Package 'modeltime.gluonts'

November 30, 2020

Type Package

Title 'GluonTS' Deep Learning

Version 0.1.0

Description Use the 'GluonTS' deep learning library inside of 'modeltime'.
Available models include 'DeepAR', 'N-BEATS', and 'N-BEATS' Ensemble.
Refer to ``GluonTS - Probabilistic Time Series Modeling"
(<https://ts.gluon.ai/index.html>).

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Encoding UTF-8

LazyData true

RoxygenNote 7.1.1

Depends modeltime (>= 0.3.1)

Imports parsnip, timetk, magrittr, rlang (>= 0.1.2), reticulate,
tibble, forcats, dplyr, tidyr, purrr, stringr, glue, fs

Suggests tidyverse, tidymodels, knitr, rmarkdown, roxygen2, testthat

VignetteBuilder knitr

URL https://github.com/business-science/modeltime.gluonts

BugReports https://github.com/business-science/modeltime.gluonts/issues

NeedsCompilation no

Author Matt Dancho [aut, cre],
Business Science [cph]

Maintainer Matt Dancho <mdancho@business-science.io>

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R topics documented:

`as_pandas_timestamp` *Convert R Date or POSIXt to Pandas Timestamp*

Description

Convert R Date or POSIXt to Pandas Timestamp

Usage

```
as_pandas_timestamp(x, ..., pass_time_zone = FALSE)
```

Arguments

`x`	A Date or Date Time
`...`	Additional parameters passed to Pandas Timestamp
`pass_time_zone`	Whether or not to include the time zone in the conversion to Pandas. GluonTS does not work with Pandas Time Zones. Default: FALSE.

Examples

```
dt <- as.Date("2011-01-01")
as_pandas_timestamp(dt)

dt_time <- as.POSIXct("2011-01-01 12:43:01", tz = "GMT")
as_pandas_timestamp(dt_time, pass_time_zone = TRUE)
```

deepar_fit_impl *GluonTS DeepAR Modeling Function (Bridge)*

Description

GluonTS DeepAR Modeling Function (Bridge)

Usage

```
deepar_fit_impl(
  x,
  y,
  freq,
  prediction_length,
  id,
  epochs = 5,
  batch_size = 32,
  num_batches_per_epoch = 50,
  learning_rate = 0.001,
  learning_rate_decay_factor = 0.5,
  patience = 10,
  minimum_learning_rate = 5e-05,
  clip_gradient = 10,
  weight_decay = 1e-08,
  init = "xavier",
  ctx = NULL,
  hybridize = TRUE,
  context_length = NULL,
  num_layers = 2,
  num_cells = 40,
  cell_type = "lstm",
  dropout_rate = 0.1,
  use_feat_dynamic_real = FALSE,
  use_feat_static_cat = FALSE,
  use_feat_static_real = FALSE,
  cardinality = NULL,
  embedding_dimension = NULL,
  distr_output = "default",
  scaling = TRUE,
  lags_seq = NULL,
  time_features = NULL,
  num_parallel_samples = 100
)
```

Arguments

x	A dataframe of xreg (exogenous regressors)

