Package ‘astsa’

December 22, 2016

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astsa-package Applied Statistical Time Series Analysis

Description


Details

Package: astsa
Type: Package
Version: 1.7
Date: 2016-12-24
License: GPL (>= 2)
LazyLoad: yes
LazyData: yes

Author(s)

David Stoffer <stoffer@pitt.edu>

References

See the webpage for the text: http://www.stat.pitt.edu/stoffer/lsa4/
acf2  

Plot and print ACF and PACF of a time series

Description

Produces a simultaneous plot (and a printout) of the sample ACF and PACF on the same scale. The zero lag value of the ACF is removed.

Usage

acf2(series, max.lag = NULL, ...)

Arguments

series  
The data. Does not have to be a time series object.
max.lag  
Maximum lag. Can be omitted. Defaults to $\sqrt{n} + 10$ unless $n < 50$.
...  
Additional arguments passed to acf

Details

This is basically a wrapper for acf() provided in tseries. The error bounds are approximate white noise bounds, $0 \pm 2/\sqrt{n}$; no other option is given.

Value

ACF  
The sample ACF
PACF  
The sample PACF

Author(s)

D.S. Stoffer

References

http://www.stat.pitt.edu/stoffer/tsa4/

Examples

acf2(rnorm(100))
acf2(rnorm(100), 25)
ar1miss  

**Description**

Data used in Chapter 6

**Format**

The format is: Time-Series [1:100] with NA for missing values.

**References**

http://www.stat.pitt.edu/stoffer/tsa4/

arf  

**Simulated ARFIMA**

**Description**

1000 simulated observations from an ARFIMA(1, 1, 0) model with $\phi = .75$ and $d = .4$.

**Format**

The format is: Time-Series [1:1000] from 1 to 1000: -0.0294 0.7487 -0.3386 -1.0332 -0.2627 ...

**References**

http://www.stat.pitt.edu/stoffer/tsa4/

arma.spec  

**Spectral Density of an ARMA Model**

**Description**

Gives the ARMA spectrum (on a log scale), tests for causality, invertibility, and common zeros.

**Usage**

arma.spec(ar = 0, ma = 0, var.noise = 1, n.freq = 500, ...)

Arguments

- **ar** vector of AR parameters
- **ma** vector of MA parameters
- **var.noise** variance of the noise
- **n.freq** number of frequencies
- **...** additional arguments

Details

The basic call is `arma.spec(ar, ma)` where `ar` and `ma` are vectors containing the model parameters. Use `log="no"` if you do not want the plot on a log scale. If the model is not causal or invertible an error message is given. If there are common zeros, a spectrum will be displayed and a warning will be given; e.g., `arma.spec(ar = .9, ma = -.9)` will yield a warning and the plot will be the spectrum of white noise.

Value

- **freq** frequencies - returned invisibly
- **spec** spectral ordinates - returned invisibly

Author(s)

D.S. Stoffer

References


Examples

`arma.spec(ar = c(1, -.9), ma = .8, log="no")`

Description

Infrasonic signal from a nuclear explosion.

Usage

`data(beamd)`

Format

A data frame with 2048 observations (rows) on 3 numeric variables (columns): sensor1, sensor2, sensor3.
**birth**

**Details**

This is a data frame consisting of three columns (that are not time series objects). The data are an infrasonic signal from a nuclear explosion observed at sensors on a triangular array.

**References**

http://www.stat.pitt.edu/stoffer/tsa4/

---

**birth**  
*U.S. Monthly Live Births*

**Description**


**Format**

The format is: Time-Series [1:373] from 1948 to 1979: 295 286 300 278 272 268 308 321 313 308 ...

**References**

http://www.stat.pitt.edu/stoffer/tsa4/

---

**blood**  
*Daily Blood Work*

**Description**

Multiple time series of measurements made for 91 days on the three variables, log(white blood count) [WBC], log(platelet) [PLT] and hematocrit [HCT]. Missing data code is NA.

