = 0 \),

\[ f_0(x) = \log(x) \]

**Value**

a transformed numeric vector of the same length as `x`.

**Author(s)**

Rob J Hyndman & Mitchell O’Hara-Wild

**References**


**Examples**

```r
library(tsibble)
library(dplyr)
airmiles %>%
as_tsibble() %>%
mutate(box_cox = box_cox(value, lambda = 0.3))
```
### combination_ensemble

**Description**

Ensemble combination

**Usage**

```
combination_ensemble(..., weights = c("equal", "inv_var"))
```

**Arguments**

- `...` Estimated models used in the ensemble.
- `weights` The method used to weight each model in the ensemble.

**See Also**

`combination_weighted()`

### combination_model

**Description**

Combines multiple model definitions (passed via ...) to produce a model combination definition using some combination function (`cmbn_fn`). Currently distributional forecasts are only supported for models producing normally distributed forecasts.

**Usage**

```
combination_model(..., cmbn_fn = combination_ensemble, cmbn_args = list())
```

**Arguments**

- `...` Model definitions used in the combination.
- `cmbn_fn` A function used to produce the combination.
- `cmbn_args` Additional arguments passed to `cmbn_fn`.

**Details**

A combination model can also be produced using mathematical operations.
Examples

library(fable)
library(tsibble)
library(tsibbledata)

# cmbn1 and cmbn2 are equivalent and equally weighted.
aus_production %>%
  model(
    cmbn1 = combination_model(SNAIVE(Beer), TSLM(Beer ~ trend() + season())),
    cmbn2 = (SNAIVE(Beer) + TSLM(Beer ~ trend() + season()))/2
  )

# An inverse variance weighted ensemble.
aus_production %>%
  model(
    cmbn1 = combination_model(
      SNAIVE(Beer), TSLM(Beer ~ trend() + season()),
      cmbn_args = list(weights = "inv_var")
    )
  )

combination_weighted  Weighted combination

Description

Weighted combination

Usage

combination_weighted(..., weights = NULL)

Arguments

... Estimated models used in the ensemble.
weights The numeric weights applied to each model in ...

See Also

combination_ensemble()
common_periods

Extract frequencies for common seasonal periods

Description

Extract frequencies for common seasonal periods

Usage

common_periods(x)

## Default S3 method:
common_periods(x)

## S3 method for class 'tbl_ts'
common_periods(x)

## S3 method for class 'interval'
common_periods(x)

get_frequencies(period, ...)

## S3 method for class 'numeric'
get_frequencies(period, ...)

## S3 method for class '-NULL-'
get_frequencies(period, data, ..., .auto = c("smallest", "largest", "all"))

## S3 method for class 'character'
get_frequencies(period, data, ...)

## S3 method for class 'Period'
get_frequencies(period, data, ...)

Arguments

x An object containing temporal data (such as a tsibble, interval, datetime and others.)

period Specification of the time-series period

... Other arguments to be passed on to methods
data A tsibble

.auto The method used to automatically select the appropriate seasonal periods

Value

A named vector of frequencies appropriate for the provided data.

References

https://robjhyndman.com/hyndsight/seasonal-periods/
common_xregs

Examples

common_periods(tsibble::pedestrian)

Description

These special functions provide interfaces to more complicated functions within the model formulae interface.

Usage

common_xregs

Specials

trend: The trend special includes common linear trend regressors in the model. It also supports piecewise linear trend via the knots argument.

trend(knots = NULL, origin = NULL)

knots A vector of times (same class as the data’s time index) identifying the position of knots for a piecewise linear trend.

origin An optional time value to act as the starting time for the trend.

season: The season special includes seasonal dummy variables in the model.

season(period = NULL)

period The periodic nature of the seasonality. This can be either a number indicating the number of observations in each seasonal period, or text indicating the duration of the seasonal window (for example, annual seasonality would be "1 year").

fourier: The fourier special includes seasonal fourier terms in the model. The maximum order of the fourier terms must be specified using K.

fourier(period = NULL, K, origin = NULL)

period The periodic nature of the seasonality. This can be either a number indicating the number of observations in each seasonal period, or text indicating the duration of the seasonal window (for example, annual seasonality would be "1 year").

K The maximum order of the fourier terms.

origin An optional time value to act as the starting time for the fourier series.
components.mdl_df

Extract components from a fitted model

Description

Allows you to extract elements of interest from the model which can be useful in understanding how they contribute towards the overall fitted values.

Usage

```r
## S3 method for class 'mdl_df'
components(object, ...)
## S3 method for class 'mdl_ts'
components(object, ...)
```

Arguments

- `object`: A mable.
- `...`: Other arguments passed to methods.

Details

A dable will be returned, which will allow you to easily plot the components and see the way in which components are combined to give forecasts.

