Package 'UComp'

February 3, 2026

Type Package

Title Automatic Univariate Time Series Modelling of many Kinds

Version 5.1.7

Date 2026-02-03

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Description Comprehensive analysis and forecasting
of univariate time series using automatic
time series models of many kinds.
Harvey AC (1989) <doi:10.1017/CBO9781107049994>.
Pedregal DJ and Young PC (2002) <doi:10.1002/9780470996430>.
Durbin J and Koopman SJ (2012) <doi:10.1093/acprof:oso/9780199641178.001.0001>.
Hyndman RJ, Koehler AB, Ord JK, and Snyder RD (2008) <doi:10.1007/978-3-540-71918-2>.
Gómez V, Maravall A (2000) <doi:10.1002/9781118032978>.
Pedregal DJ, Trapero JR and Holgado E (2024) <doi:10.1016/j.ijforecast.2023.09.004>.

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Encoding UTF-8

Imports ggplot2, gridExtra, tsibble, tsoutliers, stats, ggforce,
utils, parallel

LinkingTo Rcpp, RcppArmadillo

Depends Rcpp (>= 1.0.3), R (>= 3.5.0)

LazyData true

Suggests knitr, rmarkdown

RoxygenNote 7.3.3

NeedsCompilation yes

Repository CRAN

Date/Publication 2026-02-03 19:30:02 UTC

Contents

`Accuracy` *Accuracy*

Description

Accuracy for 1 time series y and several forecasting methods py and h steps ahead py is h x nMethods x nSeries

Usage

```
Accuracy(py, y, s = frequency(y), collectFun = mean)
```

Arguments

`py`	matrix of forecasts (h x nMethods x nForecasts)
`y`	a matrix of actual values (n x nForecasts)
`s`	seasonal period, number of observations per year
`collectFun`	aggregation function (mean, median, etc.)

Value

Table of accuracy results

Author(s)

Diego J. Pedregal

See Also

colMedians, rowMedians, tests, sumStats, gaussTest, ident, cusum, varTest, conv, armaFilter, dif, roots, zplane, acft, slide, plotSlide, tsDisplay, size

Examples

```
## Not run: Accuracy(py, y, 12)
```

---

acft *acft*

Description

Theoretical autocorrelation functions of ARMA models

Usage

```
acft(MApoly = 1, ARpoly = 1, ncoef = 38, s = 1)
```

Arguments

MApoly	coefficients of numerator polynomial in descending order
ARpoly	coefficients of denominator polynomial in descending order
ncoef	number of coefficients
s	seasonal period, number of observations per year

Value

Theoretical autocorrelation functions

Author(s)

Diego J. Pedregal

See Also

colMedians, rowMedians, tests, sumStats, gaussTest, ident, cusum, varTest, conv, armaFilter, dif, roots, zplane, slide, plotSlide, Accuracy, tsDisplay, size

Examples

```
acft(c(1, -0.8), c(1, 0.8))
```

AIC.UComp *AIC.UComp*

Description

Extract AIC value of UComp object

Usage

```
## S3 method for class 'UComp'
AIC(object, ..., k = 2)
```

Arguments

object	Object of class "UComp".
...	Additional inputs to function.
k	The penalty per parameter to be used.

Details

Selection criteria for models with different number of parameters, the smaller AIC the better. The formula used here is $AIC = -2(ln(L) - k)/n$, where $ln(L)$ is the log-likelihood at the optimum, k is the number of parameters plus non-stationary states and n is the number of observations. Mind that this formulation differs from the usual definition that does not divide by n. This makes that AIC(m) and AIC(logLik(m)) give different results, being m an UComp object.

Value

AIC value of a UC model

Author(s)

Diego J. Pedregal

See Also

UC, UCforecast, UCvalidate, UCfilter, UCsmooth, UCdisturb, UCcomponents

Examples

```
y <- log(AirPassengers)
m1 <- UCforecast(y, model = "llt/equal/arma(0,0)")
AIC(m1)
```

airpas *Airpassengers in Spain*

Description

Foreign arrivals by air in Spain in thousands of passengers (airpas).

Usage

```
airpas
```

Format

Time series objects.

Monthly data from 1969

https://portal.mineco.gob.es/es-es/economiayempresa/EconomiaInformesMacro/Paginas/bdsice.aspx

Value

No return value, called for side effects

Examples

```
airpas
```

ARIMA *ARIMA*

Description

Runs all relevant functions for ARIMA modelling

Usage

```
ARIMA(
  y,
  u = NULL,
  model = NULL,
  cnst = NULL,
  s = frequency(y),
  criterion = "bic",
  h = 2 * s,
  verbose = FALSE,
  lambda = 1,
  maxOrders = c(3, 2, 3, 2, 1, 2),
```

```
  bootstrap = FALSE,
  nSimul = 5000,
  fast = FALSE
)
```

Arguments

y	a time series to forecast (it may be either a numerical vector or a time series object). This is the only input required. If a vector, the additional input s should be supplied compulsorily (see below).
u	a matrix of input time series. If the output wanted to be forecast, matrix u should contain future values for inputs.
model	the model to estimate. A vector c(p,d,q,P,D,Q) containing the model orders of an ARIMA(p,d,q)x(P,D,Q)_s model. A constant may be estimated with the cnst input. Use a NULL to automatically identify the ARIMA model.
cnst	flag to include a constant in the model (TRUE/FALSE/NULL). Use NULL to estimate
s	seasonal period of time series (1 for annual, 4 for quarterly, ...)
criterion	information criterion for identification stage ("aic", "bic", "aicc")
h	forecast horizon. If the model includes inputs h is not used, the lenght of u is used instead.
verbose	intermediate estimation output (TRUE / FALSE)
lambda	Box-Cox lambda parameter (NULL: estimate)
maxOrders	a vector c(p,d,q,P,D,Q) containing the maximum orders of model orders to search for in the automatic identification
bootstrap	use bootstrap simulation for predictive distributions
nSimul	number of simulation runs for bootstrap simulation of predictive distributions
fast	fast identification (avoids post-identification checks)

Details

See help of ARIMAforecast.

Value

An object of class ARIMA. It is a list with fields including all the inputs and the fields listed below as outputs. All the functions in this package fill in part of the fields of any ARIMA object as specified in what follows (function ARIMA fills in all of them at once):

After running ARIMAforecast or ARIMA:

p	Estimated parameters
yFor	Forecasted values of output
yForV	Variance of forecasted values of output
ySimul	Bootstrap simulations for forecasting distribution evaluation

After running ARIMAvalidate:

table	Estimation and validation table

Author(s)

Diego J. Pedregal

See Also

ARIMAforecast, ARIMAvalidate,

Examples

```
y <- log(AirPassengers)
m1 <- ARIMA(y)
m1 <- ARIMA(y, lambda = NULL)
```

ARIMAestim *ARIMAestim*

Description

Estimates and forecasts ARIMA models

Usage

```
ARIMAestim(m)
```

Arguments

m	an object of type ARIMA created with ARIMAforecast

Details

ARIMAestim estimates and forecasts a time series using an ARIMA model

Value

The same input object with the appropriate fields filled in, in particular:

p	Estimated parameters
yFor	Forecasted values of output
yForV	Variance of forecasted values of output
ySimul	Bootstrap simulations for forecasting distribution evaluation

ARIMAforecast *ARIMAforecast*

Description

Estimates and forecasts ARIMA general univariate models

Usage

```
ARIMAforecast(
  y,
  u = NULL,
  model = NULL,
  cnst = NULL,
  s = frequency(y),
  criterion = "bic",
  h = 2 * s,
  verbose = FALSE,
  lambda = 1,
  maxOrders = c(3, 2, 3, 2, 1, 2),
  bootstrap = FALSE,
  nSimul = 5000,
  fast = FALSE
)
```

Arguments

y	a time series to forecast (it may be either a numerical vector or a time series object). This is the only input required. If a vector, the additional input s should be supplied compulsorily (see below).
u	a matrix of input time series. If the output wanted to be forecast, matrix u should contain future values for inputs.
model	the model to estimate. A vector c(p,d,q,P,D,Q) containing the model orders of an ARIMA(p,d,q)x(P,D,Q)_s model. A constant may be estimated with the cnst input. Use a NULL to automatically identify the ARIMA model.
cnst	flag to include a constant in the model (TRUE/FALSE/NULL). Use NULL to estimate
s	seasonal period of time series (1 for annual, 4 for quarterly, ...)
criterion	information criterion for identification stage ("aic", "bic", "aicc")
h	forecast horizon. If the model includes inputs h is not used, the lenght of u is used instead.
verbose	intermediate estimation output (TRUE / FALSE)
lambda	Box-Cox lambda parameter (NULL: estimate)
maxOrders	a vector c(p,d,q,P,D,Q) containing the maximum orders of model orders to search for in the automatic identification

bootstrap	use bootstrap simulation for predictive distributions
nSimul	number of simulation runs for bootstrap simulation of predictive distributions
fast	fast identification (avoids post-identification checks)

Details

ARIMAforecast is a function for modelling and forecasting univariate time series with Autoregressive Integrated Moving Average (ARIMA) time series models. It sets up the model with a number of control variables that govern the way the rest of functions in the package will work. It also estimates the model parameters by Maximum Likelihood and forecasts the data.