**Format**

The format is: mts [1:91, 1:3]

**Details**

This is the data set used in Chapter 6 with NA as the missing data code.

**Source**

References

http://www.stat.pitt.edu/stoffer/tsa4/

See Also

HCT, PLT, WBC

Examples

## Not run: plot(blood, type="o", pch=19)

---

bnrf1ebv  Nucleotide sequence - BNRF1 Epstein-Barr

Description

Nucleotide sequence of the BNRF1 gene of the Epstein-Barr virus (EBV): 1=A, 2=C, 3=G, 4=T. The data are used in Chapter 7.

Format

The format is: Time-Series [1:3954] from 1 to 3954: 1 4 3 3 1 1 3 1 3 1 ...

References

http://www.stat.pitt.edu/stoffer/tsa4/

---

bnrf1hvs  Nucleotide sequence - BNRF1 of Herpesvirus saimiri

Description

Nucleotide sequence of the BNRF1 gene of the herpesvirus saimiri (HVS): 1=A, 2=C, 3=G, 4=T. The data are used in Chapter 7.

Format

The format is: Time-Series [1:3741] from 1 to 3741: 1 4 3 2 4 3 4 4 4 ...
chicken  

Monthly price of a pound of chicken

Description
Poultry (chicken), Whole bird spot price, Georgia docks, US cents per pound

Usage
data("chicken")

Format
The format is: Time-Series [1:180] from August 2001 to July 2016: 65.6 66.5 65.7 64.3 63.2 ...

Source
http://www.indexmundi.com/commodities/

References
http://www.stat.pitt.edu/stoffer/tsa4/

climhyd  

Lake Shasta inflow data

Description
Lake Shasta inflow data This is a data frame.

Format
A data frame with 454 observations (rows) on the following 6 numeric variables (columns): Temp, DewPt, CldCvr, WndSpd, Precip, Inflow.

Details
The data are 454 months of measured values for the climatic variables: air temperature, dew point, cloud cover, wind speed, precipitation, and inflow, at Lake Shasta, California. The man-made lake is famous for the placard stating, "We don’t swim in your toilet, so don’t pee in our lake."

References
http://www.stat.pitt.edu/stoffer/tsa4/
**cmort**  
*Cardiovascular Mortality from the LA Pollution study*

**Description**

Average weekly cardiovascular mortality in Los Angeles County; 508 six-day smoothed averages obtained by filtering daily values over the 10 year period 1970-1979.

**Format**

The format is: Time-Series [1:508] from 1970 to 1980: 97.8 104.6 94.4 98 95.8 ...

**References**

http://www.stat.pitt.edu/stoffer/tsa4/

**See Also**

lap

---

**cpg**  
*Hard Drive Cost per GB*

**Description**

Median annual cost per gigabyte (GB) of storage.

**Format**

The format is: Time-Series [1:29] from 1980 to 2008: 213000.00 295000.00 260000.00 175000.00 160000.00 ...

**Details**

The median annual cost of hard drives used in computers. The data are retail prices per GB taken from a sample of manufacturers.

**Source**

http://ns1758.ca/winch/winchest.html

**References**

http://www.stat.pitt.edu/stoffer/tsa4/
**djia**  
*Dow Jones Industrial Average*

**Description**

Daily DJIA values from April 2006 - April 2016

**Format**

The format is: xts [1:2518, 1:5] 11279 11343 11347 11337 11283 ...  
- attr(*, "class")= chr [1:2] "xts" "zoo"  
- attr(*, "indexCLASS")= chr "Date"  
- attr(*, "indexTZ")= chr "UTC"  
- attr(*, "tclass")= chr "Date"  
- attr(*, "tzone")= chr "UTC"  
- attr(*, "index")= atomic [1:2518] 1.15e+09 1.15e+09 1.15e+09 1.15e+09 1.15e+09 ...  
..- attr(*, "tzone")= chr "UTC"  
..- attr(*, "tclass")= chr "Date"  
- attr(*, "dimnames")=List of 2  
..$ : NULL  
..$ : chr [1:5] "Open" "High" "Low" "Close" ...