y	A numeric vector of values to fit
freq	A pandas timeseries frequency such as "5min" for 5-minutes or "D" for daily. Refer to Pandas Offset Aliases.
prediction_length	Numeric value indicating the length of the prediction horizon
id	A quoted column name that tracks the GluonTS FieldName "item_id"
epochs	Number of epochs that the network will train (default: 5).
batch_size	Number of examples in each batch (default: 32).
num_batches_per_epoch	Number of batches at each epoch (default: 50).
learning_rate	Initial learning rate (default: 10-3).
learning_rate_decay_factor	Factor (between 0 and 1) by which to decrease the learning rate (default: 0.5).
patience	The patience to observe before reducing the learning rate, nonnegative integer (default: 10).
minimum_learning_rate	Lower bound for the learning rate (default: 5x10-5).
clip_gradient	Maximum value of gradient. The gradient is clipped if it is too large (default: 10).
weight_decay	The weight decay (or L2 regularization) coefficient. Modifies objective by adding a penalty for having large weights (default 10-8).
init	Initializer of the weights of the network (default: "xavier").
ctx	The mxnet CPU/GPU context. Refer to using CPU/GPU in the mxnet documentation. (default: NULL, uses CPU)
hybridize	Increases efficiency by using symbolic programming. (default: TRUE)
context_length	Number of steps to unroll the RNN for before computing predictions (default: NULL, in which case context_length = prediction_length)
num_layers	Number of RNN layers (default: 2)
num_cells	Number of RNN cells for each layer (default: 40)
cell_type	Type of recurrent cells to use (available: 'lstm' or 'gru'; default: 'lstm')
dropout_rate	Dropout regularization parameter (default: 0.1)
use_feat_dynamic_real	Whether to use the 'feat_dynamic_real' field from the data (default: FALSE)
use_feat_static_cat	Whether to use the feat_static_cat field from the data (default: FALSE)
use_feat_static_real	Whether to use the feat_static_real field from the data (default: FALSE)
cardinality	Number of values of each categorical feature. This must be set if use_feat_static_cat == TRUE (default: NULL)
embedding_dimension	Dimension of the embeddings for categorical features (default: min(50, (cat+1)//2) for cat in cardinality)

distr_output	Distribution to use to evaluate observations and sample predictions (default: StudentTOutput())
scaling	Whether to automatically scale the target values (default: TRUE)
lags_seq	Indices of the lagged target values to use as inputs of the RNN (default: NULL, in which case these are automatically determined based on freq)
time_features	Time features to use as inputs of the RNN (default: None, in which case these are automatically determined based on freq)
num_parallel_samples	Number of evaluation samples per time series to increase parallelism during inference. This is a model optimization that does not affect the accuracy (default: 100)

`deepar_predict_impl` *Bridge prediction Function for DeepAR Models*

Description

Bridge prediction Function for DeepAR Models

Usage

```
deepar_predict_impl(object, new_data)
```

Arguments

object	An object of class `model_fit`
new_data	A rectangular data object, such as a data frame.

`deep_ar` *General Interface for DeepAR Time Series Models*

Description

`deep_ar()` is a way to generate a *specification* of a DeepAR model before fitting and allows the model to be created using different packages. Currently the only package is `gluonts`.

Usage

```
deep_ar(
  mode = "regression",
  id,
  freq,
  prediction_length,
  lookback_length = NULL,
  cell_type = NULL,
  num_layers = NULL,
  num_cells = NULL,
  dropout = NULL,
  epochs = NULL,
  batch_size = NULL,
  num_batches_per_epoch = NULL,
  learn_rate = NULL,
  learn_rate_decay_factor = NULL,
  learn_rate_min = NULL,
  patience = NULL,
  clip_gradient = NULL,
  penalty = NULL
)
```

Arguments

mode	A single character string for the type of model. The only possible value for this model is "regression".
id	A quoted column name that tracks the GluonTS FieldName "item_id"
freq	A pandas timeseries frequency such as "5min" for 5-minutes or "D" for daily. Refer to Pandas Offset Aliases.
prediction_length	Numeric value indicating the length of the prediction horizon
lookback_length	Number of steps to unroll the RNN for before computing predictions (default: NULL, in which case context_length = prediction_length)
cell_type	Type of recurrent cells to use (available: 'lstm' or 'gru'; default: 'lstm')
num_layers	Number of RNN layers (default: 2)
num_cells	Number of RNN cells for each layer (default: 40)
dropout	Dropout regularization parameter (default: 0.1)
epochs	Number of epochs that the network will train (default: 5).
batch_size	Number of examples in each batch (default: 32).
num_batches_per_epoch	Number of batches at each epoch (default: 50).
learn_rate	Initial learning rate (default: 10-3).
learn_rate_decay_factor	Factor (between 0 and 1) by which to decrease the learning rate (default: 0.5).

learn_rate_min	Lower bound for the learning rate (default: 5x10-5).
patience	The patience to observe before reducing the learning rate, nonnegative integer (default: 10).
clip_gradient	Maximum value of gradient. The gradient is clipped if it is too large (default: 10).
penalty	The weight decay (or L2 regularization) coefficient. Modifies objective by adding a penalty for having large weights (default 10-8).