Examples

```r
library(fable)
library(tsibbledata)

# Forecasting with an ETS(M,Ad,A) model to Australian beer production
aus_production %>%
model(ets = ETS(log(Beer) ~ error("M") + trend("Ad") + season("A"))) %>%
components() %>%
autoplot()
```

dable

Create a dable object

Description

A dable (decomposition table) data class (dcmp_ts) which is a tsibble-like data structure for representing decompositions. This data class is useful for representing decompositions, as its print method describes how its columns can be combined to produce the original data, and has a more appropriate autoplot() method for displaying decompositions. Beyond this, a dable (dcmp_ts) behaves very similarly to a tsibble (tbl_ts).
**Usage**

detable(..., response, method = NULL, seasons = list(), aliases = list())

**Arguments**

... Arguments passed to tsibble::tsibble().
response The name of the response variable column.
method The name of the decomposition method.
seasons A named list describing the structure of seasonal components (such as period, and base).
aliases A named list of calls describing common aliases computed from components.

---

**Description**

This function allows you to specify a decomposition combination model using any additive decomposition. It works by first decomposing the data using the decomposition method provided to dcmp_fn with the given formula. Secondary models are used to fit each of the components from the resulting decomposition. These models are specified after the decomposition formula. All non-seasonal decomposition components must be specified, and any unspecified seasonal components will be forecasted using seasonal naive. These component models will be combined according to the decomposition method, giving a combination model for the response of the decomposition.

**Usage**

decomposition_model(dcmp, ...)

**Arguments**

dcmp A model definition which supports extracting decomposed components().
... Model definitions used to model the components

**See Also**

*Forecasting: Principles and Practice* - Forecasting Decomposition

**Examples**

```r
library(fable)
library(feasts)
library(tsibble)
library(dplyr)

vic_food <- tsibbledata::aus_retail %>%
  filter(State == "Victoria", Industry == "Food retailing")

# Identify an appropriate decomposition
vic_food %>%
  model(STL(log(Turnover) ~ season(window = Inf))) %>%
```


```
components() %>% autoplot()

# Use an ETS model to seasonally adjusted data, and SNAIVE to season_year
# Any model can be used, and seasonal components will default to use SNAIVE.
my_dcmp_spec <- decomposition_model(
  STL(log(Turnover) ~ season(window = Inf)),
  ETS(season_adjust ~ season("N")), SNAIVE(season_year)
)

distribution_var

vic_food %>%
  model(my_dcmp_spec) %>%
  forecast(h="5 years") %>%
  autoplot(vic_food)
```

distribution_var  

Return distribution variable

Description
distribution_var() returns a character vector of the distribution variable in the data.

Usage
distribution_var(x)

Arguments

x  
A dataset containing a distribution variable (such as a fable).

estimate

Estimate a model

Description
Estimate a model

Usage
estimate(.data, ...)

## S3 method for class 'tbl_ts'
estimate(.data, .model, ...)

Arguments

.data  
A data structure suitable for the models (such as a tsibble).

...  
Further arguments passed to methods.

.model  
Definition for the model to be used.
fable  

Create a fable object

Description

A fable (forecast table) data class (fbl_ts) which is a tsibble-like data structure for representing forecasts. In extension to the key and index from the tsibble (tbl_ts) class, a fable (fbl_ts) must also contain a single distribution column that uses values from the distributional package.

Usage

fable(..., response, distribution)

Arguments

...  
Arguments passed to tsibble::tsibble().
response  
The character vector of response variable(s).
distribution  
The name of the distribution column (can be provided using a bare expression).

features  

Extract features from a dataset

Description

Create scalar valued summary features for a dataset from feature functions.

Usage

features(.tbl, .var, features, ...)
features_at(.tbl, .vars, features, ...)
features_all(.tbl, features, ...)
features_if(.tbl, .predicate, features, ...)

Arguments

.tbl  
A dataset
.var  
An expression that produces a vector from which the features are computed.
features  
A list of functions (or lambda expressions) for the features to compute. feature_set() is a useful helper for building sets of features.
...  
Additional arguments to be passed to each feature. These arguments will only be passed to features which use it in their formal arguments (base::formals()), and not via their ... . While passing na.rm = TRUE to stats::var() will work, it will not for base::mean() as its formals are x and .... To more precisely pass inputs to each function, you should use lambdas in the list of features (~ mean(., na.rm = TRUE)).
feature_set

Description

Construct a feature set from features available in currently loaded packages. Lists of available features can be found in the following pages:

- Features by package
- Features by tag

Usage

feature_set(pkgs = NULL, tags = NULL)
Arguments

pkg s

The package(s) from which to search for features. If NULL, all registered features from currently loaded packages will be searched.

tags

Tags used to identify similar groups of features. If NULL, all tags will be included.

Registering features

Features can be registered for use with the `feature_set()` function using `register_feature()`. This function allows you to register a feature along with the tags associated with it. If the features are being registered from within a package, this feature registration should happen at load time using `.onLoad()`.

fitted.mdl_df

Extract fitted values from models

Description

Extracts the fitted values from each of the models in a mable. A tsibble will be returned containing these fitted values. Fitted values will be automatically back-transformed if a transformation was specified.

Usage

```r
## S3 method for class 'mdl_df'
fitted(object, ...)
## S3 method for class 'mdl_ts'
fitted(object, h = 1, ...)
```

Arguments

object

A mable or time series model.