Value

An object of class ARIMA. It is a list with fields including all the inputs and the fields listed below as outputs. All the functions in this package fill in part of the fields of any ARIMA object as specified in what follows (function ARIMA fills in all of them at once):

After running ARIMAforecast or ARIMA:

p	Estimated parameters
yFor	Forecasted values of output
yForV	Variance of forecasted values of output
ySimul	Bootstrap simulations for forecasting distribution evaluation

After running ARIMAvalidate:

table	Estimation and validation table

Author(s)

Diego J. Pedregal

See Also

ARIMA, ARIMAvalidate,

Examples

```
y <- log(AirPassengers)
m1 <- ARIMAforecast(y)
m1 <- ARIMAforecast(y, lambda = NULL)
```

ARIMAsetup *ARIMAsetup*

Description

Sets up ARIMA general models

Usage

```
ARIMAsetup(
  y,
  u = NULL,
  model = NULL,
  cnst = NULL,
  s = frequency(y),
  criterion = "bic",
  h = 2 * s,
  verbose = FALSE,
  lambda = 1,
  maxOrders = c(3, 2, 3, 2, 1, 2),
  bootstrap = FALSE,
  nSimul = 5000,
  fast = FALSE
)
```

Arguments

y	a time series to forecast (it may be either a numerical vector or a time series object). This is the only input required. If a vector, the additional input s should be supplied compulsorily (see below).
u	a matrix of input time series. If the output wanted to be forecast, matrix u should contain future values for inputs.
model	the model to estimate. A vector c(p,d,q,P,D,Q) containing the model orders of an ARIMA(p,d,q)x(P,D,Q)_s model. A constant may be estimated with the cnst input. Use a NULL to automatically identify the ARIMA model.
cnst	flag to include a constant in the model (TRUE/FALSE/NULL). Use NULL to estimate
s	seasonal period of time series (1 for annual, 4 for quarterly, ...)
criterion	information criterion for identification stage ("aic", "bic", "aicc")
h	forecast horizon. If the model includes inputs h is not used, the lenght of u is used instead.
verbose	intermediate estimation output (TRUE / FALSE)
lambda	Box-Cox lambda parameter (NULL: estimate)
maxOrders	a vector c(p,d,q,P,D,Q) containing the maximum orders of model orders to search for in the automatic identification

bootstrap	use bootstrap simulation for predictive distributions
nSimul	number of simulation runs for bootstrap simulation of predictive distributions
fast	fast identification (avoids post-identification checks)

Details

See help of ARIMAforecast.

Value

An object of class ARIMA. It is a list with fields including all the inputs and the fields listed below as outputs. All the functions in this package fill in part of the fields of any ARIMA object as specified in what follows (function ARIMA fills in all of them at once):

After running ARIMAforecast or ARIMA:

p	Estimated parameters
yFor	Forecasted values of output
yForV	Variance of forecasted values of output
ySimul	Bootstrap simulations for forecasting distribution evaluation

After running ARIMAvalidate:

table	Estimation and validation table

Author(s)

Diego J. Pedregal

See Also

ARIMA, ARIMAforecast, ARIMAvalidate,

Examples

```
y <- log(AirPassengers)
m1 <- ARIMAsetup(y)
m1 <- ARIMAsetup(y, lambda = NULL)
```

ARIMAvalidate *ARIMAvalidate*

Description

Shows a table of estimation and diagnostics results for ARIMA models

Usage

```
ARIMAvalidate(m)
```

Arguments

m	an object of type ARIMA created with ARIMAforecast

Value

The same input object with the appropriate fields filled in, in particular:

table	Estimation and validation table

Author(s)

Diego J. Pedregal

See Also

ARIMA, ARIMAforecast, ARIMAvalidate,

Examples

```
m1 <- ARIMAforecast(log(gdp))
m1 <- ARIMAvalidate(m1)
```

arma2tsi *arma2tsi*

Description

AR polynomial coefficients of ARMA model

Usage

```
arma2tsi(MApoly, ARpoly, n = 100)
```

Arguments

MApoly	coefficients of numerator polynomial in descending order
ARpoly	coefficients of denominator polynomial in descending order
n	number of coefficients

Value

Tsi (MA form) coefficients of equivalent ARMA model

Author(s)

Diego J. Pedregal

---

armaFilter *armaFilter*

Description

Filter of time series

Usage

```
armaFilter(MA = 1, AR = 1, y)
```

Arguments

MA	numerator polynomial
AR	denominator polynomial
y	a vector, ts or tsibble object

Value

Filtered time series

Author(s)

Diego J. Pedregal

See Also

colMedians, rowMedians, tests, sumStats, gaussTest, ident, cusum, varTest, conv, dif, roots, zplane, acft, slide, plotSlide, Accuracy, tsDisplay, size

Examples

```
y <- armaFilter(1, c(1 , -0.8), rnorm(200))
```

auxInvBoxCox *auxInvBoxCox*

Description

Inverse of Box-Cox transformation

Usage

```
auxInvBoxCox(y, lambda)
```

Arguments

y	matrix, array or vector
lambda	lambda parameter of Box-Cox transformation

Value

Inverse of Box-Cox heteroskedasticity transformation

Author(s)

Diego J. Pedregal

BIC.UComp *BIC.UComp*

Description

Extract BIC (or SBC) value of UComp object

Usage

```
## S3 method for class 'UComp'
BIC(object, ...)
```

Arguments

object	Object of class "UComp".
...	Additional inputs to function.

Details

Selection criteria for models with different number of parameters, the smaller BIC the better. The formula used here is $BIC = (-2ln(L) + kln(n))/n$, where $ln(L)$ is the log-likelihood at the optimum, k is the number of parameters plus non-stationary states and n is the number of observations. Mind that this formulation differs from the usual definition that does not divide by n. This makes that BIC(m) and BIC(logLik(m)) give different results, being m an UComp object.

Value

BIC value of a UC model

Author(s)

Diego J. Pedregal

See Also

UC, UCforecast, UCvalidate, UCfilter, UCsmooth, UCdisturb, UCcomponents

Examples

```
y <- log(AirPassengers)
m1 <- UCforecast(y, model = "llt/equal/arma(0,0)")
BIC(m1)
```

---

box.cox *box.cox*

Description

Runs Box-Cox transform of a time series

Usage

```
box.cox(x, lambda)
```

Arguments

x	Time series object.
lambda	Lambda parameter for Box-Cox transform.

Value

Box-Cox transformed time series

Author(s)

Diego J. Pedregal

See Also

inv.box.cox, UC, UCforecast, UCvalidate, UCfilter, UCsmooth, UCdisturb, UCcomponents

Examples

```
y <- box.cox(AirPassengers, 0.5)
plot(y)
```

---

ch4 *Methane concentration at Cape Grim in Australia*

Description

Methane concentration at Cape Grim in Australia (ch4).

Usage

```
ch4
```

Format

Time series objects.

Monthly data from January 1992 to December 2019

Value

No return value, called for side effects

Source

CH4 data

Examples

```
ch4
```

---

colMedians *colMedians*

Description

Medians of matrix by columns

Usage

```
colMedians(x, na.rm = TRUE, ...)
```

Arguments

x	a matrix
na.rm	boolean indicating whether to remove nans
...	rest of inputs

Value

A vector with all the medians in columns

Author(s)

Diego J. Pedregal

See Also

rowMedians, tests, sumStats, gaussTest, ident, cusum, varTest, conv, armaFilter, dif, roots, zplane, acft, slide, plotSlide, Accuracy, tsDisplay, size

Examples

```
s <- colMedians(matrix(4, 3, 2))
```

---

conv *conv*

Description

1D convolution: filtering or polynomial multiplication

Usage

```
conv(...)
```

Arguments

...	list of vectors to convolute

Value

Convolution of all input vectors

Author(s)

Diego J. Pedregal

See Also

colMedians, rowMedians, tests, sumStats, gaussTest, ident, cusum, varTest, armaFilter, dif, roots, zplane, acft, slide, plotSlide, Accuracy, tsDisplay, size

Examples

```
conv(c(1, -1), c(1, -2, 1))
conv(c(1, -1), c(1, 0.8))
```

---

cusum *cusum*

Description

Cusum and cusumsq tests

Usage

```
cusum(y, runFromTest = FALSE)
```

Arguments

y	a vector, ts or tsibble object
runFromTest	internal check variable

Value

No return value, called for side effects

Author(s)

Diego J. Pedregal

See Also

colMedians, rowMedians, tests, sumStats, gaussTest, ident, varTest, conv, armaFilter, dif, roots, zplane, acft, slide, plotSlide, Accuracy, tsDisplay, size

Examples

```
cusum(AirPassengers)
```

dif *dif*

Description

Discrete differencing of time series

Usage

```
dif(y, difs = 1, seas = 1)
```

Arguments

y	a vector, ts or tsibble object
difs	vector with differencing orders
seas	vector of seasonal periods

Value

Differenced time series

Author(s)

Diego J. Pedregal

See Also

colMedians, rowMedians, tests, sumStats, gaussTest, ident, cusum, varTest, conv, armaFilter, roots, zplane, acft, slide, plotSlide, Accuracy, tsDisplay, size

Examples

```
dif(AirPassengers)
dif(AirPassengers, 2)
dif(AirPassengers, c(1, 1), c(1, 12))
```

ETS *ETS*

Description

Runs all relevant functions for ETS modelling

Usage

```
ETS(
  y,
  u = NULL,
  model = "???",
  s = frequency(y),
  h = 2 * s,
  criterion = "aicc",
  lambda = 1,
  armaIdent = FALSE,
  identAll = FALSE,
  forIntervals = FALSE,
  bootstrap = FALSE,
  nSimul = 5000,
  verbose = FALSE,
  alphaL = c(1e-08, 1 - 1e-08),
  betaL = alphaL,
  gammaL = alphaL,
  phiL = c(0.8, 0.98),
  p0 = -99999
)
```

Arguments

y	a time series to forecast (it may be either a numerical vector or a time series object). This is the only input required. If a vector, the additional input s should be supplied compulsorily (see below).
u	a matrix of input time series. If the output wanted to be forecast, matrix u should contain future values for inputs.
model	the model to estimate. It is a single string indicating the type of model for each component with one or two letters: • Error: ? / A / M • Trend: ? / N / A / Ad / M / Md • Seasonal: ? / N / A / M
s	seasonal period of time series (1 for annual, 4 for quarterly, ...)
h	forecast horizon. If the model includes inputs h is not used, the lenght of u is used instead.

criterion	information criterion for identification ("aic", "bic" or "aicc").
lambda	Box-Cox lambda parameter (NULL: estimate)
armaIdent	check for arma models for error component (TRUE / FALSE).
identAll	run all models to identify the best one (TRUE / FALSE)
forIntervals	estimate forecasting intervals (TRUE / FALSE)
bootstrap	use bootstrap simulation for predictive distributions
nSimul	number of simulation runs for bootstrap simulation of predictive distributions
verbose	intermediate estimation output (TRUE / FALSE)
alphaL	constraints limits for alpha parameter
betaL	constraints limits for beta parameter
gammaL	constraints limits for gamma parameter
phiL	constraints limits for phi parameter
p0	initial values for parameter search (alpha, beta, phi, gamma) with consraints: • 0 < alpha < 1 • 0 < beta < alpha • 0 < phi < 1 • 0 < gamma < 1 - alpha

Details

See help of ETSforecast.