**Source**

The data were obtained as follows, and can be updated in a similar way.  
library(TTR) # install.packages('TTR') if you don't have it  
djia = getYahooData("^DJI", start=20060420, end=20160420, freq="daily")

**References**

http://www.stat.pitt.edu/stoffer/tsa4/

---

**econ5**  
*Five Quarterly Economic Series*

**Description**

Data frame containing quarterly U.S. unemployment, GNP, consumption, and government and private investment, from 1948-III to 1988-II.

**Usage**

data(econ5)
Format

A data frame with 161 observations (rows) on the following 5 numeric variables (columns): unemp, gnp, consum, goinv, privn.

Source


References

http://www.stat.pitt.edu/stoffer/tsa4/

Description

Estimation of the parameters in the model (6.1)–(6.2) via the EM algorithm.

Usage

EM0(num, y, A, mu0, Sigma0, Phi, cQ, cR, max.iter = 50, tol = 0.01)

Arguments

num number of observations
y observation vector or time series
A time-invariant observation matrix
mu0 initial state mean vector
Sigma0 initial state covariance matrix
Phi state transition matrix
cQ Cholesky-like decomposition of state error covariance matrix Q – see details below
cR Cholesky-like decomposition of state error covariance matrix R – see details below
max.iter maximum number of iterations
tol relative tolerance for determining convergence

Details

Practically, the script only requires that Q or R may be reconstructed as t(cQ)**(cQ) or t(cR)**(cR), respectively.
**Value**

- **Phi** Estimate of Phi
- **Q** Estimate of Q
- **R** Estimate of R
- **mu0** Estimate of initial state mean
- **Sigma0** Estimate of initial state covariance matrix
- **like** -log likelihood at each iteration
- **niter** number of iterations to convergence
- **cvg** relative tolerance at convergence

**Author(s)**

D.S. Stoffer

**References**

http://www.stat.pitt.edu/stoffer/tsa4/

---

**EM1**

*EM Algorithm for General State Space Models*

**Description**

Estimation of the parameters in the general state space model via the EM algorithm. Inputs are not allowed; see the note.

**Usage**

```
EM1(num, y, A, mu0, Sigma0, Phi, cQ, cR, max.iter = 100, tol = 0.001)
```

**Arguments**

- **num** number of observations
- **y** observation vector or time series; use 0 for missing values
- **A** observation matrices, an array with dim=c(q,p,n); use 0 for missing values
- **mu0** initial state mean
- **Sigma0** initial state covariance matrix
- **Phi** state transition matrix
- **cQ** Cholesky-like decomposition of state error covariance matrix Q – see details below
- **cR** R is diagonal here, so cR = sqrt(R) – also, see details below
- **max.iter** maximum number of iterations
- **tol** relative tolerance for determining convergence
Details

Practically, the script only requires that $Q$ or $R$ may be reconstructed as $t(cQ)^\cdot(cQ)$ or $t(cR)^\cdot(cR)$, respectively.

Value

<table>
<thead>
<tr>
<th>Column</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phi</td>
<td>Estimate of Phi</td>
</tr>
<tr>
<td>Q</td>
<td>Estimate of $Q$</td>
</tr>
<tr>
<td>R</td>
<td>Estimate of $R$</td>
</tr>
<tr>
<td>$\mu\theta$</td>
<td>Estimate of initial state mean</td>
</tr>
<tr>
<td>$\Sigma\theta$</td>
<td>Estimate of initial state covariance matrix</td>
</tr>
<tr>
<td>$\text{like}$</td>
<td>$-\log$ likelihood at each iteration</td>
</tr>
<tr>
<td>niter</td>
<td>number of iterations to convergence</td>
</tr>
<tr>
<td>cvg</td>
<td>relative tolerance at convergence</td>
</tr>
</tbody>
</table>

Note

Inputs are not allowed (and hence not estimated). The script uses Ksmooth1 and everything related to inputs are set equal to zero when it is called.