... Other arguments passed to the model method for `fitted()`

h The number of steps ahead that these fitted values are computed from.

forecast.mdl_df

Produce forecasts

Description

The forecast function allows you to produce future predictions of a time series from fitted models. If the response variable has been transformed in the model formula, the transformation will be automatically back-transformed (and bias adjusted if `bias_adjust` is TRUE). More details about transformations in the fable framework can be found in vignette("transformations",package = "fable").
Usage

```r
## S3 method for class 'mdl_df'
forecast(
  object,
  new_data = NULL,
  h = NULL,
  point_forecast = list(.mean = mean),
  ...
)
```

```r
## S3 method for class 'mdl_ts'
forecast(
  object,
  new_data = NULL,
  h = NULL,
  bias_adjust = NULL,
  simulate = FALSE,
  bootstrap = FALSE,
  times = 5000,
  point_forecast = list(.mean = mean),
  ...
)
```

Arguments

- **object**: The time series model used to produce the forecasts
- **new_data**: A tsibble containing future information used to forecast.
- **h**: The forecast horizon (can be used instead of `new_data` for regular time series with no exogenous regressors).
- **point_forecast**: The point forecast measure(s) which should be returned in the resulting fable. Specified as a named list of functions which accept a distribution and return a vector. To compute forecast medians, you can use `list(.median = median)`.
- **...**: Additional arguments for forecast model methods.
- **bias_adjust**: Deprecated. Please use `point_forecast` to specify the desired point forecast method.
- **simulate**: Should forecasts be based on simulated future paths instead of analytical results.
- **bootstrap**: Should innovations from simulated forecasts be bootstrapped from the model’s fitted residuals. This allows the forecast distribution to have a different underlying shape which could better represent the nature of your data.
- **times**: The number of future paths for simulations if `simulate = TRUE`.

Details

The forecasts returned contain both point forecasts and their distribution. A specific forecast interval can be extracted from the distribution using the `hilo()` function, and multiple intervals can be obtained using `report()`. These intervals are stored in a single column using the `hilo` class, to extract the numerical upper and lower bounds you can use `unpack_hilo()`.
Value

A fable containing the following columns:

- `.model`: The name of the model used to obtain the forecast. Taken from the column names of models in the provided mable.
- The forecast distribution. The name of this column will be the same as the dependent variable in the model(s). If multiple dependent variables exist, it will be named `.distribution`.
- Point forecasts computed from the distribution using the functions in the `point_forecast` argument.
- All columns in `new_data`, excluding those whose names conflict with the above.

Examples

```r
library(fable)
library(tsibble)
library(tsibbledata)
library(dplyr)
library(tidyr)

# Forecasting with an ETS(M,Ad,A) model to Australian beer production
beer_fc <- aus_production %>%
  model(ets = ETS(log(Beer) ~ error("M") + trend("Ad") + season("A"))) %>%
  forecast(h = "3 years")

# Compute 80% and 95% forecast intervals
beer_fc %>%
  hilo(level = c(80, 95))

beer_fc %>%
  autoplot(aus_production)

# Forecasting with a seasonal naive and linear model to the monthly "Food retailing" turnover for each Australian state/territory.
library(dplyr)
aus_retail %>%
  filter(Industry == "Food retailing") %>%
  model(
    snaive = SNAIVE(Turnover),
    ets = TSLM(log(Turnover) ~ trend() + season()),
  ) %>%
  forecast(h = "2 years 6 months") %>%
  autoplot(filter(aus_retail, Month >= yearmonth("2000 Jan")), level = 90)

# Forecast GDP with a dynamic regression model on log(GDP) using population and an automatically chosen ARIMA error structure. Assume that population is fixed in the future.
aus_economy <- global_economy %>%
  filter(Country == "Australia")
fit <- aus_economy %>%
  model(lm = ARIMA(log(GDP) ~ Population))

future_aus <- new_data(aus_economy, n = 10) %>%
  mutate(Population = last(aus_economy$Population))

fit %>%
```
### Description

Use a model’s fitted distribution to simulate additional data with similar behaviour to the response. This is a tidy implementation of `stats::simulate()`.

### Usage

```
## S3 method for class 'mdl_df'
generate(x, new_data = NULL, h = NULL, times = 1, seed = NULL, ...)

## S3 method for class 'mdl_ts'
generate(
  x,
  new_data = NULL,
  h = NULL,
  times = 1,
  seed = NULL,
  bootstrap = FALSE,
  bootstrap_block_size = 1,
  ...
)
```

### Arguments

- **x**: A mable.
- **new_data**: The data to be generated (time index and exogenous regressors)
- **h**: The simulation horizon (can be used instead of `new_data` for regular time series with no exogenous regressors).
- **times**: The number of replications.
- **seed**: The seed for the random generation from distributions.
- **bootstrap**: If TRUE, then forecast distributions are computed using simulation with resampled errors.
- **bootstrap_block_size**: The bootstrap block size specifies the number of contiguous residuals to be taken in each bootstrap sample.