Value

An object of class ETS. It is a list with fields including all the inputs and the fields listed below as outputs. All the functions in this package fill in part of the fields of any ETS object as specified in what follows (function ETS fills in all of them at once):

After running ETSforecast:

p	Estimated parameters
criteria	Values for estimation criteria (LogLik, AIC, BIC, AICc)
yFor	Forecasted values of output
yForV	Variance of forecasted values of output
ySimul	Bootstrap simulations for forecasting distribution evaluation

After running ETSvalidate:

table	Estimation and validation table
comp	Estimated components in matrix form

After running ETScomponents:

comp	Estimated components in matrix form

An object of class ETS. See ETSforecast.

Author(s)

Diego J. Pedregal

See Also

ETSforecast, ETSvalidate, ETScomponents

Examples

```
y <- log(AirPassengers)
m1 <- ETS(y)
m1 <- ETS(y, model = "MAM")
```

ETScomponents *ETScomponents*

Description

Estimates components of ETS models

Usage

```
ETScomponents(m)
```

Arguments

m	an object of type ETS created with ETSforecast

Value

The same input object with the appropriate fields filled in, in particular:

comp	Estimated components in matrix form

Author(s)

Diego J. Pedregal

See Also

ETS, ETSforecast, ETSvalidate

Examples

```
m1 <- ETS(log(gdp))
m1 <- ETScomponents(m1)
```

ETSestim *ETSestim*

Description

Estimates and forecasts ETS models

Usage

```
ETSestim(m)
```

Arguments

m	an object of type ETS created with ETSforecast

Details

ETSestim estimates and forecasts a time series using an an ETS model

Value

The same input object with the appropriate fields filled in, in particular:

p	Estimated parameters
yFor	Forecasted values of output
yForV	Variance of forecasted values of output
ySimul	Bootstrap simulations for forecasting distribution evaluation

Author(s)

Diego J. Pedregal

See Also

ETS, ETSforecast, ETSvalidate, ETScomponents

Examples

```
m1 <- ETSsetup(log(gdp))
m1 <- ETSestim(m1)
```

ETSforecast *ETSforecast*

Description

Estimates and forecasts ETS general univariate models

Usage

```
ETSforecast(
  y,
  u = NULL,
  model = "???",
  s = frequency(y),
  h = max(2 * s, 6),
  criterion = "aicc",
  lambda = 1,
  armaIdent = FALSE,
  identAll = FALSE,
  forIntervals = FALSE,
  bootstrap = FALSE,
  nSimul = 5000,
  verbose = FALSE,
  alphaL = c(1e-08, 1 - 1e-08),
  betaL = alphaL,
  gammaL = alphaL,
  phiL = c(0.8, 0.98),
  p0 = -99999
)
```

Arguments

y	a time series to forecast (it may be either a numerical vector or a time series object). This is the only input required. If a vector, the additional input s should be supplied compulsorily (see below).
u	a matrix of input time series. If the output wanted to be forecast, matrix u should contain future values for inputs.
model	the model to estimate. It is a single string indicating the type of model for each component with one or two letters: • Error: ? / A / M • Trend: ? / N / A / Ad / M / Md • Seasonal: ? / N / A / M
s	seasonal period of time series (1 for annual, 4 for quarterly, ...)
h	forecast horizon. If the model includes inputs h is not used, the lenght of u is used instead.

criterion	information criterion for identification ("aic", "bic" or "aicc").
lambda	Box-Cox lambda parameter (NULL: estimate)
armaIdent	check for arma models for error component (TRUE / FALSE).
identAll	run all models to identify the best one (TRUE / FALSE)
forIntervals	estimate forecasting intervals (TRUE / FALSE)
bootstrap	use bootstrap simulation for predictive distributions
nSimul	number of simulation runs for bootstrap simulation of predictive distributions
verbose	intermediate estimation output (TRUE / FALSE)
alphaL	constraints limits for alpha parameter
betaL	constraints limits for beta parameter
gammaL	constraints limits for gamma parameter
phiL	constraints limits for phi parameter
p0	initial values for parameter search (alpha, beta, phi, gamma) with consraints: • 0 < alpha < 1 • 0 < beta < alpha • 0 < phi < 1 • 0 < gamma < 1 - alpha

Details

ETSforecast is a function for modelling and forecasting univariate time series with ExponenTial Smoothing (ETS) time series models. It sets up the model with a number of control variables that govern the way the rest of functions in the package will work. It also estimates the model parameters by Maximum Likelihood and forecasts the data.

Value

An object of class ETS. It is a list with fields including all the inputs and the fields listed below as outputs. All the functions in this package fill in part of the fields of any ETS object as specified in what follows (function ETS fills in all of them at once):

After running ETSforecast:

p	Estimated parameters
criteria	Values for estimation criteria (LogLik, AIC, BIC, AICc)
yFor	Forecasted values of output
yForV	Variance of forecasted values of output
ySimul	Bootstrap simulations for forecasting distribution evaluation

After running ETSvalidate:

table	Estimation and validation table
comp	Estimated components in matrix form

After running ETScomponents:

comp	Estimated components in matrix form

Author(s)

Diego J. Pedregal

See Also

ETS, ETSvalidate, ETScomponents

Examples

```
y <- log(AirPassengers)
m1 <- ETSforecast(y)
m1 <- ETSforecast(y, model = "A?A")
```

ETSsetup *ETSsetup*

Description

Sets up ETS general univariate models

Usage

```
ETSsetup(
  y,
  u = NULL,
  model = "???",
  s = frequency(y),
  h = 2 * s,
  criterion = "aicc",
  lambda = 1,
  armaIdent = FALSE,
  identAll = FALSE,
  forIntervals = FALSE,
  bootstrap = FALSE,
  nSimul = 5000,
  verbose = FALSE,
  alphaL = c(1e-08, 1 - 1e-08),
  betaL = alphaL,
  gammaL = alphaL,
  phiL = c(0.8, 0.98),
  p0 = -99999
)
```

Arguments

y	a time series to forecast (it may be either a numerical vector or a time series object). This is the only input required. If a vector, the additional input s should be supplied compulsorily (see below).
u	a matrix of input time series. If the output wanted to be forecast, matrix u should contain future values for inputs.
model	the model to estimate. It is a single string indicating the type of model for each component with one or two letters: • Error: ? / A / M • Trend: ? / N / A / Ad / M / Md • Seasonal: ? / N / A / M
s	seasonal period of time series (1 for annual, 4 for quarterly, ...)
h	forecast horizon. If the model includes inputs h is not used, the lenght of u is used instead.
criterion	information criterion for identification ("aic", "bic" or "aicc").
lambda	Box-Cox lambda parameter (NULL: estimate)
armaIdent	check for arma models for error component (TRUE / FALSE).
identAll	run all models to identify the best one (TRUE / FALSE)
forIntervals	estimate forecasting intervals (TRUE / FALSE)
bootstrap	use bootstrap simulation for predictive distributions
nSimul	number of simulation runs for bootstrap simulation of predictive distributions
verbose	intermediate estimation output (TRUE / FALSE)
alphaL	constraints limits for alpha parameter
betaL	constraints limits for beta parameter
gammaL	constraints limits for gamma parameter
phiL	constraints limits for phi parameter
p0	initial values for parameter search (alpha, beta, phi, gamma) with consraints: • 0 < alpha < 1 • 0 < beta < alpha • 0 < phi < 1 • 0 < gamma < 1 - alpha

Details

See help of ETSforecast.

Value

An object of class ETS. It is a list with fields including all the inputs and the fields listed below as outputs. All the functions in this package fill in part of the fields of any ETS object as specified in what follows (function ETS fills in all of them at once):

After running ETSforecast:

p	Estimated parameters
criteria	Values for estimation criteria (LogLik, AIC, BIC, AICc)
yFor	Forecasted values of output
yForV	Variance of forecasted values of output
ySimul	Bootstrap simulations for forecasting distribution evaluation

After running ETSvalidate:

table	Estimation and validation table
comp	Estimated components in matrix form

After running ETScomponents:

comp	Estimated components in matrix form

An object of class ETS. See ETSforecast.

Author(s)

Diego J. Pedregal

See Also

ETS, ETSforecast, ETSvalidate, ETScomponents

Examples

```
y <- log(AirPassengers)
m1 <- ETSsetup(y)
m1 <- ETSsetup(y,  model = "???")
m1 <- ETSsetup(y,  model = "?AA")
```

ETSvalidate *ETSvalidate*

Description

Shows a table of estimation and diagnostics results for ETS models

Usage

```
ETSvalidate(m)
```

Arguments

m	an object of type ETS created with ETSforecast

Value

The same input object with the appropriate fields filled in, in particular:

`table`	Estimation and validation table

Author(s)

Diego J. Pedregal

See Also

ETS, ETSforecast, ETSvalidate, ETScomponents

Examples

```
m1 <- ETSforecast(log(gdp))
m1 <- ETSvalidate(m1)
```

---

extract *extract*

Description

Reorder data frame returning column col reordered according to the values in column accordingTo

Usage

```
extract(x, col, accordingTo = 1)
```

Arguments

`x`	a data frame
`col`	column to be ordered
`accordingTo`	column to take as the pattern

Value

Data frame reordered accoring to a given column data

Author(s)

Diego J. Pedregal

gaussTest *gaussTest*

Description

Gaussianity tests

Usage

```
gaussTest(y, runFromTests = FALSE)
```

Arguments

y	a vector, ts or tsibble object
runFromTests	internal check

Value

No return value, called for side effects

Author(s)

Diego J. Pedregal

See Also

colMedians, rowMedians, tests, sumStats, ident, cusum, varTest, conv, armaFilter, dif, roots, zplane, acft, slide, plotSlide, Accuracy, tsDisplay, size

Examples

```
gaussTest(AirPassengers)
```

gdp *Spanish GDP*

Description

Quarterly real Spanish Gross Domestic Product (gdp)

Usage

```
gdp
```

Format

Time series objects.