It would be relatively easy to include estimates of ‘Ups’ and ‘Gam’ because conditional on the states, these are just regression coefficients. If you decide to alter EM1 to include estimates of the ‘Ups’ or ‘Gam’, feel free to notify me with a workable example and I’ll include it in the next update.

Author(s)

D.S. Stoffer

References

http://www.stat.pitt.edu/stoffer/tsa4/

---

EQ5

*Seismic Trace of Earthquake number 5*

Description

Seismic trace of an earthquake [two phases or arrivals along the surface, the primary wave ($t = 1, \ldots, 1024$) and the shear wave ($t = 1025, \ldots, 2048$)] recorded at a seismic station.

Format

The format is: Time-Series [1:2048] from 1 to 2048: 0.01749 0.01139 0.01512 0.01477 0.00651 ...

References

http://www.stat.pitt.edu/stoffer/tsa4/
**EQcount**

**See Also**
- eqexp

<table>
<thead>
<tr>
<th>EQcount</th>
<th>EQ Counts</th>
</tr>
</thead>
</table>

**Description**

Series of annual counts of major earthquakes (magnitude 7 and above) in the world between 1900 and 2006.

**Format**

The format is: Time-Series [1:107] from 1900 to 2006: 13 14 8 10 16 26 ...

**Source**


**References**

http://www.stat.pitt.edu/stoffer/tsa4/

---

**eqexp**

*Earthquake and Explosion Seismic Series*

**Description**

This is a data frame of the earthquake and explosion seismic series used throughout the text.

**Format**

A data frame with 2048 observations (rows) on 17 variables (columns). Each column is a numeric vector.

**Details**

The matrix has 17 columns, the first eight are earthquakes, the second eight are explosions, and the last column is the Novaya Zemlya event of unknown origin.

The column names are: EQ1, EQ2, ..., EQ8; EX1, EX2, ..., EX8; NZ. The first 1024 observations correspond to the P wave, the second 1024 observations correspond to the S wave.

**References**

http://www.stat.pitt.edu/stoffer/tsa4/
Description

Seismic trace of an explosion [two phases or arrivals along the surface, the primary wave \( t = 1, \ldots, 1024 \) and the shear wave \( t = 1025, \ldots, 2048 \)] recorded at a seismic station.

Format

The format is: Time-Series [1:2048] from 1 to 2048: -0.001837 -0.000554 -0.002284 -0.000303 -0.000721 ... 

References

http://www.stat.pitt.edu/stoffer/tsa3/

See Also

eqexp

---

FDR

Basic False Discovery Rate

Description

Computes the basic false discovery rate given a vector of p-values.

Usage

\[ \text{FDR}(pvals, qlevel = 0.05) \]

Arguments

- `pvals`: a vector of pvals on which to conduct the multiple testing
- `qlevel`: the proportion of false positives desired

Value

- `fdr.id`: NULL if no significant tests, or the index of the maximal p-value satisfying the FDR condition.

References

http://www.stat.berkeley.edu/~paciorek/code/fdr/fdr.R
flu


Description

Monthly pneumonia and influenza deaths per 10,000 people in the United States for 11 years, 1968 to 1978.

Usage
data(flu)

Format

The format is: Time-Series [1:132] from 1968 to 1979: 0.811 0.446 0.342 0.277 0.248 ...

References

http://www.stat.pitt.edu/stoffer/tsa4/

fMRI - complete data set

Description

Data (as a vector list) from an fMRI experiment in pain, listed by location and stimulus. The data are BOLD signals when a stimulus was applied for 32 seconds and then stopped for 32 seconds. The signal period is 64 seconds and the sampling rate was one observation every 2 seconds for 256 seconds ($n = 128$). The number of subjects under each condition varies.