### Details

Innovations are sampled by the model’s assumed error distribution. If `bootstrap` is TRUE, innovations will be sampled from the model’s residuals. If `new_data` contains the `.innov` column, those values will be treated as innovations for the simulated paths.
Examples

library(fable)
library(dplyr)
UKLungDeaths <- as_tsibble(cbind(mdeaths, fdeaths), pivot_longer = FALSE)
UKLungDeaths %>%
  model(lm = TSLM(mdeaths ~ fourier("year", K = 4) + fdeaths)) %>%
generate(UKLungDeaths, times = 5)

Description

Uses the models within a mable to produce a one row summary of their fits. This typically contains information about the residual variance, information criterion, and other relevant summary statistics. Each model will be represented with a row of output.

Usage

## S3 method for class 'mdl_df'
glance(x, ...)

## S3 method for class 'mdl_ts'
glance(x, ...)

Arguments

x

A mable.

... Arguments for model methods.

Examples

library(fable)
library(tsibbledata)

olympic_running %>%
  model(lm = TSLM(log(Time) ~ trend())) %>%
glance()
hypothesize.mdl_df  Run a hypothesis test from a mable

Description
This function will return the results of a hypothesis test for each model in the mable.

Usage
## S3 method for class 'mdl_df'
hypothesize(x, ...)

## S3 method for class 'mdl_ts'
hypothesize(x, tests = list(), ...)

Arguments
x  A mable.
...  Arguments for model methods.
tests  a list of test functions to perform on the model

Examples
library(fable)
library(tsibbledata)

olympic_running %>%
  model(lm = TSLM(log(Time) ~ trend())) %>%
  hypothesize()

interpolate.mdl_df  Interpolate missing values

Description
Uses a fitted model to interpolate missing values from a dataset.

Usage
## S3 method for class 'mdl_df'
interpolate(object, new_data, ...)

## S3 method for class 'mdl_ts'
interpolate(object, new_data, ...)

Arguments
object  A mable containing a single model column.
new_data  A dataset with the same structure as the data used to fit the model.
...  Other arguments passed to interpolate methods.
Examples

```r
library(fable)
library(tsibbledata)

# The fastest running times for the olympics are missing for years during
# world wars as the olympics were not held.
olympic_running

olympic_running %>%
  model(TSLM(Time ~ trend())) %>%
  interpolate(olympic_running)
```

---

is_aggregated

Is the element an aggregation of smaller data

**Description**

Is the element an aggregation of smaller data

**Usage**

```r
is_aggregated(x)
```

**Arguments**

- `x` An object.

**See Also**

aggregate_key

---

is_dable

Is the object a dable

**Description**

Is the object a dable

**Usage**

```r
is_dable(x)
```

**Arguments**

- `x` An object.
<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
<th>Usage</th>
<th>Arguments</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>is_fable</code></td>
<td>Is the object a fable</td>
<td><code>is_fable(x)</code></td>
<td>x: An object.</td>
</tr>
<tr>
<td></td>
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<tr>
<td><code>is_mable</code></td>
<td>Is the object a mable</td>
<td><code>is_mable(x)</code></td>
<td>x: An object.</td>
</tr>
<tr>
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</tr>
<tr>
<td><code>is_model</code></td>
<td>Is the object a model</td>
<td><code>is_model(x)</code></td>
<td>x: An object.</td>
</tr>
</tbody>
</table>
### MAAPE

Mean Arctangent Absolute Percentage Error

**Description**

Mean Arctangent Absolute Percentage Error

**Usage**

MAAPE(.resid, .actual, na.rm = TRUE, ...)

**Arguments**

- `.resid` A vector of residuals from either the training (model accuracy) or test (forecast accuracy) data.
- `.actual` A vector of responses matching the fitted values (for forecast accuracy, `new_data` must be provided).
- `na.rm` Remove the missing values before calculating the accuracy measure
- `...` Additional arguments for each measure.

**References**


### mable

Create a new mable

**Description**

A mable (model table) data class (`mdl_df`) is a tibble-like data structure for applying multiple models to a dataset. Each row of the mable refers to a different time series from the data (identified by the key columns). A mable must contain at least one column of time series models (`mdl_ts`), where the list column itself (`lst_mdl`) describes how these models are related.

**Usage**

mable(..., key = NULL, model = NULL)

**Arguments**

- `...` <dynamic-dots> A set of name-value pairs. These arguments are processed with `rlang::quos()` and support unquote via `!!` and unquote-splice via `!!!`. Use `:=` to create columns that start with a dot.
  
  Arguments are evaluated sequentially. You can refer to previously created elements directly or using the `.data` pronoun. To refer explicitly to objects in the calling environment, use `!!` or `.env`, e.g. `!!`.data or `.env$.data` for the special case of an object named `.data`.
  
  - `key` Structural variable(s) that identify each model.
  - `model` Identifiers for the columns containing model(s).
mable_vars

Return model column variables

Description

mable_vars() returns a character vector of the model variables in the object.

Usage

mable_vars(x)

Arguments

x A dataset containing models (such as a mable).