Quarterly since 1995

https://portal.mineco.gob.es/es-es/economiayempresa/EconomiaInformesMacro/Paginas/bdsice.aspx

Value

No return value, called for side effects

Examples

```
gdp
```

`getp0` *getp0*

Description

Get initial conditions for parameters of `UComp` object

Usage

```
getp0(y, model = "llt/equal/arma(0,0)", periods = NA)
```

Arguments

`y`	a time series to forecast.
`model`	any valid `UComp` model without any ?.
`periods`	vector of fundamental period and harmonics required.

Details

Provides initial parameters of a given model for the time series. They may be changed arbitrarily by the user to include as an input `p0` to `UC` or `UCforecast` functions (see example below). There is no guarantee that the model will converge and selecting initial conditions should be used with care.

Value

A set of parameters p0 of an object of class `UComp` to use as input to `UC`, `UCforecast`.

Author(s)

Diego J. Pedregal

See Also

`UC`, `UCvalidate`, `UCfilter`, `UCsmooth`, `UCdisturb`, `UCcomponents`, `UChp`

Examples

```
## Not run:
p0 <- getp0(log(AirPassengers), model = "llt/equal/arma(0,0)")
p0[1] <- 0  # p0[1] <- NA
m <- UCforecast(log(AirPassengers), model = "llt/equal/arma(0,0)", p0 = p0)

## End(Not run)
```

---

ident *ident*

Description

Autocorrelation functions of a time series

Usage

```
ident(y, nCoef = min(37, floor(length(y)/4)), nPar = 0, runFromTests = FALSE)
```

Arguments

y	a vector, ts or tsibble object
nCoef	number of autocorrelation coefficients to estimate
nPar	number of parameters in a model if y is a residual
runFromTests	internal check

Value

A vector with output table including ACF, etc.

Author(s)

Diego J. Pedregal

See Also

colMedians, rowMedians, tests, sumStats, gaussTest, cusum, varTest, conv, armaFilter, dif, roots, zplane, acft, slide, plotSlide, Accuracy, tsDisplay, size

Examples

```
ident(AirPassengers)
```

inv.box.cox *inv.box.cox*

Description

Runs inverse of Box-Cox transform of a time series

Usage

```
inv.box.cox(x, lambda)
```

Arguments

x	Transformed time series object.
lambda	Lambda parameter used for Box-Cox transform.

Value

Inverse Box-Cox transformed time series

Author(s)

Diego J. Pedregal

See Also

box.cox, UC, UCforecast, UCvalidate, UCfilter, UCsmooth, UCdisturb, UCcomponents

Examples

```
y <- inv.box.cox(box.cox(AirPassengers, 0.5), 0.5)
plot(y)
```

invBoxCox *invBoxCox*

Description

Calculates inverse of Box-Cox transformation with confidence bands, calculated as const time the standard error

Usage

```
invBoxCox(y, yVar, lambda, const = 2)
```

Arguments

y	matrix, array or vector
yVar	matrix, array or vector of variances of y
lambda	lambda parameter of Box-Cox transformation
const	number of standard error for confidence band

Value

Inverse of Box-Cox heteroskedasticity transformation with confidence bands

Author(s)

Diego J. Pedregal

---

ipi *Spanish Industrial Production Index*

Description

Spanish Industrial Production Index (ipi).

Usage

```
ipi
```

Format

Objeto time series.

Monthly since 1975

https://portal.mineco.gob.es/es-es/economiayempresa/EconomiaInformesMacro/Paginas/bdsice.aspx

Value

No return value, called for side effects

Examples

```
ipi
```

OECDgdp *OECD GDP*

Description

Seasonally adjusted quarterly OECD real gross domestic product (OECDgdp).

Usage

```
OECDgdp
```

Format

Time series objects.

Quarterly data from 1962 to 2019

https://portal.mineco.gob.es/es-es/economiayempresa/EconomiaInformesMacro/Paginas/bdsice.aspx

Value

No return value, called for side effects

Examples

```
OECDgdp
```

plotAcfPacf *plotAcfPacf*

Description

Plot of ACF and PACF

Usage

```
plotAcfPacf(ACF, PACF, s = 1, n = NA, runFromTest = FALSE)
```

Arguments

ACF	variable to plot
PACF	second variable to plot
s	seasonal period
n	number of coefficients
runFromTest	internal check variable

Value

No return value, called for side effects

Author(s)

Diego J. Pedregal

`plotBar` *plotBar*

Description

Plot variable in bars

Usage

```
plotBar(ACF, s = 1, n = NA, label = "ACF")
```

Arguments

`ACF`	variable to plot
`s`	seasonal period
`n`	number of coefficients
`label`	label for plot

Value

Handle of plot

Author(s)

Diego J. Pedregal

plotSlide *plotSlide*

Description

Plot summarised results from slide

Usage

```
plotSlide(py1, y, orig, step = 1, errorFun, collectFun = mean)
```

Arguments

py1	output from slide function
y	a vector, matrix or list of time series (the same used in slide call)
orig	starting forecasting origin (the same used in slide call)
step	observations ahead to move the forecasting origin (the same used in slide call)
errorFun	user function to calculate error measures
collectFun	aggregation function (mean, median, etc.)

Value

An array of forecasting errors of dimensions (horizon x nOrigs x nModels x nSeries)

Author(s)

Diego J. Pedregal

See Also

colMedians, rowMedians, tests, sumStats, gaussTest, ident, cusum, varTest, conv, armaFilter, dif, roots, zplane, acft, slide, Accuracy, tsDisplay, size

Examples

```
## Not run: plotSlide(py1, AirPassengers, 100, 1, errorFun)
```

plus_one *plus_one*

Description

Returns date of next to end time series y

Usage

```
plus_one(y)
```

Arguments

y	a ts object

Value

Next time stamp

Author(s)

Diego J. Pedregal

predict.UComp *predict.UComp*

Description

Forecasting using structural Unobseved Components models with prediction intervals

Usage

```
## S3 method for class 'UComp'
predict(object, newdata = NULL, n.ahead = NULL, level = 0.95, ...)
```

Arguments

object	Object of class "UComp".
newdata	New output data to apply "UComp" object to.
n.ahead	Number of steps ahead to forecast or new inputs variables including their predictions.
level	Confidence level for prediction intervals.
...	Ignored.

Details

See help of UC.

Value

Forecasts of a UC model

A matrix with the mean forecasts and lower and upper prediction intervals

Author(s)

Diego J. Pedregal

See Also

UC, UCforecast, UCvalidate, UCfilter, UCsmooth, UCdisturb, UCcomponents

Examples

```
y <- log(AirPassengers)
m1 <- UCforecast(y, model = "llt/eq/arma(0,0)")
f1 <- predict(m1)
```

---

removeNaNs *removeNaNs*

Description

Remove nans at beginning or end of vector

Usage

```
removeNaNs(x)
```

Arguments

x	a vector or a ts object

Value

vector with nans removed (only those at beginning or end)

Author(s)

Diego J. Pedregal

roots *roots*

Description

Roots of polynomial

Usage

```
roots(x)
```

Arguments

x	coefficients of polynomial in descending order

Value

Roots of polynomial

Author(s)

Diego J. Pedregal

See Also

colMedians, rowMedians, tests, sumStats, gaussTest, ident, cusum, varTest, conv, armaFilter, dif, zplane, acft, slide, plotSlide, Accuracy, tsDisplay, size

Examples

```
roots(c(1, -2 ,1))
roots(conv(c(1, -1), c(1, 0.8)))
```

rowMedians *rowMedians*

Description

Medians of matrix by rows

Usage

```
rowMedians(x, na.rm = TRUE, ...)
```

Arguments

x	a matrix
na.rm	boolean indicating whether to remove nans
...	rest of inputs

Value

A vector with all the medians in rows

Author(s)

Diego J. Pedregal

See Also

colMedians, tests, sumStats, gaussTest, ident, cusum, varTest, conv, armaFilter, dif, roots, zplane, acft, slide, plotSlide, Accuracy, tsDisplay, size

Examples

```
s <- rowMedians(matrix(4, 3, 2))
```

---

sales *Sales index for large retailers in Spain*

Description

Sales index for food of large retailers in Spain

Usage

```
sales
```

Format

Time series objects.