Details

These arguments are converted to their specific names at the time that the model is fit. Other options and arguments can be set using `set_engine()`. If left to their defaults here (see above), the values are taken from the underlying model functions. If parameters need to be modified, `update()` can be used in lieu of recreating the object from scratch.

The model can be created using the fit() function using the following engines:

- **GluonTS DeepAR:** "gluonts_deepar" (the default)

Engine Details

The standardized parameter names in `modeltime` can be mapped to their original names in each engine:

modeltime	DeepAREstimator
id	NA
freq	freq
prediction_length	prediction_length
lookback_length	context_length (= prediction_length)
epochs	epochs (5)
batch_size	batch_size (32)
num_batches_per_epoch	num_batches_per_epoch (50)
learn_rate	learning_rate (0.001)
learn_rate_decay_factor	learning_rate_decay_factor (0.5)
learn_rate_min	minimum_learning_rate (5e-5)
patience	patience (10)
clip_gradient	clip_gradient (10)
penalty	weight_decay (1e-8)
cell_type	cell_type ('lstm')
num_layers	num_layers (2)
num_cells	num_cells (40)
dropout	dropout_rate (0.1)

Other options can be set using `set_engine()`.

Engine

gluonts_deepar

The engine uses `gluonts.model.deepar.DeepAREstimator()`. Default values that have been changed to prevent long-running computations:

- `epochs = 5`: GluonTS uses 100 by default.

Required Parameters

The `gluonts` implementation has several *Required Parameters*, which are user-defined.

1. ID Variable (Required):

An important difference between other parsnip models is that each time series (even single time series) must be uniquely identified by an ID variable.

- The ID feature must be of class `character` or `factor`.
- This ID feature is provided as a quoted expression during the model specification process (e.g. `deep_ar(id = "ID")` assuming you have a column in your data named "ID").

2. Frequency (Required):

The GluonTS models use a Pandas Timestamp Frequency `freq` to generate features internally. Examples:

- `freq = "5min"` for timestamps that are 5-minutes apart
- `freq = "D"` for Daily Timestamps

The Pandas Timestamps are quite flexible. Refer to Pandas Offset Aliases.

3. Prediction Length (Required):

Unlike other parsnip models, a `prediction_length` is required during the model specification and fitting process.

Fit Details

The following features are REQUIRED to be available in the incoming data for the fitting process.

- **Fit:** `fit(y ~ date + id, data)`: Includes a target feature that is a function of a "date" and "id" feature. The ID feature must be pre-specified in the model_specification.
- **Predict:** `predict(model, new_data)` where `new_data` contains both a column named "date" and "id".

ID Variable

An ID feature must be included in the recipe or formula fitting process. This assists with cataloging the time series inside `GluonTS` ListDataset. The column name must match the quoted feature name specified in the `deep_ar(id = "id")` expects a column inside your data named "id".

Date and Date-Time Variable

It's a requirement to have a date or date-time variable as a predictor. The `fit()` interface accepts date and date-time features and handles them internally.

See Also

`fit.model_spec()`, `set_engine()`

Examples

```
library(tidymodels)
library(tidyverse)
library(timetk)


# ---- MODEL SPEC ----
# - Important: Make sure *required* parameters are provided
model_spec <- deep_ar(

    # User Defined (Required) Parameters
    id                    = "id",
    freq                  = "M",
    prediction_length     = 24,

    # Hyper Parameters
    epochs                = 1,
    num_batches_per_epoch = 4
) %>%
    set_engine("gluonts_deepar")

model_spec

# ---- TRAINING ----
# Important: Make sure the date and id features are included as regressors
#  and do NOT dummy the id feature.
model_fitted <- model_spec %>%
    fit(value ~ date + id, m750)

model_fitted

# ---- PREDICT ----
# - IMPORTANT: New Data must have id and date features
new_data <- tibble(
    id   = factor("M750"),
    date = as.Date("2015-07-01")
)

predict(model_fitted, new_data)
```

`install_gluonts` *Install GluonTS*

Description

Installs `GluonTS` Probabilisitic Deep Learning Time Series Forecasting Software using `reticulate::py_install()`.