MDA

Directional accuracy measures

Description

A collection of accuracy measures based on the accuracy of the prediction’s direction (say, increasing or decreasing).

Usage

MDA(.resid, .actual, na.rm = TRUE, reward = 1, penalty = 0, ...)
MDV(.resid, .actual, na.rm = TRUE, ...)
MDPV(.resid, .actual, na.rm = TRUE, ...)

directional_accuracy_measures

Arguments

.resid A vector of residuals from either the training (model accuracy) or test (forecast accuracy) data.
.actual A vector of responses matching the fitted values (for forecast accuracy, new_data must be provided).
.na.rm Remove the missing values before calculating the accuracy measure
.reward, penalty The weights given to correct and incorrect predicted directions.
... Additional arguments for each measure.

Format

An object of class list of length 3.
Details

\texttt{MDA()}: Mean Directional Accuracy
\texttt{MDV()}: Mean Directional Value
\texttt{MDPV()}: Mean Directional Percentage Value

References


\begin{itemize}
\item \texttt{ME(.resid, na.rm = TRUE, ...)}
\item \texttt{MSE(.resid, na.rm = TRUE, ...)}
\item \texttt{RMSE(.resid, na.rm = TRUE, ...)}
\item \texttt{MAE(.resid, na.rm = TRUE, ...)}
\item \texttt{MPE(.resid, .actual, na.rm = TRUE, ...)}
\item \texttt{MAPE(.resid, .actual, na.rm = TRUE, ...)}
\item \texttt{MASE(}
\begin{verbatim}
    .resid,  
    .train,  
    demean = FALSE,  
    na.rm = TRUE,  
    .period,  
    d = .period == 1,  
    D = .period > 1,  
    ... 
\end{verbatim}
\)
\item \texttt{RMSSE(}
\begin{verbatim}
    .resid,  
    .train,  
    demean = FALSE,  
    na.rm = TRUE,  
    .period,  
    d = .period == 1,  
    D = .period > 1,  
    ... 
\end{verbatim}
\)
\end{itemize}
ACF1(.resid, na.action = stats::na.pass, demean = TRUE, ...)

point_accuracy_measures

Arguments
.resid A vector of residuals from either the training (model accuracy) or test (forecast accuracy) data.
na.rm Remove the missing values before calculating the accuracy measure
... Additional arguments for each measure.
.actual A vector of responses matching the fitted values (for forecast accuracy, new_data must be provided).
.train A vector of responses used to train the model (for forecast accuracy, the orig_data must be provided).
demean Should the response be demeaned (MASE)
.period The seasonal period of the data (defaulting to 'smallest' seasonal period). from a model, or forecasted values from the forecast.
d Should the response model include a first difference?
D Should the response model include a seasonal difference?
na.action Function to handle missing values.

Format
An object of class list of length 8.

middle_out Middle out forecast reconciliation

Description
[Experimental]

Usage
middle_out(models, split = 1)

Arguments
.models A column of models in a mable.
split The middle level of the hierarchy from which the bottom-up and top-down approaches are used above and below respectively.

Details
Reconciles a hierarchy using the middle out reconciliation method. The response variable of the hierarchy must be aggregated using sums. The forecasted time points must match for all series in the hierarchy.
See Also

reconcile(), aggregate_key()

Forecasting: Principles and Practice - Middle-out approach

---

min_trace

*Minimum trace forecast reconciliation*

**Description**

Reconciles a hierarchy using the minimum trace combination method. The response variable of the hierarchy must be aggregated using sums. The forecasted time points must match for all series in the hierarchy (caution: this is not yet tested for beyond the series length).

**Usage**

```r
min_trace(
  models,
  method = c("wls_var", "ols", "wls_struct", "mint_cov", "mint_shrink"),
  sparse = NULL
)
```

**Arguments**

- `models`: A column of models in a mable.
- `method`: The reconciliation method to use.
- `sparse`: If TRUE, the reconciliation will be computed using sparse matrix algebra? By default, sparse matrices will be used if the MatrixM package is installed.

**References**


See Also

reconcile(), aggregate_key()

---

**model**

*Estimate models*

**Description**

Trains specified model definition(s) to a dataset. This function will estimate the a set of model definitions (passed via ...) to each series within .data (as identified by the key structure). The result will be a mable (a model table), which neatly stores the estimated models in a tabular structure. Rows of the data identify different series within the data, and each model column contains all models from that model definition. Each cell in the mable identifies a single model.
model

Usage

model(.data, ...)

## S3 method for class 'tbl_ts'
model(.data, ..., .safely = TRUE)

Arguments

.data A data structure suitable for the models (such as a tsibble)

... Definitions for the models to be used. All models must share the same response variable.

.safely If a model encounters an error, rather than aborting the process a NULL model will be returned instead. This allows for an error to occur when computing many models, without losing the results of the successful models.

Parallel

It is possible to estimate models in parallel using the future package. By specifying a future::plan() before estimating the models, they will be computed according to that plan.

Progress

Progress on model estimation can be obtained by wrapping the code with progressr::with_progress(). Further customisation on how progress is reported can be controlled using the progressr package.