Monthly data from January 1995 to December 2019

https://portal.mineco.gob.es/es-es/economiayempresa/EconomiaInformesMacro/Paginas/bdsice.aspx

Value

No return value, called for side effects

Examples

```
sales
```

size *size*

Description

Size of vector, matrix or array

Usage

```
size(y)
```

Arguments

y	a vector, matrix or array

Value

A vector with all the dimensions

Author(s)

Diego J. Pedregal

See Also

colMedians, rowMedians, tests, sumStats, gaussTest, ident, cusum, varTest, conv, armaFilter, dif, roots, zplane, acft, slide, plotSlide, Accuracy, tsDisplay

Examples

```
s <- size(matrix(4, 3, 2))
s <- size(rep(4, 3))
s <- size(array(4, c(3, 2, 2)))
```

slide *slide*

Description

Rolling forecasting of a matrix of time series

Usage

```
slide(
  y,
  orig,
  forecFun,
  ...,
  h = 12,
  step = 1,
  output = TRUE,
  window = NA,
  parallel = FALSE
)
```

Arguments

y	a vector, a matrix or a list of time series
orig	starting forecasting origin
forecFun	user function that implements forecasting methods
...	rest of inputs to forecFun function
h	forecasting horizon
step	observations ahead to move the forecasting origin
output	output TRUE/FALSE
window	fixed window width in number of observations (NA for non fixed)
parallel	run forecasts in parallel

Details

Takes time series and run forecasting methods implemented in function forecFun h steps ahead along the time series y, starting at forecasting origin orig, and moving step observations ahead. Forecasts may be run in parallel by setting parallel to TRUE. A fixed window width may be specified with input window. The output is of dimensions (h, nOrigs, nModels, nSeries)

Value

An array of forecasts of dimensions (horizon x nOrigs x nModels x nSeries)

Author(s)

Diego J. Pedregal

See Also

colMedians, rowMedians, tests, sumStats, gaussTest, ident, cusum, varTest, conv, armaFilter, dif, roots, zplane, acft, plotSlide, Accuracy, tsDisplay, size

Examples

```
## Not run: slide(AirPassengers, 100, forecFun)
```

slideAux *slideAux*

Description

Auxiliary function run from slide

Usage

```
slideAux(
  y,
  orig,
  forecFun,
  h = 12,
  step = 1,
  output = TRUE,
  graph = TRUE,
  window = NA,
  parallel = FALSE,
  isList = FALSE,
  ...
)
```

Arguments

y	a vector or matrix of time series
orig	starting forecasting origin
forecFun	user function that implements forecasting methods
h	forecasting horizon
step	observations ahead to move the forecasting origin
output	output TRUE/FALSE
graph	fraphical output TRUE/FALSE
window	fixed window width in number of observations (NA for non fixed)
parallel	run forecasts in parallel
isList	whether the input data y is a list or a matrix
...	rest of inputs to forecFun function

Value

Auxiliary output of slide function for just one time series

Author(s)

Diego J. Pedregal

sumStats *sumStats*

Description

Summary statistics of a matrix of variables

Usage

```
sumStats(y, decimals = 5)
```

Arguments

y	a vector, matrix of time series
decimals	number of decimals for table

Details

Position, dispersion, skewness, kurtosis, etc.

Value

Table of values in string matrix

Author(s)

Diego J. Pedregal

See Also

colMedians, rowMedians, tests, gaussTest, ident, cusum, varTest, conv, armaFilter, dif, roots, zplane, acft, slide, plotSlide, Accuracy, tsDisplay, size

Examples

```
s <- sumStats(AirPassengers)
```

tests *tests*

Description

Tests on a time series

Usage

```
tests(
  y,
  parts = 1/3,
  nCoef = min(25, length(x)/4),
  nPar = 0,
  s = frequency(y),
  avoid = 16
)
```

Arguments

y	a vector, ts or tsibble object
parts	proportion of sample to include in ratio of variances test
nCoef	number of autocorrelation coefficients to estimate
nPar	number of parameters in a model if y is a residual
s	seasonal period, number of observations per year
avoid	number of observations to avoid at beginning of sample to eliminate initial effects

Details

Multiple tests on a time series, including summary statistics, autocorrelation, Gaussianity and heteroskedasticity,

Value

Table with all test results

Author(s)

Diego J. Pedregal

See Also

colMedians, rowMedians, sumStats, gaussTest, ident, cusum, varTest, conv, armaFilter, dif, roots, zplane, acft, slide, plotSlide, Accuracy, tsDisplay, size

Examples

```
tests(AirPassengers)
```

TETS *TETS*

Description

Runs all relevant functions for TETS modelling

Usage

```
TETS(
  y,
  u = NULL,
  model = "???",
  s = frequency(y),
  h = 2 * s,
  criterion = "aicc",
  forIntervals = FALSE,
  bootstrap = FALSE,
  nSimul = 5000,
  verbose = FALSE,
  alphaL = c(0, 1),
  betaL = alphaL,
  gammaL = alphaL,
  phiL = c(0.8, 0.98),
  p0 = -99999,
  Ymin = -Inf,
  Ymax = Inf
)
```

Arguments

y	a time series to forecast (it may be either a numerical vector or a time series object). This is the only input required. If a vector, the additional input s should be supplied compulsorily (see below).
u	a matrix of input time series. If the output wanted to be forecast, matrix u should contain future values for inputs.
model	the model to estimate. It is a single string indicating the type of model for each component with one or two letters: • Error: ? / A • Trend: ? / N / A / Ad • Seasonal: ? / N / A
s	seasonal period of time series (1 for annual, 4 for quarterly, ...)

h	forecast horizon. If the model includes inputs h is not used, the lenght of u is used instead.
criterion	information criterion for identification ("aic", "bic" or "aicc").
forIntervals	estimate forecasting intervals (TRUE / FALSE)
bootstrap	use bootstrap simulation for predictive distributions
nSimul	number of simulation runs for bootstrap simulation of predictive distributions
verbose	intermediate estimation output (TRUE / FALSE)
alphaL	constraints limits for alpha parameter
betaL	constraints limits for beta parameter
gammaL	constraints limits for gamma parameter
phiL	constraints limits for phi parameter
p0	initial values for parameter search (alpha, beta, phi, gamma, sigma2) with consraints:
Ymin	scalar or vector of time varying censoring values from below
Ymax	scalar or vector of time varying censoring values from above

- 0 < alpha < 1
- 0 < beta < alpha
- 0 < phi < 1
- 0 < gamma < 1 - alpha
- sigma2 > 0

Details

See help of TETSforecast.

Value

An object of class TETS. It is a list with fields including all the inputs and the fields listed below as outputs. All the functions in this package fill in part of the fields of any TETS object as specified in what follows (function TETS fills in all of them at once):

After running TETSforecast:

p	Estimated parameters
criteria	Values for estimation criteria (LogLik, AIC, BIC, AICc)
yFor	Forecasted values of output
yForV	Variance of forecasted values of output
ySimul	Bootstrap simulations for forecasting distribution evaluation

After running TETSvalidate:

table	Estimation and validation table
comp	Estimated components in matrix form

After running TETScomponents:

comp	Estimated components in matrix form

Author(s)

Diego J. Pedregal

See Also

TETSforecast, TETSvalidate, TETScomponents

Examples

```
y <- log(AirPassengers)
m1 <- TETS(y)
m1 <- TETS(y, model = "MAM")
```

TETScomponents *TETScomponents*

Description

Estimates components of TOBIT TETS models

Usage

```
TETScomponents(m)
```

Arguments

m	an object of type TETS created with TETSforecast

Value

The same input object with the appropriate fields filled in, in particular:

comp	Estimated components in matrix form

Author(s)

Diego J. Pedregal

See Also

TETS, TETSforecast, TETSvalidate

Examples

```
m1 <- TETS(log(gdp))
m1 <- TETScomponents(m1)
```

TETSestim *TETSestim*

Description

Estimates and forecasts TOBIT TETS models

Usage

```
TETSestim(m)
```

Arguments

m	an object of type TETS created with TETSforecast

Details

TETSestim estimates and forecasts a time series using an a TOBIT TETS model

Value

The same input object with the appropriate fields filled in, in particular:

p	Estimated parameters
yFor	Forecasted values of output
yForV	Variance of forecasted values of output
ySimul	Bootstrap simulations for forecasting distribution evaluation

Author(s)

Diego J. Pedregal

See Also

TETS, TETSforecast, TETSvalidate, TETScomponents

Examples

```
m1 <- TETSsetup(log(gdp))
m1 <- TETSestim(m1)
```

TETSforecast *TETSforecast*

Description

Estimates and forecasts TOBIT TETS general univariate models

Usage

```
TETSforecast(
  y,
  u = NULL,
  model = "???",
  s = frequency(y),
  h = max(2 * s, 6),
  criterion = "aicc",
  forIntervals = FALSE,
  bootstrap = FALSE,
  nSimul = 5000,
  verbose = FALSE,
  alphaL = c(0, 1),
  betaL = alphaL,
  gammaL = alphaL,
  phiL = c(0.8, 0.98),
  p0 = -99999,
  Ymin = -Inf,
  Ymax = Inf
)
```

Arguments

y	a time series to forecast (it may be either a numerical vector or a time series object). This is the only input required. If a vector, the additional input s should be supplied compulsorily (see below).
u	a matrix of input time series. If the output wanted to be forecast, matrix u should contain future values for inputs.
model	the model to estimate. It is a single string indicating the type of model for each component with one or two letters: • Error: ? / A • Trend: ? / N / A / Ad • Seasonal: ? / N / A
s	seasonal period of time series (1 for annual, 4 for quarterly, ...)
h	forecast horizon. If the model includes inputs h is not used, the lenght of u is used instead.
criterion	information criterion for identification ("aic", "bic" or "aicc").

forIntervals	estimate forecasting intervals (TRUE / FALSE)
bootstrap	use bootstrap simulation for predictive distributions
nSimul	number of simulation runs for bootstrap simulation of predictive distributions
verbose	intermediate estimation output (TRUE / FALSE)
alphaL	constraints limits for alpha parameter
betaL	constraints limits for beta parameter
gammaL	constraints limits for gamma parameter
phiL	constraints limits for phi parameter
p0	initial values for parameter search (alpha, beta, phi, gamma, sigma2) with consraints:
Ymin	scalar or vector of time varying censoring values from below
Ymax	scalar or vector of time varying censoring values from above

- 0 < alpha < 1
- 0 < beta < alpha
- 0 < phi < 1
- 0 < gamma < 1 - alpha
- sigma2 > 0

Details

TETSforecast is a function for modelling and forecasting univariate time series with TOBIT ExponenTial Smoothing (TETS) time series models. It sets up the model with a number of control variables that govern the way the rest of functions in the package will work. It also estimates the model parameters by Maximum Likelihood and forecasts the data.