- A Python Environment will be created named `r-gluonts`.
- The Modletime GluonTS R package will connect to the `r-gluonts` Python environment to use `GluonTS`

Usage

```
install_gluonts()
```

Examples

```
## Not run:
install_gluonts()

## End(Not run)
```

`nbeats` *General Interface for N-BEATS Time Series Models*

Description

`nbeats()` is a way to generate a *specification* of a N-BEATS model before fitting and allows the model to be created using different packages. Currently the only package is `gluonts`. There are 2 N-Beats implementations: (1) Standard N-Beats, and (2) Ensemble N-Beats.

Usage

```
nbeats(
  mode = "regression",
  id,
  freq,
  prediction_length,
  lookback_length = NULL,
  loss_function = NULL,
  bagging_size = NULL,
  num_stacks = NULL,
  num_blocks = NULL,
  epochs = NULL,
  batch_size = NULL,
  num_batches_per_epoch = NULL,
  learn_rate = NULL,
  learn_rate_decay_factor = NULL,
  learn_rate_min = NULL,
  patience = NULL,
  clip_gradient = NULL,
  penalty = NULL
)
```

Arguments

mode	A single character string for the type of model. The only possible value for this model is "regression".
id	A quoted column name that tracks the GluonTS FieldName "item_id"
freq	A pandas timeseries frequency such as "5min" for 5-minutes or "D" for daily. Refer to Pandas Offset Aliases.
prediction_length	Numeric value indicating the length of the prediction horizon
lookback_length	Number of time units that condition the predictions Also known as 'lookback period'. Default is 2 * prediction_length.
loss_function	The loss function (also known as metric) to use for training the network. Unlike other models in GluonTS this network does not use a distribution. One of the following: "sMAPE", "MASE" or "MAPE". The default value is "MAPE".
bagging_size	(Applicable to Ensemble N-Beats). The number of models that share the parameter combination of 'context_length' and 'loss_function'. Each of these models gets a different initialization random initialization. Default and recommended value: 10.
num_stacks	The number of stacks the network should contain. Default and recommended value for generic mode: 30 Recommended value for interpretable mode: 2
num_blocks	The number of blocks per stack. A list of ints of length 1 or 'num_stacks'. Default and recommended value for generic mode: 1. Recommended value for interpretable mode: 3.
epochs	Number of epochs that the network will train (default: 5).
batch_size	Number of examples in each batch (default: 32).
num_batches_per_epoch	Number of batches at each epoch (default: 50).
learn_rate	Initial learning rate (default: 10-3).
learn_rate_decay_factor	Factor (between 0 and 1) by which to decrease the learning rate (default: 0.5).
learn_rate_min	Lower bound for the learning rate (default: 5x10-5).
patience	The patience to observe before reducing the learning rate, nonnegative integer (default: 10).
clip_gradient	Maximum value of gradient. The gradient is clipped if it is too large (default: 10).
penalty	The weight decay (or L2 regularization) coefficient. Modifies objective by adding a penalty for having large weights (default 10-8).

Details

These arguments are converted to their specific names at the time that the model is fit. Other options and arguments can be set using `set_engine()`. If left to their defaults here (see above), the values are taken from the underlying model functions. If parameters need to be modified, `update()` can be used in lieu of recreating the object from scratch.

The model can be created using the fit() function using the following engines:

- **GluonTS N-BEATS:** "gluonts_nbeats" (the default)
- **GluonTS N-BEATS Ensemble:** "gluonts_nbeats_ensemble"

