Package ‘thief’

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1
AEdemand

Accident and Emergency demand in the UK

Description

Weekly demand of Accident & Emergency departments in the UK, from 7 November 2010 to 7 June 2015.

Usage

AEdemand

Format

An object of class ts.

Examples

library(ggplot2)
autoplot(AEdemand, xlab="Year", ylab="Demand (‘000’)") +
ggtitle("Accident & Emergency Demand in the UK")

# Not run:
# Demonstration of the adjustment of all temporal aggregates
# using Total Emergency Admissions

total <- AEdemand[,12]
totalagg <- tsaggregates(total)
plot(totalagg, main="Total Emergency Admissions")

# Base forecasts
base <- list()
for(i in 1:5)
  base[[i]] <- forecast(auto.arima(totalagg[[i]]))
base[[6]] <- forecast(auto.arima(totalagg[[6]]), h=2)

# Reconciled forecasts
reconciled <- reconcilethief(base)

main <- paste(names(totalagg)," (k=",
  52/unlist(lapply(reconciled,frequency)),")",sep="")
par(mfrow=c(2,3))
for(i in 6:1)
{
  ylim <- range(base[[i]]$mean, base[[i]]$x, reconciled[[i]]$mean)
  plot(base[[i]], main=main[i], fcol='white',
       plot.conf=FALSE, ylim=ylim, xlim=c(2010.5,2017.5))
  polygon(c(2015.45, 2020, 2020, 2015.45),
          c(0, 0, 1e5, 1e5), col='grey', border=FALSE)
```r
lines(base[[i]]$mean, col='red', lty=2)
lines(reconciled[[i]]$mean, col='blue')
}
## End(Not run)
```

---

### plot.tsaggregates

**Plot time series aggregates**

**Description**

Plots all temporal aggregations of a time series

**Usage**

```r
## S3 method for class 'tsaggregates'
plot(x, series = "all", ...)
```

```r
## S3 method for class 'tsaggregates'
autoplot(object, series = "all", ...)
```

**Arguments**

- `x` tsaggregates object, produced by `tsaggregates`.
- `series` The indexes of the series to plot. By default, all series are plotted.
- `...` Other arguments passed to `plot.ts` or `autoplot.ts`.
- `object` tsaggregates object, produced by `tsaggregates`.

**Author(s)**

Rob J Hyndman

**Examples**

```r
deathagg <- tsaggregates(USAccDeaths)
plot(deathagg, series=c(1,2,4,6))

library(ggplot2)
autoplot(deathagg)
```
reconcilethief

Reconcile temporal hierarchical forecasts

Description

Takes forecasts of time series at all levels of temporal aggregation and combines them using the temporal hierarchical approach of Athanasopoulos et al (2016).

Usage

reconcilethief(forecasts, comb = c("struc", "mse", "ols", "bu", "shr", "sam"), mse = NULL, residuals = NULL, returnall = TRUE, aggregatelist = NULL)

Arguments

forecasts List of forecasts. Each element must be a time series of forecasts, or a forecast object. The number of forecasts should be equal to k times the seasonal period for each series, where k is the same across all series.

comb Combination method of temporal hierarchies, taking one of the following values:

"struc" Structural scaling - weights from temporal hierarchy
"mse" Variance scaling - weights from in-sample MSE
"ols" Unscaled OLS combination weights
"bu" Bottom-up combination – i.e., all aggregate forecasts are ignored.
"shr" GLS using a shrinkage (to block diagonal) estimate of residuals
"sam" GLS using sample covariance matrix of residuals

mse A vector of one-step MSE values corresponding to each of the forecast series.

residuals List of residuals corresponding to each of the forecast models. Each element must be a time series of residuals. If forecast contains a list of forecast objects, then the residuals will be extracted automatically and this argument is not needed. However, it will be used if not NULL.

returnall If TRUE, a list of time series corresponding to the first argument is returned, but now reconciled. Otherwise, only the most disaggregated series is returned.

aggregatelist (optional) User-selected list of forecast aggregates to consider

Value

List of reconciled forecasts in the same format as forecast. If returnall==FALSE, only the most disaggregated series is returned.