Details


The TREATMENTS or stimuli (and number of subjects in each condition) are [1] Awake-Brush (5 subjects), [2] Awake-Heat (4 subjects), [3] Awake-Shock (5 subjects), [4] Low-Brush (3 subjects), [5] Low-Heat (5 subjects), and [6] Low-Shock (4 subjects). Issue the command summary(fmri) for further details. In particular, awake (Awake) or mildly anesthetized (Low) subjects were subjected levels of periodic brushing (Brush), application of heat (Heat), and mild shock (Shock) effects.

As an example, fmri$\{L\}T6$ (Location 1, Treatment 6) will show the data for the four subjects receiving the Low-Shock treatment at the Cortex 1 location; note that fmri[[6]] will display the same data.
References

http://www.stat.pitt.edu/stoffer/tsa4/

fmri1

fMRI Data Used in Chapter 1

Description

A data frame that consists of average fMRI BOLD signals at eight locations.

Usage

data(fmri1)

Format

The format is: mts [1:128, 1:9]

Details

Multiple time series consisting of fMRI BOLD signals at eight locations (in columns 2-9, column 1 is time period), when a stimulus was applied for 32 seconds and then stopped for 32 seconds. The signal period is 64 seconds and the sampling rate was one observation every 2 seconds for 256 seconds ($n = 128$). The columns are labeled: "time" "cort1" "cort2" "cort3" "cort4" "thal1" "thal2" "cere1" "cere2".

References

http://www.stat.pitt.edu/stoffer/tsa4/

See Also

fmri

gas

Gas Prices

Description

New York Harbor conventional regular gasoline weekly spot price FOB (in cents per gallon) from 2000 to mid-2010.

Format

The format is: Time-Series [1:545] from 2000 to 2010: 70.6 71 68.5 65.1 67.9 ...
globtemp

Details
   Pairs with series oil

Source
   http://tonto.eia.doe.gov/dnav/pet/pet_pri_spt_s1_w.htm

References
   http://www.stat.pitt.edu/stoffer/tsa4/

See Also
   oil

---

globtemp  Global mean land-ocean temperature deviations - updated

Description
   Global mean land-ocean temperature deviations (from 1951-1980 average), measured in degrees centigrade, for the years 1880-2015. This is an update of gtemp.

Format
   The format is: Time-Series [1:136] from 1880 to 2015: -0.2 -0.11 -0.1 -0.2 -0.28 -0.31 -0.3 -0.33 -0.2 -0.11 ...

Details
   The data were changed after 2011, so there are discrepancies between this data set and gtemp. The differences are explained here: http://www1.ncdc.noaa.gov/pub/data/ghcn/v3/GHCNM-v3.2.0-FAQ.pdf.

Source
   http://data.giss.nasa.gov/gistemp/graphs/

References
   http://www.stat.pitt.edu/stoffer/tsa4/

See Also
   globtemp1, gtemp, gtemp2
globtempl  

*Global mean land (only) temperature deviations - updated*

**Description**

Global mean [land only] temperature deviations (from 1951-1980 average), measured in degrees centigrade, for the years 1880-2015. This is an update of gtemp2. Note the data file is globtemp-el not globtemp-one; the el stands for land.

**Usage**

data("globtempl")

**Format**

The format is: Time-Series [1:136] from 1880 to 2015: -0.53 -0.51 -0.41 -0.43 -0.72 -0.56 -0.7 -0.74 -0.53 -0.25 ...

**Details**

The data were changed after 2011, so there are discrepancies between this data set and gtemp2. The differences are explained here: [http://www1.ncdc.noaa.gov/pub/data/ghcn/v3/ghcnm-v3.2.0-FAQ.pdf](http://www1.ncdc.noaa.gov/pub/data/ghcn/v3/ghcnm-v3.2.0-FAQ.pdf).