Examples

library(fable)
library(tsibbledata)

# Training an ETS(M,Ad,A) model to Australian beer production
aus_production %>%
  model(ets = ETS(log(Beer) ~ error("M") + trend("Ad") + season("A")))

# Training a seasonal naive and ETS(A,A,A) model to the monthly "Food retailing" turnover for selected Australian states.
library(dplyr)
progressr::with_progress(
  aus_retail %>%
    filter(Industry == "Food retailing",
           State %in% c("Victoria", "New South Wales", "Queensland")
    ) %>%
    model(
      snaive = SNAIVE(Turnover),
      ets = ETS(log(Turnover) ~ error("A") + trend("A") + season("A")),
    )
  )
)
model_lhs

**Description**

Extract the left hand side of a model

**Usage**

```r
model_lhs(model)
```

**Arguments**

- `model`: A formula

model_rhs

**Description**

Extract the right hand side of a model

**Usage**

```r
model_rhs(model)
```

**Arguments**

- `model`: A formula

model_sum

**Description**

Similarly to pillar’s type_sum and obj_sum, model_sum is used to provide brief model summaries.

**Usage**

```r
model_sum(x)
```

**Arguments**

- `x`: The model to summarise
new_model_class

Create a new class of models

Description

Suitable for extension packages to create new models for fable.

Usage

```r
new_model_class(
  model = "Unknown model",
  train = function(.data, formula, specials, ...)
    abort("This model has not defined a training method."),
  specials = new_specials(),
  check = function(.data) {
  },
  prepare = function(...) {
  },
  ...,
  .env = caller_env(),
  .inherit = model_definition
)

new_model_definition(.class, formula, ..., .env = caller_env(n = 2))
```

Arguments

- **model**
  - The name of the model

- **train**
  - A function that trains the model to a dataset. `.data` is a tsibble containing the data's index and response variables only. `formula` is the user's provided formula. `specials` is the evaluated specials used in the formula.

- **specials**
  - Special functions produced using `new_specials()`

- **check**
  - A function that is used to check the data for suitability with the model. This can be used to check for missing values (both implicit and explicit), regularity of observations, ordered time index, and univariate responses.

- **prepare**
  - This allows you to modify the model class according to user inputs. `...` is the arguments passed to `new_model_definition`, allowing you to perform different checks or training procedures according to different user inputs.

- **...**
  - Further arguments to `R6::R6Class()`. This can be useful to set up additional elements used in the other functions. For example, to use `common_xregs`, an origin element in the model is used to store the origin for `trend()` and `fourier()` specials. To use these specials, you must add an `origin` element to the object (say with `origin = NULL`).

- **.env**
  - The environment from which functions should inherit from.

- **.inherit**
  - A model class to inherit from.

- **.class**
  - A model class (typically created with `new_model_class()`).

- **formula**
  - The user’s model formula.
Details

This function produces a new R6 model definition. An understanding of R6 is not required, however could be useful to provide more sophisticated model interfaces. All functions have access to self, allowing the functions for training the model and evaluating specials to access the model class itself. This can be useful to obtain elements set in the %TODO

new_specials

Description

Create evaluation environment for specials

Allows extension packages to make use of the formula parsing of specials.

Usage

new_specials(..., .required_specials = NULL, .xreg_specials = NULL)

Arguments

... A named set of functions which used to parse formula inputs
(required_specials
The names of specials which must be provided (and if not, are included with no inputs).
.xreg_specials The names of specials which will be only used as inputs to other specials (most commonly xreg).

new_transformation

Description

Create a new modelling transformation

Produces a new transformation for fable modelling functions which will be used to transform, back-transform, and adjust forecasts.

Usage

new_transformation(transformation, inverse)

invert_transformation(x, ...)

Arguments

transformation A function which transforms the data
inverse A function which is the inverse of a transformation
x A transformation (such as one created with new_transformation).
... Further arguments passed to other methods.
Details

For more details about transformations, read the vignette: `vignette("transformations", package = "fable")`

Examples

```r
scaled_logit <- function(x, lower=0, upper=1){
  log((x-lower)/(upper-x))
}
inv_scaled_logit <- function(x, lower=0, upper=1){
  (upper-lower)*exp(x)/(1+exp(x)) + lower
}
my_scaled_logit <- new_transformation(scaled_logit, inv_scaled_logit)
t_vals <- my_scaled_logit(1:10, 0, 100)
t_vals
```

outliers

### Identify outliers

Return a table of outlying observations using a fitted model.

#### Usage

```r
outliers(object, ...)
```

#### Arguments

- `object` An object which can identify outliers.
- `...` Arguments for further methods.

percentile_score

### Distribution accuracy measures

These accuracy measures can be used to evaluate how accurately a forecast distribution predicts a given actual value.
Usage

percentile_score(.dist, .actual, na.rm = TRUE, ...)

quantile_score(
  .dist,
  .actual,
  probs = c(0.05, 0.25, 0.5, 0.75, 0.95),
  na.rm = TRUE,
  ...
)

CRPS(.dist, .actual, n_quantiles = 1000, na.rm = TRUE, ...)

distribution_accuracy_measures

Arguments

.dist The distribution of fitted values from the model, or forecasted values from the forecast.

