# Package: lambdaTS (via r-universe)

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**Type** Package

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

**Version** 1.1

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**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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# Contents

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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

| | |
|---|---|
| data | A data frame with ts on columns and possibly a date column (not mandatory) |
| target | String. Time series names to be jointly analyzed within the seq2seq model |
| future | Positive integer. The future dimension with number of time-steps to be predicted |
| past | Positive integer. The past dimension with number of time-steps in the past used for the prediction. Default: future |
| ci | Confidence interval. Default: 0.8 |
| deriv | Positive integer. Number of differentiation operations to perform on the original series. 0 = no change; 1: one diff; 2: two diff, and so on. |
| yjt | Logical. Performing Yeo-Johnson Transformation on data is always advisable, especially when dealing with different ts at different scales. Default: TRUE |
| shift | 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. |
| smoother | Logical. Perform optimal smooting using standard loess. Default: FALSE |
| k_embed | Positive integer. Number of Time2Vec embedding dimensions. Minimum value is 2. Default: 30 |
| r_proj | Positive integer. Number of dimensions for the reduction space (to reduce quadratic complexity). Must be largely less than k_embed size. Default: ceiling(k_embed/3) + 1 |
| n_heads | Positive integer. Number of heads for the attention mechanism. Computationally expensive, use with care. Default: 1 |
| n_bases | Positive integer. Number of normal curves to build on each parameter. Computationally expensive, use with care. Default: 1 |
| activ | 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: "adadelta", "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 evalute 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. Minimun 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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