Author(s)

Rob J Hyndman
See Also

`thief`, `tsaggregates`

Examples

```
# Construct aggregates
aggts <- tsaggregates(USAccDeaths)

# Compute forecasts
fc <- list()
for(i in seq_along(aggts))
  fc[[i]] <- forecast(auto.arima(aggts[[i]]), h=2*frequency(aggts[[i]]))

# Reconcile forecasts
reconciled <- reconcilethief(fc)

# Plot forecasts before and after reconciliation
par(mfrow=c(2,3))
for(i in seq_along(fc))
  {plot(reconciled[[i]], main=names(aggts)[i])
   lines(fc[[i]]$mean, col='red')
  }
```

---

**thief**

*Temporal hierarchical forecasting*

**Description**

Takes a time series as input and produces forecasts using the temporal hierarchical approach of Athanasopoulos et al (2016).

**Usage**

```
thief(y, m = frequency(y), h = m * 2, comb = c("struc", "mse", "ols",
  "bu", "shr", "sam"), usemodel = c("ets", "arima", "theta", "naive",
  "snaive"), forecastfunction = NULL, aggregatelist = NULL, ...)
```

**Arguments**

- `y` Time series input
- `m` Seasonal period
- `h` Forecast horizon
- `comb` Combination method of temporal hierarchies, taking one of the following values:
  - "struc" Structural scaling - weights from temporal hierarchy
"mse"  Variance scaling - weights from in-sample MSE
"ols"  Unscaled OLS combination weights
"bu"   Bottom-up combination – i.e., all aggregate forecasts are ignored.
"shr"  GLS using a shrinkage (to block diagonal) estimate of residuals
"sam"  GLS using sample covariance matrix of residuals

usemodel  Model used for forecasting each aggregation level:
"ets"  exponential smoothing, using the ets function.
"arima" arima, using the auto.arima function.
"theta" theta method, using the thetaf function.
"naive" random walk forecasts
"snaive" seasonal naive forecasts, based on the last year of observed data.

forecastfunction  User-defined function to be used instead of usemodel. The function must take a time series as the first argument, and the forecast horizon as the second argument. It must return an object of class forecast.

aggregatelist  User-selected list of forecast aggregates to consider

Details
This function computes the temporal aggregates of y using tsaggregates, then calculates all forecasts using the model function specified by usemodel or forecastfunction, and finally reconciles the forecasts using reconcilethief. The reconciled forecasts of y are returned.

Value
forecast object.

Author(s)
Rob J Hyndman and Nikolaos Kourentzes

See Also
reconcilethief

Examples
## Not run:

# Select ARIMA models for all series using auto.arima()
z <- thief(AEdemand[,12], usemodel='arima')
plot(z)

# Use your own function
ftbats <- function(y,h,...)(forecast(tbats(y),h,...))
z <- thief(AEdemand[,12], forecastfunction=ftbats)
tsaggregates

plot(z)

## End(Not run)

---

**tsaggregates**

*Non-overlapping temporal aggregation of a time series*

**Description**

Produces all temporal aggregations for frequencies greater than 1

**Usage**

```r
tsaggregates(y, m = frequency(y), align = c("end", "start"),
aggregatelist = NULL)
```

**Arguments**

- `y`  
  Univariate time series of class ts.
- `m`  
  Integer seasonal period
- `align`  
  Indicates how the aggregates are to be aligned: either with the start of the series or the end of the series. For forecasting purposes, it should be set to end.
- `aggregatelist`  
  User-selected list of aggregates to consider.

**Value**

A list of time series. The first element is the series ‘y’, followed by series with increasing levels of aggregation. The last element is the “annual” series (i.e., the series aggregated over all seasons).

**Author(s)**

Rob J Hyndman

**See Also**

`plot.tsaggregates`

**Examples**

```r
tsaggregates(USAccDeaths)
```
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