

# Package ‘lambdaTS’

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**Type** Package

**Title** Variational Seq2Seq Model with Lambda Transformer for Time Series Analysis

**Version** 1.1

**Author** Giancarlo Vercellino

**Maintainer** Giancarlo Vercellino <giancarlo.vercellino@gmail.com>

**Description**

Time series analysis based on lambda transformer and variational seq2seq, built on 'Torch'.

**License** GPL-3

**Encoding** UTF-8

**LazyData** true

**RoxygenNote** 7.1.1

**Depends** R (>= 3.6)

**Imports** car, purrr, abind, ggplot2, readr, stringr, lubridate, narray, fANCOVA, imputeTS, modeest, scales, tictoc, bizdays, torch

**NeedsCompilation** no

**Repository** CRAN

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bitcoin\_gold\_oil      *bitcoin\_gold\_oil data set*

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**Description**

A data frame with different time series (prices and volumes) for bitcoin, gold and oil.

**Usage**

```
bitcoin_gold_oil
```

**Format**

A data frame with 18 columns and 1827 rows.

**Source**

Yahoo Finance

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lambdaTS      *lambdaTS: Variational Seq2Seq Lambda Transformer Model for Time Series Analysis*

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**Description**

Time series analysis based on Lambda Transformer and Variational Seq2Seq, built on 'Torch'.

**Usage**

```
lambdaTS(  
  data,  
  target,  
  future,  
  past = future,  
  ci = 0.8,  
  deriv = 1,  
  yjt = TRUE,  
  shift = 0,  
  smoother = FALSE,  
  k_embed = 30,  
  r_proj = ceiling(k_embed/3) + 1,  
  n_heads = 1,  
  n_bases = 1,  
  activ = "linear",  
  loss_metric = "elbo",  
  optim = "adam",
```

```

    epochs = 30,
    lr = 0.01,
    patience = epochs,
    verbose = TRUE,
    sample_n = 100,
    seed = 42,
    dev = "cpu",
    starting_date = NULL,
    dbreak = NULL,
    days_off = NULL,
    min_set = future,
    holdout = 0.5,
    batch_size = 30
  )

```

### Arguments

<code>data</code>	A data frame with <code>ts</code> on columns and possibly a date column (not mandatory)
<code>target</code>	String. Time series names to be jointly analyzed within the <code>seq2seq</code> model
<code>future</code>	Positive integer. The future dimension with number of time-steps to be predicted
<code>past</code>	Positive integer. The past dimension with number of time-steps in the past used for the prediction. Default: <code>future</code>
<code>ci</code>	Confidence interval. Default: 0.8
<code>deriv</code>	Positive integer. Number of differentiation operations to perform on the original series. 0 = no change; 1: one diff; 2: two diff, and so on.
<code>yjt</code>	Logical. Performing Yeo-Johnson Transformation on data is always advisable, especially when dealing with different <code>ts</code> at different scales. Default: <code>TRUE</code>
<code>shift</code>	Vector of positive integers. Allow for target variables to shift ahead of time. Zero means no shift. Length must be equal to the number of targets. Default: 0.
<code>smoother</code>	Logical. Perform optimal smooting using standard loess. Default: <code>FALSE</code>
<code>k_embed</code>	Positive integer. Number of <code>Time2Vec</code> embedding dimensions. Minimum value is 2. Default: 30
<code>r_proj</code>	Positive integer. Number of dimensions for the reduction space (to reduce quadratic complexity). Must be largely less than <code>k_embed</code> size. Default: $\text{ceiling}(k\_embed/3) + 1$
<code>n_heads</code>	Positive integer. Number of heads for the attention mechanism. Computationally expensive, use with care. Default: 1
<code>n_bases</code>	Positive integer. Number of normal curves to build on each parameter. Computationally expensive, use with care. Default: 1
<code>activ</code>	String. The activation function for the linear transformation of the attention matrix into the future sequence. Implemented options are: "linear", "leaky_relu", "celu", "elu", "gelu", "selu", "softplus", "bent", "snake", "softmax", "softmin", "softsign", "sigmoid", "tanh", "tanhshrink", "swish", "hardtanh", "mish". Default: "linear".

loss_metric	String. Loss function for the variational model. Two options: "elbo" or "crps". Default: "crps".
optim	String. Optimization methods available are: "adadelat", "adagrad", "rmsprop", "rprop", "sgd", "asgd", "adam". Default: "adam".
epochs	Positive integer. Default: 30.
lr	Positive numeric. Learning rate. Default: 0.01.
patience	Positive integer. Waiting time (in epochs) before evaluating the overfit performance. Default: epochs.
verbose	Logical. Default: TRUE
sample_n	Positive integer. Number of samples from the variational model to evaluate the mean forecast values. Computationally expensive, use with care. Default: 100.
seed	Random seed. Default: 42.
dev	String. Torch implementation of computational platform: "cpu" or "cuda" (gpu). Default: "cpu".
starting_date	Date. Initial date to assign temporal values to the series. Default: NULL (progressive numbers).
dbreak	String. Minimum time marker for x-axis, in liberal form: i.e., "3 months", "1 week", "20 days". Default: NULL.
days_off	String. Weekdays to exclude (i.e., c("saturday", "sunday")). Default: NULL.
min_set	Positive integer. Minimum number for validation set in case of automatic resize of past dimension. Default: future.
holdout	Positive numeric. Percentage of time series for holdout validation. Default: 0.5.
batch_size	Positive integer. Default: 30.

### Value

This function returns a list including:

- prediction: a table with quantile predictions, mean and std for each ts
- history: plot of loss during the training process for the joint-transformed ts
- plot: graph with history and prediction for each ts
- learning\_error: errors for the joint-ts in the transformed scale (rmse, mae, mdae, mpe, mape, smape, rrse, rae)
- feature\_errors: errors for each ts in the original scale (rmse, mae, mdae, mpe, mape, smape, rrse, rae)
- pred\_stats: for each predicted time feature, IQR to range, KL-divergence, risk ratio, upside probability, averaged across time-points and compared at the terminal points.
- time\_log

### Author(s)

Giancarlo Vercellino <giancarlo.vercellino@gmail.com>

**Examples**

```
## Not run:  
lambdaTS(bitcoin_gold_oil, c("gold_close", "oil_Close"), 30, deriv = 1)  
  
## End(Not run)
```

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## \* **datasets**

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