Value

An object of class TETS. It is a list with fields including all the inputs and the fields listed below as outputs. All the functions in this package fill in part of the fields of any TETS object as specified in what follows (function TETS fills in all of them at once):

After running TETSforecast:

p	Estimated parameters
criteria	Values for estimation criteria (LogLik, AIC, BIC, AICc)
yFor	Forecasted values of output
yForV	Variance of forecasted values of output
ySimul	Bootstrap simulations for forecasting distribution evaluation

After running TETSvalidate:

table	Estimation and validation table
comp	Estimated components in matrix form

After running TETScomponents:

comp	Estimated components in matrix form

Author(s)

Diego J. Pedregal

See Also

TETS, TETSvalidate, TETScomponents

Examples

```
y <- log(AirPassengers)
m1 <- TETSforecast(y)
m1 <- TETSforecast(y, model = "A?A")
```

TETSsetup *TETSsetup*

Description

Sets up TOBIT TETS general univariate models

Usage

```
TETSsetup(
  y,
  u = NULL,
  model = "???",
  s = frequency(y),
  h = 2 * s,
  criterion = "aicc",
  forIntervals = FALSE,
  bootstrap = FALSE,
  nSimul = 5000,
  verbose = FALSE,
  alphaL = c(0, 1),
  betaL = alphaL,
  gammaL = alphaL,
  phiL = c(0.8, 0.98),
  p0 = -99999,
  Ymin = -Inf,
  Ymax = Inf
)
```

Arguments

y	a time series to forecast (it may be either a numerical vector or a time series object). This is the only input required. If a vector, the additional input s should be supplied compulsorily (see below).
u	a matrix of input time series. If the output wanted to be forecast, matrix u should contain future values for inputs.
model	the model to estimate. It is a single string indicating the type of model for each component with one or two letters: • Error: ? / A • Trend: ? / N / A / Ad • Seasonal: ? / N / A
s	seasonal period of time series (1 for annual, 4 for quarterly, ...)
h	forecast horizon. If the model includes inputs h is not used, the lenght of u is used instead.
criterion	information criterion for identification ("aic", "bic" or "aicc").
forIntervals	estimate forecasting intervals (TRUE / FALSE)
bootstrap	use bootstrap simulation for predictive distributions
nSimul	number of simulation runs for bootstrap simulation of predictive distributions
verbose	intermediate estimation output (TRUE / FALSE)
alphaL	constraints limits for alpha parameter
betaL	constraints limits for beta parameter
gammaL	constraints limits for gamma parameter
phiL	constraints limits for phi parameter
p0	initial values for parameter search (alpha, beta, phi, gamma, sigma2) with consraints: • 0 < alpha < 1 • 0 < beta < alpha • 0 < phi < 1 • 0 < gamma < 1 - alpha • sigma2 > 0
Ymin	scalar or vector of time varying censoring values from below
Ymax	scalar or vector of time varying censoring values from above

Details

See help of TETSforecast.

Value

An object of class TETS. It is a list with fields including all the inputs and the fields listed below as outputs. All the functions in this package fill in part of the fields of any TETS object as specified in what follows (function TETS fills in all of them at once):

After running TETSforecast:

p	Estimated parameters
criteria	Values for estimation criteria (LogLik, AIC, BIC, AICc)
yFor	Forecasted values of output
yForV	Variance of forecasted values of output
ySimul	Bootstrap simulations for forecasting distribution evaluation

After running TETSvalidate:

table	Estimation and validation table
comp	Estimated components in matrix form

After running TETScomponents:

comp	Estimated components in matrix form

Author(s)

Diego J. Pedregal

See Also

TETS, TETSforecast, TETSvalidate, TETScomponents

Examples

```
y <- log(AirPassengers)
m1 <- TETSsetup(y)
m1 <- TETSsetup(y,  model = "???")
m1 <- TETSsetup(y,  model = "?AA")
```

TETSvalidate *TETSvalidate*

Description

Shows a table of estimation and diagnostics results for TOBIT TETS models

Usage

```
TETSvalidate(m)
```

Arguments

m	an object of type TETS created with TETSforecast

Value

The same input object with the appropriate fields filled in, in particular:

table	Estimation and validation table

Author(s)

Diego J. Pedregal

See Also

TETS, TETSforecast, TETSvalidate, TETScomponents

Examples

```
m1 <- TETSforecast(log(gdp))
m1 <- TETSvalidate(m1)
```

---

tsDisplay *tsDisplay*

Description

Displays time series plot with autocorrelation functions

Usage

```
tsDisplay(y, nCoef = 25, nPar = 0, s = NA)
```

Arguments

y	a vector, ts or tsibble object
nCoef	number of autocorrelation coefficients to estimate
nPar	number of parameters in a model if y is a residual
s	seasonal period, number of observations per year

Value

No return value, called for side effects

Author(s)

Diego J. Pedregal

See Also

colMedians, rowMedians, tests, sumStats, gaussTest, ident, cusum, varTest, conv, armaFilter, dif, roots, zplane, acft, slide, plotSlide, Accuracy, size

Examples

```
tsDisplay(AirPassengers)
```

UC *UC*

Description

Runs all relevant functions for UC modelling

Usage

```
UC(
  y,
  u = NULL,
  model = "?/none/?/?",
  h = 24,
  lambda = 1,
  outlier = 9999,
  tTest = FALSE,
  criterion = "aic",
  periods = NA,
  verbose = FALSE,
  stepwise = FALSE,
  p0 = -9999.9,
  arma = FALSE,
  TVP = NULL,
  trendOptions = "none/rw/llt/dt",
  seasonalOptions = "none/equal/different",
  irregularOptions = "none/arma(0,0)"
)
```

Arguments

y	a time series to forecast (it may be either a numerical vector or a time series object). This is the only input required. If a vector, the additional input periods should be supplied compulsorily (see below).
u	a matrix of external regressors included only in the observation equation. (it may be either a numerical vector or a time series object). If the output wanted to be forecast, matrix u should contain future values for inputs.

`model` the model to estimate. It is a single string indicating the type of model for each component. It allows two formats "trend/seasonal/irregular" or "trend/cycle/seasonal/irregular". The possibilities available for each component are:

- Trend: ? / none / rw / irw / llt / dt / td;
- Seasonal: ? / none / equal / different;
- Irregular: ? / none / arma(0, 0) / arma(p, q) - with p and q integer positive orders;
- Cycles: ? / none / combination of positive or negative numbers. Positive numbers fix the period of the cycle while negative values estimate the period taking as initial condition the absolute value of the period supplied. Several cycles with positive or negative values are possible and if a question mark is included, the model test for the existence of the cycles specified. The following are valid examples with different meanings: 48, 48?, -48, -48?, 48+60, -48+60, -48-60, 48-60, 48+60?, -48+60?, -48-60?, 48-60?.

`h` forecast horizon. If the model includes inputs h is not used, the lenght of u is used instead.

`lambda` Box-Cox transformation lambda, NULL for automatic estimation

`outlier` critical level of outlier tests. If NA it does not carry out any outlier detection (default). A positive value indicates the critical minimum t test for outlier detection in any model during identification. Three types of outliers are identified, namely Additive Outliers (AO), Level Shifts (LS) and Slope Change (SC).

`tTest` augmented Dickey Fuller test for unit roots used in stepwise algorithm (TRUE / FALSE). The number of models to search for is reduced, depending on the result of this test.

`criterion` information criterion for identification ("aic", "bic" or "aicc").

`periods` vector of fundamental period and harmonics required.

`verbose` intermediate results shown about progress of estimation (TRUE / FALSE).

`stepwise` stepwise identification procedure (TRUE / FALSE).

`p0` initial parameter vector for optimisation search.

`arma` check for arma models for irregular components (TRUE / FALSE).

`TVP` vector of zeros and ones to indicate TVP parameters.

`trendOptions` trend models to select amongst (e.g., "rw/llt").

`seasonalOptions` seasonal models to select amongst (e.g., "none/differentt").

`irregularOptions` irregular models to select amongst (e.g., "none/arma(0,1)").

Details

`UC` is a function for modelling and forecasting univariate time series according to Unobserved Components models (UC). It sets up the model with a number of control variables that govern the way the rest of functions in the package work. It also estimates the model parameters by Maximum Likelihood, forecasts the data, performs smoothing, estimates model disturbances, estimates components and shows statistical diagnostics. Standard methods applicable to UComp objects are print, summary, plot, fitted, residuals, logLik, AIC, BIC, coef, predict, tsdiag.

Value

An object of class UComp. It is a list with fields including all the inputs and the fields listed below as outputs. All the functions in this package fill in part of the fields of any UComp object as specified in what follows (function UC fills in all of them at once):

After running UCforecast or UCestim:

- p: Estimated parameters
- v: Estimated innovations (white noise in correctly specified models)
- yFor: Forecasted values of output
- yForV: Forecasted values +- one standard error
- criteria: Value of criteria for estimated model
- iter: Number of iterations in estimation
- grad: Gradient at estimated parameters
- covp: Covariance matrix of parameters

After running UCvalidate:

- table: Estimation and validation table

After running UCcomponents:

- comp: Estimated components in matrix form
- compV: Estimated components variance in matrix form

After running UCfilter, UCsmooth or UCdisturb:

- yFit: Fitted values of output
- yFitV: Variance of fitted values of output
- a: State estimates
- P: Variance of state estimates
- aFor: Forecasts of states
- PFor: Forecasts of states variances

After running UCdisturb:

- eta: State perturbations estimates
- eps: Observed perturbations estimates

Author(s)

Diego J. Pedregal

See Also

UC, UCvalidate, UCfilter, UCsmooth, UCdisturb, UCcomponents, UChp

Examples

```
y <- log(AirPassengers)
m1 <- UC(y)
m1 <- UC(y, model = "llt/different/arma(0,0)")
```

UCcommand *UCcommand*

Description

Auxiliar function for UC modeling

Usage

```
UCcommand(command, sys)
```

Arguments

command	Command to execute: "forecast", "validate", "filter", "smooth", "disturb", "components", "all"
sys	A UComp object created with UC

Value

The input UComp object with the appropriate fields filled in

Author(s)

Diego J. Pedregal

See Also

UC, UCforecast, UCvalidate, UCfilter, UCsmooth, UCcomponents, UCdisturb

Examples

```
cycle <- UChp(USgdp)
plot(cycle)
```

UCcomponents *UCcomponents*

Description

Estimates unobserved components of UC models Standard methods applicable to UComp objects are print, summary, plot, fitted, residuals, logLik, AIC, BIC, coef, predict, tsdiag.