.actual A vector of responses matching the fitted values (for forecast accuracy, new_data must be provided).

na.rm Remove the missing values before calculating the accuracy measure

... Additional arguments for each measure.

probs A vector of probabilities at which the metric is evaluated.

n_quantiles The number of quantiles to use in approximating CRPS when an exact solution is not available.

Format

An object of class list of length 2.

Quantile/percentile score (pinball loss)

A quantile (or percentile) score evaluates how accurately a set of quantiles (or percentiles) from the distribution match the given actual value. This score uses a pinball loss function, and can be calculated via the average of the score function given below:

The score function $s_p(q_p, y)$ is given by $(1 - p)(q_p - y)$ if $y < q_p$, and $p(y - q_p)$ if $y \geq q_p$. Where $p$ is the quantile probability, $q_p = F^{-1}(p)$ is the quantile with probability $p$, and $y$ is the actual value.

The resulting accuracy measure will average this score over all predicted points at all desired quantiles (defined via the probs argument).

The percentile score is uses the same method with probs set to all percentiles probs = seq(0.01, 0.99, 0.01).

Continuous ranked probability score (CRPS)

The continuous ranked probability score (CRPS) is the continuous analogue of the pinball loss quantile score defined above. Its value is twice the integral of the quantile score over all possible quantiles:

$$CRPS(F, y) = 2 \int_0^1 s_p(q_p, y)dp$$
It can be computed directly from the distribution via:

\[ CRPS(F, y) = \int_{-\infty}^{\infty} (F(x) - 1_{y \leq x})^2 dx \]

For some forecast distribution \( F \) and actual value \( y \).

Calculating the CRPS accuracy measure is computationally difficult for many distributions, however it can be computed quickly and exactly for Normal and empirical (sample) distributions. For other distributions the CRPS is approximated using the quantile score of many quantiles (using the number of quantiles specified in the \texttt{n_quantiles} argument).

---

**reconcile**

*Forecast reconciliation*

**Description**

This function allows you to specify the method used to reconcile forecasts in accordance with its key structure.

**Usage**

\[
\text{reconcile}(.data, \ldots)
\]

## S3 method for class 'mdl_df'

\[
\text{reconcile}(.data, \ldots)
\]

**Arguments**

- \texttt{.data}:
  - A mable.
- \texttt{\ldots}:
  - Reconciliation methods applied to model columns within \texttt{.data}.

**Examples**

```r
library(fable)
lung_deaths_agg <- as_tsibble(cbind(mdeaths, fdeaths)) %>%
  aggregate_key(key, value = sum(value))
lung_deaths_agg %>%
  model(lm = TSLM(value ~ trend() + season())) %>%
  reconcile(lm = min_trace(lm)) %>%
  forecast()
```
**refit.mdl_df**  
*Refit a mable to a new dataset*

**Description**

Applies a fitted model to a new dataset. For most methods this can be done with or without re-estimation of the parameters.

**Usage**

```r
## S3 method for class 'mdl_df'
refit(object, new_data, ...)

## S3 method for class 'mdl_ts'
refit(object, new_data, ...)
```

**Arguments**

- `object`  
  A mable.
- `new_data`  
  A tsibble dataset used to refit the model.
- `...`  
  Additional optional arguments for refit methods.

**Examples**

```r
library(fable)

fit <- as_tsibble(mdeaths) %>%
  model(ETS(value ~ error("M") + trend("A") + season("A")))
fit %>% report()

fit %>%
  refit(as_tsibble(fdeaths)) %>%
  report(reinitialise = TRUE)
```

---

**register_feature**  
*Register a feature function*

**Description**

Allows users to find and use features from your package using `feature_set()`. If the features are being registered from within a package, this feature registration should happen at load time using `onLoad()`.

**Usage**

```r
register_feature(fn, tags)
```
Arguments

fn  The feature function

tags  Identifying tags

Examples

## Not run:
tukey_five <- function(x){
  setNames(fivenum(x), c("min", "hinge_lwr", "med", "hinge_upr", "max"))
}

register_feature(tukey_five, tags = c("boxplot", "simple"))

## End(Not run)

---

**report**  Report information about an object

**Description**

Displays the object in a suitable format for reporting.

**Usage**

```r
report(object, ...)
```

**Arguments**

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>object</td>
<td>The object to report</td>
</tr>
<tr>
<td>...</td>
<td>Additional options for the reporting function</td>
</tr>
</tbody>
</table>

---

**residuals.mdl_df**  Extract residuals values from models

**Description**

Extracts the residuals from each of the models in a mable. A tsibble will be returned containing these residuals.

**Usage**

```r
## S3 method for class 'mdl_df'
residuals(object, ...)
```

```r
## S3 method for class 'mdl_ts'
residuals(object, type = "innovation", ...)
```
response

**Extract the response variable from a model**

**Description**

Returns a tsibble containing only the response variable used in the fitting of a model.