**Source**


**References**


**See Also**

globtemp, gtemp2, gtemp

---

gnp  

*Quarterly U.S. GNP*

**Description**

Quarterly U.S. GNP from 1947(1) to 2002(3).

**Format**

The format is: Time-Series [1:223] from 1947 to 2002: 1489 1497 1500 1524 1547 ...
**gtemp**

**Global mean land-ocean temperature deviations**

**Description**

This has been updated in **globtemp**. Global mean land-ocean temperature deviations (from 1951-1980 average), measured in degrees centigrade, for the years 1880-2009.

**Format**

The format is: Time-Series [1:130] from 1880 to 2009: -0.28 -0.21 -0.26 -0.27 -0.32 -0.32 -0.29 -0.36 -0.27 -0.17 ...

**Source**

http://data.giss.nasa.gov/gistemp/graphs/

**References**

http://www.stat.pitt.edu/stoffer/tsa4/

**See Also**

globtemp, globtempl, gtemp2

---

**gtemp2**

**Global Mean Surface Air Temperature Deviations**

**Description**

This has been updated in **globtemp1**. Similar to gtemp but the data are based only on surface air temperature data obtained from meteorological stations. The data are temperature deviations (from 1951-1980 average), measured in degrees centigrade, for the years 1880-2009.

**Usage**

data(gtemp2)

**Format**

The format is: Time-Series [1:130] from 1880 to 2009: -0.24 -0.19 -0.14 -0.19 -0.45 -0.32 -0.42 -0.54 -0.24 -0.05 ...
Source

http://data.giss.nasa.gov/gistemp/graphs/

References

http://www.stat.pitt.edu/stoffer/tsa4/

See Also

globtemp, globempl, gtemp

---

<table>
<thead>
<tr>
<th>HCT</th>
<th>Hematocrit Levels</th>
</tr>
</thead>
</table>

Description

HCT: Measurements made for 91 days on the three variables, log(white blood count) [WBC], log(platelet) [PLT] and hematocrit [HCT]. Missing data code is 0 (zero).

Format

The format is: Time-Series [1:91] from 1 to 91: 30 30 28.5 34.5 34 32 30.5 31 33 34 ...

Details

See Examples 6.1 and 6.9 for more details.

Source


References

http://www.stat.pitt.edu/stoffer/tsa4/

See Also

blood, PLT, WBC
Description

Johnson and Johnson quarterly earnings per share, 84 quarters (21 years) measured from the first quarter of 1960 to the last quarter of 1980.

Format

The format is: Time-Series [1:84] from 1960 to 1981: 0.71 0.63 0.85 0.44 0.61 0.69 0.92 0.55 0.72 0.77 ...

Details

This data set is also included with the R distribution as JohnsonJohnson

References

http://www.stat.pitt.edu/stoffer/tsa4/

Kalman Filter - Time Invariant Model

Description

Returns the filtered values for the basic time invariant state-space model; inputs are not allowed.

Usage

Kfilter0(num, y, A, mu0, Sigma0, Phi, cQ, cR)

Arguments

num number of observations
y data matrix, vector or time series
A time-invariant observation matrix
mu0 initial state mean vector
Sigma0 initial state covariance matrix
Phi state transition matrix
cQ Cholesky-type decomposition of state error covariance matrix Q – see details below
cR Cholesky-type decomposition of observation error covariance matrix R – see details below
Details

Practically, the script only requires that Q or R may be reconstructed as $t(cQ)^\times(cQ)$ or $t(cR)^\times(cR)$, respectively.

Value

- \(xp\): one-step-ahead state prediction
- \(Pp\): mean square prediction error
- \(xf\): filter value of the state
- \(Pf\): mean square filter error
- \(like\): the negative of the log likelihood
- \(innov\): innovation series
- \(sig\): innovation covariances
- \(Kn\): last value of the gain, needed for smoothing

Author(s)

D.S. Stoffer

References

http://www.stat.pitt.edu/stoffer/tsa4/

See also http://www.stat.pitt.edu/stoffer/tsa4/chap6.htm for an explanation of the difference between levels 0, 1, and 2.