Engine Details

The standardized parameter names in `modeltime` can be mapped to their original names in each engine:

modeltime	NBEATSEstimator	NBEATSEnsembleEstimator
id	ListDataset('item_id')	ListDataset('item_id')
freq	freq	freq
prediction_length	prediction_length	prediction_length
lookback_length	context_length (= 2 x prediction_length)	meta_context_length (= prediction_length x c(2,4))
bagging_size	NA	meta_bagging_size (3)
loss_function	loss_function ('sMAPE')	meta_loss_function (list('sMAPE'))
num_stacks	num_stacks (30)	num_stacks (30)
num_blocks	num_blocks (list(1))	num_blocks (list(1))
epochs	epochs (5)	epochs (5)
batch_size	batch_size (32)	batch_size (32)
num_batches_per_epoch	num_batches_per_epoch (50)	num_batches_per_epoch (50)
learn_rate	learning_rate (0.001)	learning_rate (0.001)
learn_rate_decay_factor	learning_rate_decay_factor (0.5)	learning_rate_decay_factor (0.5)
learn_rate_min	minimum_learning_rate (5e-5)	minimum_learning_rate (5e-5)
patience	patience (10)	patience (10)
clip_gradient	clip_gradient (10)	clip_gradient (10)
penalty	weight_decay (1e-8)	weight_decay (1e-8)

Other options can be set using `set_engine()`.

Engine

gluonts_nbeats

The engine uses `gluonts.model.n_beats.NBEATSEstimator()`. Default values that have been changed to prevent long-running computations:

- `epochs = 5`: GluonTS uses 100 by default.
- `loss_function = 'sMAPE'`: GluonTS by default uses MAPE. MAPE can suffer from issues with small values.

Required Parameters

The `gluonts_nbeats` implementation has several *Required Parameters*, which are user-defined.

1. ID Variable (Required):

An important difference between other parsnip models is that each time series (even single time series) must be uniquely identified by an ID variable.

- The ID feature must be of class `character` or `factor`.

- This ID feature is provided as a quoted expression during the model specification process (e.g. `nbeats(id = "ID")` assuming you have a column in your data named "ID").

2. Frequency (Required):

The GluonTS models use a Pandas Timestamp Frequency `freq` to generate features internally. Examples:

- `freq = "5min"` for timestamps that are 5-minutes apart
- `freq = "D"` for Daily Timestamps

The Pandas Timestamps are quite flexible. Refer to Pandas Offset Aliases.

3. Prediction Length (Required):

Unlike other parsnip models, a `prediction_length` is required during the model specification and fitting process.

gluonts_nbeats_ensemble

The engine uses `gluonts.model.n_beats.NBEATSEnsembleEstimator()`.

Number of Models Created

This model is very good, but can be expensive (long-running) due to the number of models that are being created. The number of models follows the formula:
length(lookback_length) x length(loss_function) x meta_bagging_size

The default values that have been changed from GluonTS implementation to prevent long-running computations:

- `epochs = 5`: GluonTS uses 100 by default.
- `lookback_length = prediction_length * c(2,4)`. GluonTS uses range of 2:7, which doubles the number of models created.
- `bagging_size = 3`: Averages 5 like models together. GluonTS uses 10, which doubles the number of models created.
- `loss_function = 'sMAPE'`: GluonTS uses 3 `meta_loss_function = list('sMAPE','MASE','MAPE')`, which 3X's (triples) the number of models created.

The result is: 2 x 1 x 3 = **6 models.** Each model will have 5 epochs by default.

Required Parameters

The `gluonts_nbeats_ensemble` implementation has several *Required Parameters*, which are user-defined.

1. ID Variable (Required):

An important difference between other parsnip models is that each time series (even single time series) must be uniquely identified by an ID variable.

- The ID feature must be of class `character` or `factor`.
- This ID feature is provided as a quoted expression during the model specification process (e.g. `nbeats(id = "ID")` assuming you have a column in your data named "ID").

2. Frequency (Required):

The GluonTS models use a Pandas Timestamp Frequency `freq` to generate features internally. Examples:

- `freq = "5min"` for timestamps that are 5-minutes apart
- `freq = "D"` for Daily Timestamps

The Pandas Timestamps are quite flexible. Refer to Pandas Offset Aliases.

3. Prediction Length (Required):

Unlike other parsnip models, a `prediction_length` is required during the model specification and fitting process.

Fit Details

The following features are REQUIRED to be available in the incoming data for the fitting process.

- **Fit:** `fit(y ~ date + id, data)`: Includes a target feature that is a function of a "date" and "id" feature. The ID feature must be pre-specified in the model_specification.
- **Predict:** `predict(model, new_data)` where `new_data` contains both a column named "date" and "id".