Usage

```
UCcomponents(sys)
```

Arguments

sys	an object of type UComp created with UC or UCforecast

Value

The same input object with the appropriate fields filled in, in particular:

- comp: Estimated components in matrix form
- compV: Estimated components variance in matrix form

Author(s)

Diego J. Pedregal

See Also

UC, UCforecast, UCvalidate, UCfilter, UCsmooth, UCdisturb, UChp

Examples

```
m1 <- UC(log(AirPassengers))
m1 <- UCcomponents(m1)
```

`UCdisturb` *UCdisturb*

Description

Runs the Disturbance Smoother for UC models Standard methods applicable to `UComp` objects are print, summary, plot, fitted, residuals, logLik, AIC, BIC, coef, predict, tsdiag.

Usage

```
UCdisturb(sys)
```

Arguments

`sys`	an object of type `UComp` created with `UC`

Value

The same input object with the appropriate fields filled in, in particular:

- yFit: Fitted values of output
- yFitV: Variance of fitted values of output
- a: State estimates
- P: Variance of state estimates (diagonal of covariance matrices)
- eta: State perturbations estimates
- eps: Observed perturbations estimates

Author(s)

Diego J. Pedregal

See Also

`UC`, `UCforecast`, `UCvalidate`, `UCfilter`, `UCsmooth`, `UCcomponents`, `UChp`

Examples

```
m1 <- UC(log(AirPassengers))
m1 <- UCdisturb(m1)
```

UCestim *UCestim*

Description

Estimates and forecasts UC models

Usage

```
UCestim(sys)
```

Arguments

sys	an object of type UComp created with UC

Details

UCestim estimates and forecasts a time series using an UC model. The optimization method is a BFGS quasi-Newton algorithm with a backtracking line search using Armijo conditions. Parameter names in output table are the following:

- Damping: Damping factor for DT trend.
- Level: Variance of level disturbance.
- Slope: Variance of slope disturbance.
- Rho(#): Damping factor of cycle #.
- Period(#): Estimated period of cycle #.
- Var(#): Variance of cycle #.
- Seas(#): Seasonal harmonic with period #.
- Irregular: Variance of irregular component.
- AR(#): AR parameter of lag #.
- MA(#): MA parameter of lag #.
- AO#: Additive outlier in observation #.
- LS#: Level shift outlier in observation #.
- SC#: Slope change outlier in observation #.
- Beta(#): Beta parameter of input #.
- Cnst: Constant.

Standard methods applicable to UComp objects are print, summary, plot, fitted, residuals, logLik, AIC, BIC, coef, predict, tsdiag.

Value

The same input object with the appropriate fields filled in, in particular:

- p: Estimated transformed parameters
- v: Estimated innovations (white noise in correctly specified models)
- yFor: Forecast values of output
- yForV: Forecasted values variance
- criteria: Value of criteria for estimated model
- covp: Covariance matrix of estimated transformed parameters
- grad: Gradient of log-likelihood at the optimum
- iter: Estimation iterations

Author(s)

Diego J. Pedregal

See Also

UC, UCforecast, UCvalidate, UCfilter, UCsmooth, UCdisturb, UCcomponents, UChp

Examples

```
m1 <- UCsetup(log(AirPassengers))
m1 <- UCestim(m1)
```

`UCfilter` *UCfilter*

Description

Runs the Kalman Filter for UC models Standard methods applicable to UComp objects are print, summary, plot, fitted, residuals, logLik, AIC, BIC, coef, predict, tsdiag.

Usage

```
UCfilter(sys)
```

Arguments

sys	an object of type UComp created with UC

Value

The same input object with the appropriate fields filled in, in particular:

- yFit: Fitted values of output
- yFitV: Variance of fitted values of output
- a: State estimates
- P: Variance of state estimates (diagonal of covariance matrices)

Author(s)

Diego J. Pedregal

See Also

UC, UCforecast, UCvalidate, UCsmooth, UCdisturb, UCcomponents, UChp

Examples

```
m1 <- UC(log(AirPassengers))
m1 <- UCfilter(m1)
```

`UCforecast` *UCforecast*

Description

Estimates and forecasts UC general univariate models

Usage

```
UCforecast(
  y,
  u = NULL,
  model = "?/none/?/?",
  h = 24,
  lambda = 1,
  outlier = 9999,
  tTest = FALSE,
  criterion = "aic",
  periods = NA,
  verbose = FALSE,
  stepwise = FALSE,
  p0 = -9999.9,
  arma = FALSE,
  TVP = NULL,
  trendOptions = "none/rw/llt/dt",
```

```
  seasonalOptions = "none/equal/different",
  irregularOptions = "none/arma(0,0)"
)
```

Arguments

y	a time series to forecast (it may be either a numerical vector or a time series object). This is the only input required. If a vector, the additional input periods should be supplied compulsorily (see below).
u	a matrix of external regressors included only in the observation equation. (it may be either a numerical vector or a time series object). If the output wanted to be forecast, matrix u should contain future values for inputs.
model	the model to estimate. It is a single string indicating the type of model for each component. It allows two formats "trend/seasonal/irregular" or "trend/cycle/seasonal/irregular". The possibilities available for each component are: • Trend: ? / none / rw / irw / llt / dt / td; • Seasonal: ? / none / equal / different; • Irregular: ? / none / arma(0, 0) / arma(p, q) - with p and q integer positive orders; • Cycles: ? / none / combination of positive or negative numbers. Positive numbers fix the period of the cycle while negative values estimate the period taking as initial condition the absolute value of the period supplied. Several cycles with positive or negative values are possible and if a question mark is included, the model test for the existence of the cycles specified. The following are valid examples with different meanings: 48, 48?, -48, -48?, 48+60, -48+60, -48-60, 48-60, 48+60?, -48+60?, -48-60?, 48-60?.
h	forecast horizon. If the model includes inputs h is not used, the lenght of u is used instead.
lambda	Box-Cox transformation lambda, NULL for automatic estimation
outlier	critical level of outlier tests. If NA it does not carry out any outlier detection (default). A positive value indicates the critical minimum t test for outlier detection in any model during identification. Three types of outliers are identified, namely Additive Outliers (AO), Level Shifts (LS) and Slope Change (SC).
tTest	augmented Dickey Fuller test for unit roots used in stepwise algorithm (TRUE / FALSE). The number of models to search for is reduced, depending on the result of this test.
criterion	information criterion for identification ("aic", "bic" or "aicc").
periods	vector of fundamental period and harmonics required.
verbose	intermediate results shown about progress of estimation (TRUE / FALSE).
stepwise	stepwise identification procedure (TRUE / FALSE).
p0	initial parameter vector for optimisation search.
arma	check for arma models for irregular components (TRUE / FALSE).
TVP	vector of zeros and ones to indicate TVP parameters.
trendOptions	trend models to select amongst (e.g., "rw/llt").

`seasonalOptions`
: seasonal models to select amongst (e.g., "none/differentt").

`irregularOptions`
: irregular models to select amongst (e.g., "none/arma(0,1)").

Details

`UCforecast` is a function for modelling and forecasting univariate time series according to Unobserved Components models (UC). It sets up the model with a number of control variables that govern the way the rest of functions in the package work. It also estimates the model parameters by Maximum Likelihood and forecasts the data. Standard methods applicable to UComp objects are print, summary, plot, fitted, residuals, logLik, AIC, BIC, coef, predict, tsdiag.

Value

An object of class `UComp`. It is a list with fields including all the inputs and the fields listed below as outputs. All the functions in this package fill in part of the fields of any `UComp` object as specified in what follows (function `UC` fills in all of them at once):

After running `UCforecast`:

- p: Estimated parameters
- v: Estimated innovations (white noise in correctly specified models)
- yFor: Forecasted values of output
- yForV: Forecasted values +- one standard error
- criteria: Value of criteria for estimated model
- iter: Number of iterations in estimation
- grad: Gradient at estimated parameters
- covp: Covariance matrix of parameters

After running `UCvalidate`:

- table: Estimation and validation table

After running `UCcomponents`:

- comp: Estimated components in matrix form
- compV: Estimated components variance in matrix form

After running `UCfilter`, `UCsmooth` or `UCdisturb`:

- yFit: Fitted values of output
- yFitV: Variance of fitted values of output
- a: State estimates
- P: Variance of state estimates
- aFor: Forecasts of states
- PFor: Forecasts of states variances

After running `UCdisturb`:

- eta: State perturbations estimates
- eps: Observed perturbations estimates

Author(s)

Diego J. Pedregal

See Also

UC, UCvalidate, UCfilter, UCsmooth, UCdisturb, UCcomponents, UChp

Examples

```
y <- log(AirPassengers)
m1 <- UCforecast(y)
m1 <- UCforecast(y, model = "llt/equal/arma(0,0)")
```

UChp *UChp*

Description

Hodrick-Prescott filter estimation

Usage

```
UChp(y, lambda = 1600)
```

Arguments

y	A time series object
lambda	Smoothing constant (default: 1600)

Value

The cycle estimation

Author(s)

Diego J. Pedregal

See Also

UC, UCforecast, UCvalidate, UCfilter, UCsmooth, UCcomponents, UCdisturb

Examples

```
cycle <- UChp(USgdp)
plot(cycle)
```

UComp *UComp*

Description

Package for time series modelling and forecasting of times series models inspired on different sources:

Details

- Unobserved Components models due to A.C. Harvey (Basic Structural Model: BSM), enhanced with automatic identification tools by Diego J. Pedregal.
- ExponenTial Smoothing by R.J. Hyndman and colaborators.
- ARIMA models by V. Gómez and A. Maravall
- Tobit ETS models by Pedregal, Trapero and Holgado

The package is designed for automatic identification among a wide range of possible models. The models may include exogenous variables. ARMA irregular components and automatic detection of outliers in some instances.

