Package: tsfgrnn (via r-universe)

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Type Package

Title Time Series Forecasting Using GRNN

Version 1.0.5

Maintainer Francisco Martinez <fmartin@ujaen.es>

Description A general regression neural network (GRNN) is a variant of
a Radial Basis Function Network characterized by a fast
single-pass learning. 'tsfgrnn' allows you to forecast time
series using a GRNN model Francisco Martinez et al. (2019)
<doi:10.1007/978-3-030-20521-8_17> and Francisco Martinez et
al. (2022) <doi:10.1016/j.neucom.2021.12.028>. When the
forecasting horizon is higher than 1, two multi-step ahead
forecasting strategies can be used. The model built is
autoregressive, that is, it is only based on the observations
of the time series. You can consult and plot how the prediction
was done. It is also possible to assess the forecasting
accuracy of the model using rolling origin evaluation.

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Encoding UTF-8

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RoxygenNote 7.2.3

Suggests testthat (>= 3.0.0), knitr, rmarkdown

Imports ggplot2, Rcpp

VignetteBuilder knitr

URL https://github.com/franciscomartinezdelrio/tsfgrnn

BugReports https://github.com/franciscomartinezdelrio/tsfgrnn

LinkingTo Rcpp

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Repository https://franciscomartinezdelrio.r-universe.dev

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autoplot.grnnForecast   *Create a ggplot object from a grnnForecast object*

Description

It uses an object of class `grnnForecast` to create a `ggplot` object that plots a time series and its forecast using GRNN regression.

Usage

```
## S3 method for class 'grnnForecast'
autoplot(object, ...)
```

Arguments

object	An object of class `grnnForecast`.
...	additional parameter, see details.

Details

Commonly used parameters are:

- `highlight`. A character string indicating what elements should be highlighted. Possible values are `"none"` and `"points"`. The default value is `"none"`.

Value

The `ggplot` object representing a plotting with the forecast.

Examples

```
pred <- grnn_forecasting(USAccDeaths, h = 12, lags = 1:12, sigma = 50)
library(ggplot2)
autoplot(pred)
```

---

grnn_examples *Examples of a GRNN model*

Description

It shows the examples of the model associated to a grnnForecast object.

Usage

```
grnn_examples(forecast)
```

Arguments

forecast   A grnnForecast object.

Value

A matrix including the features and targets of the examples associated with the model of a grnnForecast object.

Examples

```
pred <- grnn_forecasting(ts(1:8), h = 1, lags = 1:2)
grnn_examples(pred)
```

---

grnn_forecasting *Time series forecasting using GRNN regression*

Description

It applies GRNN regression to forecast the future values of a time series. The lags used as autoregressive variables are set with the lags parameter. If the user does not set the lags, these values are selected automatically.

Usage

```
grnn_forecasting(
  timeS,
  h,
  lags = NULL,
  sigma = "ROLLING",
  msas = c("recursive", "MIMO"),
  transform = c("additive", "multiplicative", "none")
)
```

Arguments

`timeS`	A numeric vector or time series of class `ts`.
`h`	A positive integer. Number of periods for forecasting.
`lags`	An integer vector in increasing order expressing the lags used as autoregressive variables. If NULL (the default) the lags are selected in a fast, heuristic way. It is also possible to use the values `"FS"` and `"BE"`, in which case, the lags are selected using forward selection or backward elimination respectively. These techniques are feature selection approaches.
`sigma`	A positive real value or a character value. The smoothing parameter in GRNN regression. Two character values are possible, "ROLLING" (the default) and "FIXED", in which case the parameter is chosen using an optimization tool with rolling origin evaluation or fixed origin evaluation.
`msas`	A string indicating the Multiple-Step Ahead Strategy used when more than one value is predicted. It can be "MIMO" or "recursive" (the default).
`transform`	A character value indicating whether the training samples are transformed. If the time series has a trend it is recommended. By default is `"additive"` (additive transformation). It is also possible a multiplicative transformation or no transformation.

Value

An object of class `"grnnForecast"`. The function [summary](#) can be used to obtain or print a summary of the results. An object of class `"gnnForecast"` is a list containing at least the following components:

`call`	the matched call.
`msas`	the Multi-Step Ahead Strategy.
`prediction`	a time series with the forecast.
`model`	an object of class `"grnnModel"` with the GRNN model

References

F. Martinez et al. (2022). "Strategies for time series forecasting with generalized regression neural networks", Neurocomputing, 491, pp. 509–521.

