Package ‘FitARMA’

January 4, 2019

Title  Fit ARMA or ARIMA Using Fast MLE Algorithm
Version  1.6.1
Date  2013-09-26
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Depends  R (>= 2.1.0), FitAR
Description  Implements fast maximum likelihood algorithm for fitting ARMA time series. Uses S3 methods print, summary, fitted, residuals. Fast exact Gaussian ARMA simulation.

Classification/ACM  G.3, G.4, I.5.1
Classification/MSC  62M10, 91B84
License  GPL (>= 2)
URL  http://fisher.stats.uwo.ca/faculty/aim
NeedsCompilation  yes
Repository  CRAN
Date/Publication  2019-01-04 16:33:55 UTC

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FitARMA-package

FitARMA: Fit ARMA or ARIMA using fast MLE algorithm

Description

Fit ARMA/ARIMA time series model using fast algorithm. All MLE computations in R. Two estimation functions: 'FitARMA' and 'GetFitARMA' are provided. 'FitARMA' provides more options including an option for exact MLE estimation of the intercept term. 'GetFitARMA' is provided for bootstrapping and simulation experiments. S3 Methods 'print', 'summary', 'coef', 'residuals', 'fitted' provided. Fast exact Gaussian ARMA simulation using C.

Details

Package: FitARMA
Type: Package
Version: 1.4
Date: 2010-12-01
License: GLP 2.0 or greater
LazyLoad: yes

FitARMA is the main function.

Author(s)

A.I. McLeod

References


See Also

arima, AcfPlot

Examples

data(SeriesA)
#ARIMA(0,1,1) with exact estimation of mean of differenced series
ans<-FitARMA(SeriesA, order=c(0,1,1), MeanMLEQ=TRUE)
ans
coef(ans)
#ARIMA(0,1,1) with sample-mean estimation of mean of differenced series
ans<-FitARMA(SeriesA, order=c(0,1,1))
ans
coef(ans)
#ARIMA(0,1,1) with mean of differenced series set to zero
#as in 'arima'
ans<-FitARMA(SeriesA, order=c(0,1,1), demean=FALSE)
ans
c coef(ans)
# illustrating methods
summary(ans)
resid(ans)
fitted(ans)
ans$racf
#Simulate and fit Gaussian ARMA
z<-SimulateGaussianARMA(0.9, 0.5, 200)
#GetFitARMA is faster than FitARMA.
#Use GetFitARMA for parametric bootstrap and simulation experiments
GetFitARMA(z, p=1, q=1)

---

c coef method for class FitARMA

Description

produces table showing parameters, standard errors and Z-ratios

Usage

## S3 method for class 'FitARMA'
c coef(object, ...)

Arguments

object class FitARMA object
...
auxiliary parameters

Value

matrix with 3 columns

Author(s)

A.I. McLeod

See Also

FitARMA
Examples

```r
data(SeriesA)
out<-FitARMA(SeriesA, c(1,0,1))
coef(out)
```

---

**Description**

Fits an ARIMA(p,d,q) model using the algorithm given in McLeod and Zhang (2007).

**Usage**

```
FitARMA(z, order = c(0, 0, 0), demean = TRUE, MeanMLEQ = FALSE, pApprox = 30, MaxLag = 30)
```

**Arguments**

- `z`: time series
- `order`: model order, c(p,d,q)
- `demean`: if TRUE, mean parameter included otherwise assumed zero
- `MeanMLEQ`: exact MLE for mean, ignored unless demean=TRUE
- `pApprox`: order of approximation to be used
- `MaxLag`: maximum number of lags for portmanteau test

**Details**

See McLeod and Ying (2007).

**Value**

A list with class name "FitARMA" and components:

- `loglikelihood`: value of the loglikelihood
- `phiHat`: AR coefficients
- `thetaHat`: MA coefficients
- `sigsqHat`: innovation variance estimate
- `muHat`: estimate of the mean
- `covHat`: covariance matrix of the coefficient estimates
- `racf`: residual autocorrelations
- `LjungBox`: table of Ljung-Box portmanteau test statistics
- `res`: innovation residuals, same length as `z`
- `fits`: fitted values, same length as `z`
demean  TRUE if mean estimated otherwise assumed zero
IterationCount  number of iterations in mean mle estimation
convergence  value returned by optim – should be 0
MLEMeanQ  TRUE if mle for mean algorithm used
tsp  tsp(z)
call  result from match.call() showing how the function was called
ModelTitle  description of model
DataTitle  returns attr(z,"title")

Note

When \( d>0 \) and demean=TRUE, the mean of the differenced series is estimated. This corresponds to including a polynomial of degree \( d \).

When \( d>0 \), the AIC/BIC are computed for the differenced series and so they are not comparable to the values obtained for models with \( d=0 \).

Author(s)

A.I. McLeod, aimcleod@uwo.ca

References


See Also

GetFitARMA, print.FitARMA, coef.FitARMA, residuals.FitARMA, fitted.FitARMA, arima

Examples

data(SeriesA) #in datasets()
out1<-FitARMA(SeriesA, c(1,0,1))
out1
coeff(out1)
out2<-FitARMA(SeriesA, c(0,1,1))
out2
coeff(out2)
fitted method for class FitARMA

Description

The fitted values are the observed minus residuals. If there is differencing, the observed values are those corresponding to the differenced time series.

Usage

```r
## S3 method for class 'FitARMA'
fitted(object, ...)
```

Arguments

- `object` class FitARMA object
- `...` auxiliary parameters

Value

vector or ts object

Author(s)

A.I. McLeod

See Also

`FitARMA`

Examples

```r
data(SeriesA)
out<-FitARMA(SeriesA, c(1,0,1))
fitted(out)
```
GetFitARMA

Fit ARMA\((p,q)\) model to mean zero time series.