References

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Durbin J, Koopman SJ (2012). Time Series Analysis by State Space Methods. 38. Oxford University Press.

Proietti T and Luati A (2013). Maximum likelihood estimation of time series models: the Kalman filter and beyond, in Handbook of research methods and applications in empirical macroeconomics, ed. Nigar Hashimzade and Michael Thornton, E. Elgar, UK.

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Gómez V and Maravall, A (2000), Automatic methods for univariate series. In Peña, D., Tiao, G.C. and Tsay R.S., A course in time series analyis. Wiley.

Trapero JR, Holgado E, Pedregal DJ (2024), Demand forecasting under lost sales stock policies, International Journal of Forecasting, 40, 1055-1068.

Maintainer

Diego J. Pedregal

Author(s)

Diego J. Pedregal

`UCsetup` *UCsetup*

Description

Sets up UC general univariate models

Usage

```
UCsetup(
  y,
  u = NULL,
  model = "?/none/?/?",
  h = 24,
  lambda = 1,
  outlier = 9999,
  tTest = FALSE,
  criterion = "aic",
  periods = NA,
  verbose = FALSE,
  stepwise = FALSE,
  p0 = -9999.9,
  arma = FALSE,
  TVP = NULL,
  trendOptions = "none/rw/llt/dt",
  seasonalOptions = "none/equal/different",
  irregularOptions = "none/arma(0,0)"
)
```

Arguments

`y`	a time series to forecast (it may be either a numerical vector or a time series object). This is the only input required. If a vector, the additional input `periods` should be supplied compulsorily (see below).
`u`	a matrix of external regressors included only in the observation equation. (it may be either a numerical vector or a time series object). If the output wanted to be forecast, matrix `u` should contain future values for inputs.
`model`	the model to estimate. It is a single string indicating the type of model for each component. It allows two formats "trend/seasonal/irregular" or "trend/cycle/seasonal/irregular". The possibilities available for each component are: • Trend: ? / none / rw / irw / llt / dt / td; • Seasonal: ? / none / equal / different;

- Irregular: ? / none / arma(0, 0) / arma(p, q) - with p and q integer positive orders;
- Cycles: ? / none / combination of positive or negative numbers. Positive numbers fix the period of the cycle while negative values estimate the period taking as initial condition the absolute value of the period supplied. Several cycles with positive or negative values are possible and if a question mark is included, the model test for the existence of the cycles specified. The following are valid examples with different meanings: 48, 48?, -48, -48?, 48+60, -48+60, -48-60, 48-60, 48+60?, -48+60?, -48-60?, 48-60?.

`h` forecast horizon. If the model includes inputs h is not used, the lenght of u is used instead.

`lambda` Box-Cox transformation lambda, NULL for automatic estimation

`outlier` critical level of outlier tests. If NA it does not carry out any outlier detection (default). A positive value indicates the critical minimum t test for outlier detection in any model during identification. Three types of outliers are identified, namely Additive Outliers (AO), Level Shifts (LS) and Slope Change (SC).

`tTest` augmented Dickey Fuller test for unit roots used in stepwise algorithm (TRUE / FALSE). The number of models to search for is reduced, depending on the result of this test.

`criterion` information criterion for identification ("aic", "bic" or "aicc").

`periods` vector of fundamental period and harmonics required.

`verbose` intermediate results shown about progress of estimation (TRUE / FALSE).

`stepwise` stepwise identification procedure (TRUE / FALSE).

`p0` initial parameter vector for optimisation search.

`arma` check for arma models for irregular components (TRUE / FALSE).

`TVP` vector of zeros and ones to indicate TVP parameters.

`trendOptions` trend models to select amongst (e.g., "rw/llt").

`seasonalOptions`
seasonal models to select amongst (e.g., "none/differentt").

`irregularOptions`
irregular models to select amongst (e.g., "none/arma(0,1)").

Details

See help of `UC`.

Value

An object of class `UComp`. It is a list with fields including all the inputs and the fields listed below as outputs. All the functions in this package fill in part of the fields of any `UComp` object as specified in what follows (function `UC` fills in all of them at once):

After running `UCforecast`:

- p: Estimated parameters

- v: Estimated innovations (white noise in correctly specified models)
- yFor: Forecasted values of output
- yForV: Variance of forecasts
- criteria: Value of criteria for estimated model
- iter: Number of iterations in estimation
- grad: Gradient at estimated parameters
- covp: Covariance matrix of parameters

After running `UCvalidate`:

- table: Estimation and validation table

After running `UCcomponents`:

- comp: Estimated components in matrix form
- compV: Estimated components variance in matrix form

After running `UCfilter`, `UCsmooth` or `UCdisturb`:

- yFit: Fitted values of output
- yFitV: Estimated fitted values variance
- a: State estimates
- P: Variance of state estimates
- aFor: Forecasts of states
- PFor: Forecasts of states variances

After running `UCdisturb`:

- eta: State perturbations estimates
- eps: Observed perturbations estimates

Standard methods applicable to UComp objects are print, summary, plot, fitted, residuals, logLik, AIC, BIC, coef, predict, tsdiag.

Author(s)

Diego J. Pedregal

See Also

UC, UCforecast, UCvalidate, UCfilter, UCsmooth, UCdisturb, UCcomponents, UChp

Examples

```
y <- log(AirPassengers)
m1 <- UCsetup(y)
m1 <- UCsetup(y, outlier = 4)
m1 <- UCsetup(y, model = "llt/equal/arma(0,0)")
m1 <- UCsetup(y, model = "?/?/?/?")
m1 <- UCsetup(y, model = "llt/?/equal/?", outlier = 4)
```

UCsmooth *UCsmooth*

Description

Runs the Fixed Interval Smoother for UC models Standard methods applicable to UComp objects are print, summary, plot, fitted, residuals, logLik, AIC, BIC, coef, predict, tsdiag.

Usage

```
UCsmooth(sys)
```

Arguments

sys	an object of type UComp created with UC

Value

The same input object with the appropriate fields filled in, in particular:

- yFit: Fitted values of output
- yFitV: Variance of fitted values of output
- a: State estimates
- P: Variance of state estimates (diagonal of covariance matrices)

Author(s)

Diego J. Pedregal

See Also

UC, UCforecast, UCvalidate, UCfilter, UCdisturb, UCcomponents, UChp

Examples

```
m1 <- UC(log(AirPassengers))
m1 <- UCsmooth(m1)
```

UCvalidate *UCvalidate*

Description

Shows a table of estimation and diagnostics results for UC models. Equivalent to print or summary. The table shows information in four sections: Firstly, information about the model estimated, the relevant periods of the seasonal component included, and further information about convergence. Secondly, parameters with their names are provided, the asymptotic standard errors, the ratio of the two, and the gradient at the optimum. One asterisk indicates concentrated-out parameters and two asterisks signals parameters constrained during estimation. Thirdly, information criteria and the value of the log-likelihood. Finally, diagnostic statistics about innovations, namely, the Ljung-Box Q test of absense of autocorrelation statistic for several lags, the Jarque-Bera gaussianity test, and a standard ratio of variances test.

Usage

```
UCvalidate(sys, printScreen = TRUE)
```

Arguments

sys	an object of type UComp created with UC
printScreen	print to screen or just return output table

Value

The same input object with the appropriate fields filled in, in particular:

- table: Estimation and validation table

Author(s)

Diego J. Pedregal

See Also

UC, UCforecast, UCfilter, UCsmooth, UCdisturb, UCcomponents, UChp

Examples

```
m1 <- UC(log(gdp))
m1 <- UCvalidate(m1)
```

USgdp *US GDP*

Description

Seasonally adjusted quarterly US real gross domestic product (USgdp).

Usage

```
USgdp
```

Format

Time series objects.

Quarterly data from 1962 to 2019

Value

No return value, called for side effects

Source

USgdp

Examples

```
USgdp
```

varTest *varTest*

Description

Ratio of variances test

Usage

```
varTest(y, parts = 1/3)
```

Arguments

y	a vector, ts or tsibble object
parts	portion of sample to estimate variances

Value

Table with test results

Author(s)

Diego J. Pedregal

See Also

colMedians, rowMedians, tests, sumStats, gaussTest, ident, cusum, conv, armaFilter, dif, roots, zplane, acft, slide, plotSlide, Accuracy, tsDisplay, size

Examples

```
varTest(AirPassengers)
```

---

zplane *zplane*

Description

Real-imaginary plane to show roots of digital filters (ARMA)

Usage

```
zplane(MApoly = 1, ARpoly = 1)
```

Arguments

MApoly	coefficients of numerator polynomial in descending order
ARpoly	coefficients of denominator polynomial in descending order

Details

Shows the real-imaginary plane to show zeros (roots of numerator or MA polynomial) and poles (roots of denominator of AR polynomial). Unit roots and real vs imaginary roots can be seen by eye

Value

No return value, called for side effects

Author(s)

Diego J. Pedregal

See Also

colMedians, rowMedians, tests, sumStats, gaussTest, ident, cusum, varTest, conv, armaFilter, dif, roots, acft, slide, plotSlide, Accuracy, tsDisplay, size

Examples

```
zplane(c(1, -2, 1), c(1, -0.8))
```

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