Package ‘lambdaTS’

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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

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**Description**

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

**Usage**

```r
bitcoin_gold_oil
```

**Format**

A data frame with 18 columns and 1827 rows.

**Source**

Yahoo Finance

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**Description**

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

**Usage**

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

**Arguments**

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>data</strong></td>
<td>A data frame with ts on columns and possibly a date column (not mandatory)</td>
</tr>
<tr>
<td><strong>target</strong></td>
<td>String. Time series names to be jointly analyzed within the seq2seq model</td>
</tr>
<tr>
<td><strong>future</strong></td>
<td>Positive integer. The future dimension with number of time-steps to be predicted</td>
</tr>
<tr>
<td><strong>past</strong></td>
<td>Positive integer. The past dimension with number of time-steps in the past used for the prediction. Default: future</td>
</tr>
<tr>
<td><strong>ci</strong></td>
<td>Confidence interval. Default: 0.8</td>
</tr>
<tr>
<td><strong>deriv</strong></td>
<td>Positive integer. Number of differentiation operations to perform on the original series. 0 = no change; 1: one diff; 2: two diff, and so on.</td>
</tr>
<tr>
<td><strong>yjt</strong></td>
<td>Logical. Performing Yeo-Johnson Transformation on data is always advisable, especially when dealing with different ts at different scales. Default: TRUE</td>
</tr>
<tr>
<td><strong>shift</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>smoother</strong></td>
<td>Logical. Perform optimal smoothing using standard loess. Default: FALSE</td>
</tr>
<tr>
<td><strong>k_embed</strong></td>
<td>Positive integer. Number of Time2Vec embedding dimensions. Minimum value is 2. Default: 30</td>
</tr>
<tr>
<td><strong>r_proj</strong></td>
<td>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</td>
</tr>
<tr>
<td><strong>n_heads</strong></td>
<td>Positive integer. Number of heads for the attention mechanism. Computationally expensive, use with care. Default: 1</td>
</tr>
<tr>
<td><strong>n_bases</strong></td>
<td>Positive integer. Number of normal curves to build on each parameter. Computationally expensive, use with care. Default: 1</td>
</tr>
<tr>
<td><strong>activ</strong></td>
<td>String. The activation function for the linear transformation of the attention matrix into the future sequence. Implemented options are: &quot;linear&quot;, &quot;leaky_relu&quot;, &quot;celu&quot;, &quot;elu&quot;, &quot;gelu&quot;, &quot;selu&quot;, &quot;softplus&quot;, &quot;tanh&quot;, &quot;tanhshrink&quot;, &quot;swish&quot;, &quot;hardtanh&quot;, &quot;mish&quot;. Default: &quot;linear&quot;.</td>
</tr>
</tbody>
</table>
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.


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.


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)

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Examples

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