

Package ‘temper’

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Description Implements a probabilistic ensemble time-series forecaster that combines an auto-encoder with a neural decision forest whose split variables are learned through a differentiable feature-mask layer. Functions are written with 'torch' tensors and provide CRPS (Continuous Ranked Probability Scores) training plus mixture-distribution post-processing.
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Contents

dummy_set	2
temper	2
Index	6

dummy_set

*Tech Stock Time Series Dataset***Description**

A multivariate dataset for closing prices for several major tech stocks over time. Source: YahooFinance.

Usage

```
data(dummy_set)
```

Format

A data frame with 2133 observations of 4 variables:

dates Character vector of dates in "YYYY-MM-DD" format.

TSLA.Close Numeric. Closing prices for Tesla.

MSFT.Close Numeric. Closing prices for Microsoft.

MARA.Close Numeric. Closing prices for MARA Holdings.

Examples

```
data(dummy_set)
plot(as.Date(dummy_set$dates), dummy_set$TSLA.Close, type = "l")
```

temper

*Temporal Encoder–Masked Probabilistic Ensemble Regressor***Description**

Temper trains and deploys a hybrid forecasting model that couples a temporal auto-encoder (shrinks a sliding window of length ‘past’ into a latent representation of size ‘latent_dim’) and a masked neural decision forest (an ensemble of ‘n_trees’ soft decision trees of depth ‘depth’; feature-level dropout is governed by ‘init_prob’ and annealed by a Gumbel–Softmax with parameter ‘temperature’) and a CRPS loss (Continuous Ranked Probability Score) that blends the probabilistic forecasting error with a reconstruction term (‘lambda_rec × MSE’), to yield multi-step probabilistic forecasts and their fan chart. Model weights are optimized with ADAM or other options, optional early stopping.

Implements a probabilistic ensemble time-series forecaster that combines an auto-encoder with a neural decision forest whose split variables are learned through a differentiable feature-mask layer. Functions are written with ‘torch’ tensors and provide CRPS (Continuous Ranked Probability Scores) training plus mixture-distribution post-processing.

Usage

```

temper(
  ts,
  future,
  past,
  latent_dim,
  n_trees = 30,
  depth = 6,
  init_prob = 0.8,
  temperature = 0.5,
  n_bases = 10,
  train_rate = 0.7,
  epochs = 30,
  optimizer = "adam",
  lr = 0.005,
  batch = 32,
  lambda_rec = 0.3,
  patience = 15,
  verbose = TRUE,
  alpha = 0.1,
  dates = NULL,
  seed = 42
)

```

Arguments

ts	Numeric vector of length at least past + future. Represents the input time series in levels (not log-returns). Missing values are automatically imputed using <code>na_kalman</code> .
future	Integer ≥ 1 . Forecast horizon: the number of steps ahead to predict.
past	Integer ≥ 1 . Length of the sliding window used to feed the encoder.
latent_dim	Integer ≥ 1 . Dimensionality of the autoencoder's latent bottleneck.
n_trees	Integer ≥ 1 . Number of trees in the neural decision forest ensemble. Usually in the range of 30 to 200. Default: 30.
depth	Integer ≥ 1 . Depth of each decision tree (i.e., number of binary splits). Usually in the range of 4 to 12. Default: 6.
init_prob	Numeric in (0, 1). Initial probability that each input feature is kept by the feature mask (used for stochastic feature selection). A value of 0 means always dropped; 1 means always included. Default: 0.8.
temperature	Positive numeric. Temperature parameter for the Gumbel–Softmax distribution used during feature masking. Lower values lead to harder (closer to binary) masks; higher values encourage smoother gradients. Default: 0.5.
n_bases	Integer ≥ 1 . Max numbers of bases for the Gaussian mixture. Default: 10.
train_rate	Numeric in (0, 1). Proportion of samples allocated to the training set. The remaining samples form the validation set used for early stopping. Default: 0.7.

epochs	Positive integer. Maximum number of training epochs. Have a look at the loss plot to decide the right number of epochs. Default: 30.
optimizer	Character string. Optimizer to use for training (adam, adamw, sgd, rprop, rmsprop, adagrad, asgd, adadelta). Default: adam.
lr	Positive numeric. Learning rate for the optimizer. Default: 0.005.
batch	Positive integer. Mini-batch size used during training. Default: 32.
lambda_rec	Non-negative numeric. Weight applied to the reconstruction loss relative to the probabilistic CRPS forecasting loss. Default: 0.3.
patience	Positive integer. Number of consecutive epochs without improvement on the validation CRPS before early stopping is triggered. Default: 15.
verbose	Logical. If TRUE, prints CRPS values for each epoch during training. Default: TRUE.
alpha	Numeric in (0, 1). Confidence level used to define the predictive interval band width in the output fan chart. Default: 0.1.
dates	Optional Date vector of the same length as ts. If supplied, fan chart x-axes use calendar dates; otherwise, integer time indices are used. Default: NULL.
seed	Optional integer. Used to seed both R and Torch random number generators for reproducibility. Default: 42.

Value

A named list with four components

‘loss’ A ggplot in which training and validation CRPS are plotted against epoch number, useful for diagnosing over-/under-fitting.

‘pred_funs’ A length-‘future’ list. Each element contains four empirical distribution functions (pdf, cdf, icdf, sampler) created by empfun

‘plot’ A ggplot object showing the historical series, median forecast and predictive interval. A print-ready fan chart.

‘time_log’ An object measuring the wall-clock training time.

Author(s)

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See Also

Useful links:

- https://rpubs.com/giancarlo_vercellino/temper

Examples

```
set.seed(2025)
ts <- cumsum(rnorm(250))          # synthetic price series
fit <- temper(ts, future = 3, past = 20, latent_dim = 5, epochs = 2)

# 80 % predictive interval for the 3-step-ahead forecast
pfun <- fit$pred_funs$t3$pfun
pred_interval_80 <- c(pfun(0.1), pfun(0.9))

# Visual diagnostics
print(fit$plot)
print(fit$loss)
```

Index

* **datasets**

dummy_set, [2](#)

dummy_set, [2](#)

temper, [2](#)

temper-package (temper), [2](#)