ID Variable

An ID feature must be included in the recipe or formula fitting process. This assists with cataloging the time series inside `GluonTS` ListDataset. The column name must match the quoted feature name specified in the `nbeats(id = "id")` expects a column inside your data named "id".

Date and Date-Time Variable

It's a requirement to have a date or date-time variable as a predictor. The `fit()` interface accepts date and date-time features and handles them internally.

See Also

`fit.model_spec()`, `set_engine()`

Examples

```
library(tidymodels)
library(tidyverse)
library(timetk)


# ---- MODEL SPEC ----
# - Important: Make sure *required* parameters are provided
model_spec <- nbeats(

    # User Defined (Required) Parameters
    id                    = "id",
    freq                  = "M",
    prediction_length     = 24,

    # Hyper Parameters
    epochs                = 1,
    num_batches_per_epoch = 4
) %>%
```

```
    set_engine("gluonts_nbeats")

model_spec

# ---- TRAINING ----
# Important: Make sure the date and id features are included as regressors
#  and do NOT dummy the id feature.
model_fitted <- model_spec %>%
    fit(value ~ date + id, m750)

model_fitted

# ---- PREDICT ----
# - IMPORTANT: New Data must have id and date features
new_data <- tibble(
    id   = factor("M750"),
    date = as.Date("2015-07-01")
)

predict(model_fitted, new_data)
```

`nbeats_ensemble_fit_impl` *GluonTS N-BEATS ENSEMBLE Modeling Function (Bridge)*

Description

GluonTS N-BEATS ENSEMBLE Modeling Function (Bridge)

Usage

```
nbeats_ensemble_fit_impl(
  x,
  y,
  freq,
  prediction_length,
  id,
  epochs = 5,
  batch_size = 32,
  num_batches_per_epoch = 50,
  learning_rate = 0.001,
  learning_rate_decay_factor = 0.5,
  patience = 10,
  minimum_learning_rate = 5e-05,
  clip_gradient = 10,
  weight_decay = 1e-08,
  init = "xavier",
```

```
  ctx = NULL,
  hybridize = TRUE,
  meta_context_length = prediction_length * c(2, 4),
  meta_loss_function = list("sMAPE"),
  meta_bagging_size = 3,
  num_stacks = 30,
  num_blocks = list(1),
  widths = list(512),
  sharing = list(FALSE),
  expansion_coefficient_lengths = list(32),
  stack_types = list("G")
)
```

Arguments

x	A dataframe of xreg (exogenous regressors)
y	A numeric vector of values to fit
freq	A pandas timeseries frequency such as "5min" for 5-minutes or "D" for daily. Refer to Pandas Offset Aliases.
prediction_length	Numeric value indicating the length of the prediction horizon
id	A quoted column name that tracks the GluonTS FieldName "item_id"
epochs	Number of epochs that the network will train (default: 5).
batch_size	Number of examples in each batch (default: 32).
num_batches_per_epoch	Number of batches at each epoch (default: 50).
learning_rate	Initial learning rate (default: 10-3).
learning_rate_decay_factor	Factor (between 0 and 1) by which to decrease the learning rate (default: 0.5).
patience	The patience to observe before reducing the learning rate, nonnegative integer (default: 10).
minimum_learning_rate	Lower bound for the learning rate (default: 5x10-5).
clip_gradient	Maximum value of gradient. The gradient is clipped if it is too large (default: 10).
weight_decay	The weight decay (or L2 regularization) coefficient. Modifies objective by adding a penalty for having large weights (default 10-8).
init	Initializer of the weights of the network (default: “xavier”).
ctx	The mxnet CPU/GPU context. Refer to using CPU/GPU in the mxnet documentation. (default: NULL, uses CPU)
hybridize	Increases efficiency by using symbolic programming. (default: TRUE)
meta_context_length	The different ’context_length’ (also known as ’lookback period’) to use for training the models. The ’context_length’ is the number of time units that condition the predictions. Default and recommended value: list(multiplier * prediction_length for multiplier in range(2, 7))

`meta_loss_function`
: The different 'loss_function' (also known as metric) to use for training the models. Unlike other models in GluonTS this network does not use a distribution. Default and recommended value: `list("sMAPE","MASE","MAPE")`

`meta_bagging_size`
: The number of models that share the parameter combination of 'context_length' and 'loss_function'. Each of these models gets a different initialization random initialization. Default (3). Recommended value: 10

`num_stacks`
: The number of stacks the network should contain. Default and recommended value for generic mode: 30 Recommended value for interpretable mode: 2

`num_blocks`
: The number of blocks per stack. A list of ints of length 1 or 'num_stacks'. Default and recommended value for generic mode: 1. Recommended value for interpretable mode: 3.

