Package ‘FitARMA’
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Title FitARMA: Fit ARMA or ARIMA using fast MLE algorithm
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Author A.I. McLeod
Maintainer A.I. McLeod <aimcleod@uwo.ca>
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Description Implements fast maximum likelihood algorithm for fitting ARMA time series. Uses S3 methods print, summary, fitted, residuals. Fast exact Gaussian ARMA simulation.

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R topics documented:

  FitARMA-package ......................................................... 2
  coef.FitARMA ............................................................. 3
  FitARMA ................................................................. 4
  fitted.FitARMA .......................................................... 6
  GetFitARMA ............................................................... 7
  ImpulseCoefficientsARMA ............................................... 8
  InformationMatrixARMA ............................................... 9
  print.FitARMA ........................................................... 10
  residuals.FitARMA ..................................................... 10
  SimulateGaussianARMA ............................................... 11
  summary.FitARMA ....................................................... 12
  TacvfARMA .............................................................. 13
  tccfAR ................................................................. 14

Index 16
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.

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)
coef.FitARMA

```r
#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
go
# illustrating methods
summary(ans)
resid(ans)
fitted(ans)
ans$acf
#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)```

---

**Description**

produces table showing parameters, standard errors and Z-ratios

**Usage**

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

**Arguments**

- object: class FitARMA object
- ...: auxiliary parameters

**Value**

matrix with 3 columns

**Author(s)**

A.I. McLeod

**See Also**

FitARMA
Examples

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
coef(out1)
out2<-FitARMA(SeriesA, c(0,1,1))
out2
coef(out2)
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 \text{optim}
- \(\text{algorithm}\): indicates "L-BFGS-B" or "Nelder-Mead" according as which algorithm was used in \text{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

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

ImpulseCoefficientsARMA(0.9, 0.5, 20)
Description

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

Usage

\[
\text{informationMatrixARMA}(\text{phi} = \text{numeric}(\theta), \text{theta} = \text{numeric}(\theta))
\]

Arguments

- \text{phi} \quad \text{AR coefficients}
- \text{theta} \quad \text{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

v

#and the standard errors are

sqrt(diag(v))
print.FitARMA  

print method for class FitARMA

Description

A brief summary is printed out of the fitted model.

Usage

```r
## S3 method for class 'FitARMA'
print(x, ...)
```

Arguments

- `x`: object, class FitARMA
- `...`: optional arguments

Value

The result is displayed.

Author(s)

A.I. McLeod

See Also

FitARMA

Examples

```r
data(SeriesA)  
FitARMA(SeriesA, c(1,0,1))
```

residuals.FitARMA  

residuals method for class FitARMA

Description

The innovation residuals are obtained.

Usage

```r
## S3 method for class 'FitARMA'
residuals(object, ...)  
```
Simulate Gaussian ARMA

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)

Simulate Gaussian ARMA (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
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
> t <- tacfarma(0.9, 0.5, 20)
> AcfPlot(t, g[1], LagZeroQ=FALSE)

---

tccfAR  Theoretical cross-covariances of auxiliary AR process in ARMA(p,q)

Description

The auxiliary AR processes in the ARMA(p,q) model \( \phi(B)z(t) = \theta(B)a(t) \) are defined by \( \phi(B)u(t) = -a(t) \) and \( \theta(B)v(t) = a(t) \). The upper off-diagonal p-by-q block of the ARMA information matrix is obtained from the cross-covariances of \( u(t) \) and \( v(t) \). This function obtains these covariances.

Usage

tccfAR(phi, theta)

Arguments

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)
Index

*Topic package
  FitARMA-package, 2
*Topic ts
  coef.FitARMA, 3
  FitARMA, 4
  FitARMA-package, 2
  fitted.FitARMA, 6
  GetFitARMA, 7
  ImpulseCoefficientsARMA, 8
  InformationMatrixARMA, 9
  print.FitARMA, 10
  residuals.FitARMA, 10
  SimulateGaussianARMA, 11
  summary.FitARMA, 12
  TacvfARMA, 13
  tccfAR, 14

AcfPlot, 2
arima, 2, 5, 7
arima.sim, 12
ARMAacf, 14

coef.FitARMA, 3, 5
FitARMA, 3, 4, 6, 7, 9–11, 13
FitARMA-package, 2
fitted.FitARMA, 5, 6

GetFitARMA, 5, 7

ImpulseCoefficientsARMA, 8
InformationMatrixARMA, 9, 14, 15

print.FitARMA, 5, 10
residuals.FitARMA, 5, 10

SimulateGaussianARMA, 11
summary.FitARMA, 12

TacvfARMA, 13
tccfAR, 14