Examples

```
pred <- grnn_forecasting(USAccDeaths, h = 12, lags = 1:12)
plot(pred)
```

---

grnn_weights   *Training examples and their corresponding weights used in a predic-*
                             tion

Description

It shows the input vector and the weights of the training examples used in a prediction associated
with a "grnnForecast" object.

Usage

```
grnn_weights(forecast)
```

Arguments

forecast   A grnnForecast object.

Value

A list including the input vectors used in GRNN regression and the training examples, with their
weights, used in the prediction.

Examples

```
pred <- grnn_forecasting(UKgas, h = 4, lags = 1:4, msas = "MIMO")
grnn_weights(pred)
```

---

plot.grnnForecastRO   *Plot the prediction for a test set*

Description

It plots the forecast associated with a test set generated with the function [rolling_origin](#).

Usage

```
## S3 method for class 'grnnForecastRO'
plot(x, h = NULL, ...)
```

Arguments

x	the object obtained from a call to [rolling_origin](#).
h	an integer. The forecasting horizon. If NULL (the default), the maximum fore-casting horizon of all the test sets is used.
...	Other plotting parameters to affect the plot.

Value

None

---

plot_example   *Plot an example used in a prediction of a grnnForecast object*

Description

This function is useful to see how the forecast has been computed. An ordinal specifying the order
of the weight has to be supplied and the function plots the training pattern associated with that
ordinal.

Usage

```
plot_example(forecast, position, h = 1)
```

Arguments

forecast	The grnnForecast object.
position	An integer. It is an ordinal number indicating what training pattern to plot. For instance, if `position` is 1 it means that the training pattern with the greatest weight should be plotted. If `position` is 2 the training pattern with the second greatest weight is plotted and so on.
h	An integer. This value is only useful when the recursive strategy is being used. It indicates the forecasting horizon

Value

A ggplot object representing an example used in the prediction.

Examples

```
pred <- grnn_forecasting(USAccDeaths, h = 12, lags = 1:12, sigma = 50)
library(ggplot2)
plot_example(pred, 1)
```

predict.grnnForecast   *Predict method for GRNN models for time series forecasting.*

Description

Predicted values based on a GRNN model for time series forecasting.

Usage

```
## S3 method for class 'grnnForecast'
predict(object, h, ...)
```

Arguments

object	a grnnForecast object obtained by a call to the [grnn_forecasting](#) function.
h	an integer. The forecasting horizon.
...	further arguments passed to or from other methods.

Details

If the models uses the MIMO strategy for multiple-step ahead prediction, the forecasting horizon is fixed to the model forecasting horizon.

Value

a grnnForecast object with the prediction and information about the GRNN model, see the documentation of [grnn_forecasting](#) for the structure of grnnForecast objects.

Examples

```
pred <- grnn_forecasting(UKgas, h = 4, msas = "MIMO")
new_pred <- predict(pred, h = 4)
print(new_pred$prediction)
plot(new_pred) # To see a plot with the forecast
```

rolling_origin   *Assessing forecasting accuracy with rolling origin*

Description

It uses the model and the time series associated with a grnnForecast object to assess the forecasting accuracy of the model using the last h values of the time series to build test sets applying a rolling origin evaluation.

Usage

```
rolling_origin(grnnf, h = NULL, rolling = TRUE)
```

Arguments

grnnf   A grnnForecast object.

h   A positive integer. The forecast horizon. If NULL (the default) the prediction
               horizon of the gnnForecast object is used.

rolling   A logical. If TRUE (the default), forecasting horizons from 1 to h are used. Oth-
               erwise, only horizon h is used.

Details

This function assesses the forecast accuracy of the model used by the grnnForecast object. It uses
h different test and training sets. The first test set consists of the last h values of the time series (the
training set is formed by the previous values). The next test set consists of the last $h - 1$ values of
the time series and so on (the last test set is formed by the last value of the time series).

Value

A list containing at least the following fields:

test_sets   a matrix containing the test sets used in the evaluation. Every row contains a
               different test set.

predictions   The predictions for the test sets.

errors   The errors for the test sets.

global_accu   Different measures of accuracy applied to all the errors.

h_accu   Different measures of accuracy applied to all the errors for every forecasting
               horizon.

Examples

```
pred <- grnn_forecasting(UKgas, h = 4, lags = 1:4)
ro <- rolling_origin(pred)
print(ro$global_accu)
```

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