`widths`
: Widths of the fully connected layers with ReLu activation in the blocks. A list of ints of length 1 or 'num_stacks'. Default and recommended value for generic mode: `list(512)` Recommended value for interpretable mode: `list(256,2048)`

`sharing`
: Whether the weights are shared with the other blocks per stack. A list of ints of length 1 or 'num_stacks'. Default and recommended value for generic mode: `list(FALSE)` Recommended value for interpretable mode: `list(TRUE)`

`expansion_coefficient_lengths`
: If the type is "G" (generic), then the length of the expansion coefficient. If type is "T" (trend), then it corresponds to the degree of the polynomial. If the type is "S" (seasonal) then its not used. A list of ints of length 1 or 'num_stacks'. Default value for generic mode: `list(32)` Recommended value for interpretable mode: `list(3)`

`stack_types`
: One of the following values: "G" (generic), "S" (seasonal) or "T" (trend). A list of strings of length 1 or 'num_stacks'. Default and recommended value for generic mode: `list("G")` Recommended value for interpretable mode: `list("T","S")`

Details

The total number of models used is:
meta_context_length x meta_loss_function x meta_bagging_size

`nbeats_ensemble_predict_impl` *Bridge prediction Function for N-BEATS ENSEMBLE Models*

Description

Bridge prediction Function for N-BEATS ENSEMBLE Models

Usage

```
nbeats_ensemble_predict_impl(object, new_data)
```

Arguments

object	An object of class model_fit
new_data	A rectangular data object, such as a data frame.

---

nbeats_fit_impl *GluonTS N-BEATS Modeling Function (Bridge)*

Description

GluonTS N-BEATS Modeling Function (Bridge)

Usage

```
nbeats_fit_impl(
  x,
  y,
  freq,
  prediction_length,
  id,
  epochs = 5,
  batch_size = 32,
  num_batches_per_epoch = 50,
  learning_rate = 0.001,
  learning_rate_decay_factor = 0.5,
  patience = 10,
  minimum_learning_rate = 5e-05,
  clip_gradient = 10,
  weight_decay = 1e-08,
  init = "xavier",
  ctx = NULL,
  hybridize = TRUE,
  context_length = NULL,
  loss_function = "sMAPE",
  num_stacks = 30,
  num_blocks = list(1),
  widths = list(512),
  sharing = list(FALSE),
  expansion_coefficient_lengths = list(32),
  stack_types = list("G")
)
```

Arguments

x	A dataframe of xreg (exogenous regressors)
y	A numeric vector of values to fit

`freq` A pandas timeseries frequency such as "5min" for 5-minutes or "D" for daily. Refer to Pandas Offset Aliases.

`prediction_length` Numeric value indicating the length of the prediction horizon

`id` A quoted column name that tracks the GluonTS FieldName "item_id"

`epochs` Number of epochs that the network will train (default: 5).

`batch_size` Number of examples in each batch (default: 32).

`num_batches_per_epoch` Number of batches at each epoch (default: 50).

`learning_rate` Initial learning rate (default: 10-3).

`learning_rate_decay_factor` Factor (between 0 and 1) by which to decrease the learning rate (default: 0.5).

`patience` The patience to observe before reducing the learning rate, nonnegative integer (default: 10).

`minimum_learning_rate` Lower bound for the learning rate (default: 5x10-5).

`clip_gradient` Maximum value of gradient. The gradient is clipped if it is too large (default: 10).

`weight_decay` The weight decay (or L2 regularization) coefficient. Modifies objective by adding a penalty for having large weights (default 10-8).