Description
The algorithm of McLeod and Zhang (2007) is used.

Usage
GetFitARMA\((y, p, q, p\text{Approx} = 30, \text{init} = 0)\)

Arguments
- \(y\) time series
- \(p\) AR order
- \(q\) MA order
- \(p\text{Approx}\) AR approximation
- \(\text{init}\) initial parameter estimates

Details

Value
- \(\text{loglikelihood}\) value of maximized loglikelihood
- \(\text{phiHat}\) estimated phi parameters
- \(\text{thetaHat}\) estimated theta parameters
- \(\text{convergence}\) result from optim
- \(\text{algorithm}\) indicates "L-BFGS-B" or "Nelder-Mead" according as which algorithm was used in optim

Author(s)
A.I. McLeod, aimcleod@uwo.ca

References

See Also
arima, FitARMA
**ImpulseCoefficientsARMA**

> **Impulse coefficients of ARMA**

**Description**

The coefficients in the infinite MA expansion of the ARMA model are determined.

**Usage**

```r
ImpulseCoefficientsARMA(phi, theta, lag.max)
```

**Arguments**

- `phi`: AR coefficients
- `theta`: MA coefficients
- `lag.max`: lags 0,...,lag.max

**Value**

vector length lag.max+1

**Author(s)**

A.I. McLeod

**Examples**

```r
ImpulseCoefficientsARMA(0.9, 0.5, 20)
```
Description

The expected large-sample information matrix per observation for ARMA(p,q) models is computed.

Usage

InformationMatrixARMA(phi = numeric(0), theta = numeric(0))

Arguments

phi AR coefficients
theta MA coefficients

Details

The information matrix is derived by Box and Jenkins (1970).

Value

a matrix of order (p+q)

Author(s)

A.I. McLeod

References


See Also

FitARMA

Examples

#The covariance matrix estimates of the parameters phi and theta in an ARMA(1,1) #with phi=0.9 and theta=0.5 and n=200 is 
v<-solve(InformationMatrixARMA(0.9,0.5))/200 
#and the standard errors are 
sqrt(diag(v))
residuals.FitARMA

Description

The innovation residuals are obtained.

Usage

## S3 method for class 'FitARMA'
residuals(object, ...)

Arguments

- object: An object of class FitARMA
- ...: Optional arguments

Value

The innovation residuals are returned.

Author(s)

A.I. McLeod

See Also

FitARMA

Examples

data(SeriesA)
FitARMA(SeriesA, c(1,0,1))
SimulateGaussianARMA

Arguments

object class FitARMA object
... auxiliary parameters

Value

vector or ts object

Author(s)

A.I. McLeod

See Also

FitARMA

Examples

data(SeriesA)
out<-FitARMA(SeriesA, c(1,0,1))
resid(out)

SimulateGaussianARMA Simulate Gaussian ARMA model

Description

An exact simulation method is used to simulate Gaussian ARMA models.

Usage

SimulateGaussianARMA(phi, theta, n, InnovationVariance = 1, UseC = TRUE)

Arguments

phi AR coefficients
theta MA coefficients
n length of series
InnovationVariance innovation variable, default is 1
UseC if UseC=TRUE, use C code. Otherwise, use slower R code.

Details

The detailed description is given in Hipel and McLeod (1994, 2006).
Value

a vector containing the time series

Author(s)

A.I. McLeod

References


See Also

arima.sim

Examples

z <- SimulateGaussianARMA(0.9, 0.5, 200)
FitARMA(z, c(1, 0, 1))

summary.FitARMA

Description

a summary is printed out of the fitted model

Usage

## S3 method for class 'FitARMA'
summary(object, ...)

Arguments

object object, class FitARMA
... optional arguments

Value

the result is displayed

Author(s)

A.I. McLeod
See Also

FitARMA

Examples

data(SeriesA)
out<-FitARMA(SeriesA, c(1,0,1))
summary(out)

Description

The theoretical autocovariance function of an ARMA(p,q) with unit variance is computed. This
algorithm has many applications. In this package it is used for the computation of the information
matrix, in simulating p initial starting values for AR simulations and in the computation of the exact
mle for the mean.

Usage

TacvfARMA(phi = numeric(0), theta = numeric(0), lag.max = 20)

Arguments

phi AR coefficients
theta MA coefficients
lag.max computes autocovariances lags 0,1,...,lag.max

Details

The algorithm given by McLeod (1975) is used.
The built-in R function ARMAacf could also be used but it is quite complicated and apart from the
source code, the precise algorithm used is not described. The only reference given for ARMAacf
is the Brockwell and Davis (1991) but this text does not give any detailed exact algorithm for the
general case.

Another advantage of TacvfARMA over ARMAacf is that it will be easier for to translate and
implement this algorithm in other computing environments such as MatLab etc.

Value

vector of length lag.max+1 containing the autocovariances is returned

Author(s)

A.I. McLeod
References


See Also

armaacf, InformationMatrixARMA

Examples

# calculate and plot the autocorrelations from an ARMA(1,1) model
# with parameters phi=0.9 and theta=0.5

mod <- armaFARMA(0.9, 0.5, 20)
AcfPlot(mod, LagZero=FALSE)

---

tccfAR Argument(s)

phi AR coefficients in ARMA
theta MA coefficients in ARMA

Details

A set of linear equations which determine the covariances is solved. The algorithm is similar in spirit to that for the autocovariances (McLeod, 1975).

Value

vector of cross-covariances

Author(s)

A.I. McLeod
References


See Also

InformationMatrixARMA

Examples

tccfAR(0.9,0.5)
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