**Usage**

```r
response(object, ...)
```

**Arguments**

- `object`: A mable or time series model.
- `...`: Other arguments passed to the model method for `residuals()`
- `type`: The type of residuals to compute. If `type="response"`, residuals on the back-transformed data will be computed.

---

**response_vars**

**Return response variables**

**Description**

`response_vars()` returns a character vector of the response variables in the object.

**Usage**

```r
response_vars(x)
```

**Arguments**

- `x`: A dataset containing a response variable (such as a mable, fable, or dable).
scenarios

A set of future scenarios for forecasting

Description
A set of future scenarios for forecasting

Usage
`scenarios(..., names_to = ".scenario")`

Arguments
- `...` Input data for each scenario
- `names_to` The column name used to identify each scenario

skill_score
Forecast skill score measure

Description
This function converts other error metrics such as MSE into a skill score. The reference or benchmark forecasting method is the Naive method for non-seasonal data, and the seasonal naive method for seasonal data. When used within `accuracy.fbl_ts`, it is important that the data contains both the training and test data, as the training data is used to compute the benchmark forecasts.

Usage
`skill_score(measure)`

Arguments
- `measure` The accuracy measure to use in computing the skill score.

Examples
```
skill_score(MSE)
```

library(fable)
library(tsibble)

lung_deaths <- as_tsibble(cbind(mdeaths, fdeaths))

lung_deaths %>%
  dplyr::filter(index < yearmonth("1979 Jan")) %>%
  model(
    ets = ETS(value ~ error("M") + trend("A") + season("A")),
    lm = TSLM(value ~ trend() + season())
  ) %>%
  forecast(h = "1 year") %>%
  accuracy(lung_deaths, measures = list(skill = skill_score(MSE)))
special_xreg  
*Helper special for producing a model matrix of exogenous regressors*

**Description**

Helper special for producing a model matrix of exogenous regressors

**Usage**

special_xreg(...)

**Arguments**

... Arguments for fable_xreg_matrix (see Details)

**Details**

Currently the fable_xreg_matrix helper supports a single argument named default_intercept. If this argument is TRUE (passed via ... above), then the intercept will be returned in the matrix if not specified (much like the behaviour of lm()). If FALSE, then the intercept will only be included if explicitly requested via 1 in the formula.

---

stream  
*Extend a fitted model with new data*

**Description**

Extend the length of data used to fit a model and update the parameters to suit this new data.

**Usage**

stream(object, ...)

## S3 method for class 'mdl_df'
stream(object, new_data, ...)

**Arguments**

| object | An object (such as a model) which can be extended with additional data. |
| ...    | Additional arguments passed on to stream methods. |
| new_data | A dataset of the same structure as was used to fit the model. |
tidy.mdl_df

Extract model coefficients from a mable

Description
This function will obtain the coefficients (and associated statistics) for each model in the mable.

Usage

```r
## S3 method for class 'mdl_df'
tidy(x, ...)
```

```r
## S3 method for class 'mdl_df'
coef(object, ...)
```

```r
## S3 method for class 'mdl_ts'
tidy(x, ...)
```

```r
## S3 method for class 'mdl_ts'
coef(object, ...)
```

Arguments

- `x, object` A mable.
- `...` Arguments for model methods.

Examples

```r
library(fable)
library(tsibbledata)

olympic_running %>%
  model(lm = TSLM(log(Time) ~ trend())) %>%
tidy()
```

top_down

Top down forecast reconciliation

Description

[Experimental]

Usage

```r
top_down(
  models,
  method = c("forecast_proportions", "average_proportions", "proportion_averages")
)
```
Arguments

models A column of models in a mable.
method The reconciliation method to use.

Details

Reconciles a hierarchy using the top down reconciliation method. The response variable of the hierarchy must be aggregated using sums. The forecasted time points must match for all series in the hierarchy.

See Also

reconcile(), aggregate_key()

winkler_score

Interval estimate accuracy measures

Description

Interval estimate accuracy measures

Usage

winkler_score(.dist, .actual, level = 95, na.rm = TRUE, ...)

pinball_loss(.dist, .actual, level = 95, na.rm = TRUE, ...)

scaled_pinball_loss(
  .dist,
  .actual,
  .train,
  level = 95,
  na.rm = TRUE,
  demean = FALSE,
  .period,
  d = .period == 1,
  D = .period > 1,
  ...
)

interval_accuracy_measures

Arguments

.dist The distribution of fitted values from the model, or forecasted values from the forecast.
.actual A vector of responses matching the fitted values (for forecast accuracy, new_data must be provided).
.level The level of the forecast interval.
.na.rm Remove the missing values before calculating the accuracy measure
Additional arguments for each measure.

.train A vector of responses used to train the model (for forecast accuracy, the `orig_data` must be provided).

demean Should the response be demeaned (MASE)

.period The seasonal period of the data (defaulting to `smallest` seasonal period). from a model, or forecasted values from the forecast.

d Should the response model include a first difference?

D Should the response model include a seasonal difference?

Format

An object of class `list` of length 3.
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