`init` Initializer of the weights of the network (default: "xavier").

`ctx` The mxnet CPU/GPU context. Refer to using CPU/GPU in the mxnet documentation. (default: NULL, uses CPU)

`hybridize` Increases efficiency by using symbolic programming. (default: TRUE)

`context_length` Number of time units that condition the predictions Also known as 'lookback period'. Default is 2 * prediction_length

`loss_function` The loss function (also known as metric) to use for training the network. Unlike other models in GluonTS this network does not use a distribution. One of the following: "sMAPE", "MASE" or "MAPE". The default value is "MAPE".

`num_stacks` The number of stacks the network should contain. Default and recommended value for generic mode: 30 Recommended value for interpretable mode: 2

`num_blocks` The number of blocks per stack. A list of ints of length 1 or 'num_stacks'. Default and recommended value for generic mode: 1. Recommended value for interpretable mode: 3.

`widths` Widths of the fully connected layers with ReLu activation in the blocks. A list of ints of length 1 or 'num_stacks'. Default and recommended value for generic mode: `list(512)` Recommended value for interpretable mode: `list(256,2048)`

`sharing` Whether the weights are shared with the other blocks per stack. A list of ints of length 1 or 'num_stacks'. Default and recommended value for generic mode: `list(FALSE)` Recommended value for interpretable mode: `list(TRUE)`

`expansion_coefficient_lengths` If the type is "G" (generic), then the length of the expansion coefficient. If type is "T" (trend), then it corresponds to the degree of the polynomial. If the type is "S"

	(seasonal) then its not used. A list of ints of length 1 or 'num_stacks'. Default value for generic mode: `list(32)` Recommended value for interpretable mode: `list(3)`
`stack_types`	One of the following values: "G" (generic), "S" (seasonal) or "T" (trend). A list of strings of length 1 or 'num_stacks'. Default and recommended value for generic mode: `list("G")` Recommended value for interpretable mode: `list("T","S")`

`nbeats_predict_impl` *Bridge prediction Function for N-BEATS Models*

Description

Bridge prediction Function for N-BEATS Models

Usage

```
nbeats_predict_impl(object, new_data)
```

Arguments

`object`	An object of class `model_fit`
`new_data`	A rectangular data object, such as a data frame.

`save_gluonts_model` *Saving and Loading GluonTS Models*

Description

GluonTS models require a special storage process that saves / loads the recipe used to recreate a model to / from a directory that the user defines.

Usage

```
save_gluonts_model(object, path, overwrite = FALSE)

load_gluonts_model(path)
```

Arguments

`object`	A fitted model object
`path`	A directory to store the GluonTS model files
`overwrite`	Whether or not to allow overwriting a GluonTS model's directory. Default: FALSE.

Examples

```
## Not run:
library(tidymodels)
library(tidyverse)
library(timetk)

model_fit <- nbeats(

    # User Defined (Required) Parameters
    id                    = "id",
    freq                  = "M",
    prediction_length     = 24,

    # Hyper Parameters
    epochs                = 1,
    num_batches_per_epoch = 4
) %>%
    set_engine("gluonts_nbeats") %>%
    fit(value ~ date + id, m750)

# Saves the related files needed to recreate the model
model_fit %>% save_gluonts_model(path = "/dir_nbeats_model/")

# Loads the model
load_gluonts_model(path = "/dir_nbeats_model/")


## End(Not run)
```

---

to_gluon_list_dataset *Convert a data frame to a GluonTS ListDataset*

Description

A ListDataset is the format required by `GluonTS`. This function simplifies creating a `GluonTS` ListDataset.

Usage

```
to_gluon_list_dataset(data, date_var, value_var, id_var = NULL, freq = "D")
```

Arguments

`data`	A data.frame
`date_var`	The date column (Timestamps)
`value_var`	The value column (Target)
`id_var`	The Time Series ID column for tracking time series in GluonTS
`freq`	the Pandas Timestamp Frequency.

Examples

```
library(timetk)

m4_daily %>%
    to_gluon_list_dataset(
        date_var  = date,
        value_var = value,
        id_var    = id,
        freq      = "D"
    )
```

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