---

Kfilter1

Kalman Filter - Model may be time varying or have inputs

Description

Returns both the predicted and filtered values for a linear state space model. Also evaluates the likelihood at the given parameter values.

Usage

Kfilter1(num, y, A, mu0, Sigma0, Phi, Ups, Gam, cQ, cR, input)
Arguments

- **num**: number of observations
- **y**: data matrix, vector or time series
- **A**: time-varying observation matrix, an array with `dim=c(q,p,n)`
- **mu0**: initial state mean
- **Sigma0**: initial state covariance matrix
- **phi**: state transition matrix
- **Ups**: state input matrix; use `Ups = 0` if not needed
- **Gam**: observation input matrix; use `Gam = 0` if not needed
- **cQ**: Cholesky-type decomposition of state error covariance matrix `Q` – see details below
- **cR**: Cholesky-type decomposition of observation error covariance matrix `R` – see details below
- **input**: matrix or vector of inputs having the same row dimension as `y`; use `input = 0` if not needed

Details

Practically, the script only requires that `Q` or `R` may be reconstructed as `t(cQ) %*% cQ` or `t(cR) %*% cR`, respectively.

Value

- **xp**: one-step-ahead prediction of the state
- **pp**: mean square prediction error
- **xf**: filter value of the state
- **pf**: mean square filter error
- **like**: the negative of the log likelihood
- **innov**: innovation series
- **sig**: innovation covariances
- **Kn**: last value of the gain, needed for smoothing

Author(s)

D.S. Stoffer

References


See also [http://www.stat.pitt.edu/stoffer/tsa4/chap6.htm](http://www.stat.pitt.edu/stoffer/tsa4/chap6.htm) for an explanation of the difference between levels 0, 1, and 2.
Kalman Filter - Model may be time varying or have inputs or correlated errors

Description

Returns the filtered values for the state space model. In addition, the script returns the evaluation of the likelihood at the given parameter values and the innovation sequence.

Usage

Kfilter2(num, y, A, mu0, Sigma0, Phi, Ups, Gam, Theta, cQ, cR, S, input)

Arguments

- **num**: number of observations
- **y**: data matrix, vector or time series
- **A**: time-varying observation matrix, an array with dim = c(q,p,n)
- **mu0**: initial state mean
- **Sigma0**: initial state covariance matrix
- **Phi**: state transition matrix
- **Ups**: state input matrix; use Ups = 0 if not needed
- **Gam**: observation input matrix; use Gam = 0 if not needed
- **Theta**: state error pre-matrix
- **cQ**: Cholesky decomposition of state error covariance matrix Q – see details below
- **cR**: Cholesky-type decomposition of observation error covariance matrix R – see details below
- **S**: covariance-type matrix of state and observation errors
- **input**: matrix or vector of inputs having the same row dimension as y; use input = 0 if not needed

Details

Practically, the script only requires that Q or R may be reconstructed as t(cQ)**%(cQ) or t(cR)**%(cR), respectively.

Value

- **xp**: one-step-ahead prediction of the state
- **Pp**: mean square prediction error
- **xf**: filter value of the state
- **Pf**: mean square filter error
like the negative of the log likelihood
innov innovation series
sig innovation covariances
K last value of the gain, needed for smoothing

Author(s)
D.S. Stoffer

References
http://www.stat.pitt.edu/stoffer/tsa4/

See also http://www.stat.pitt.edu/stoffer/tsa4/chap6.htm for an explanation of the difference between levels 0, 1, and 2.

Ksmooth0 Kalman Filter and Smoother - Time invariant model without inputs

Description
Returns both the filtered values and smoothed values for the state-space model.

Usage
Ksmooth0(num, y, A, mu0, Sigma0, Phi, cQ, cR)

Arguments
num number of observations
y data matrix, vector or time series
A time-invariant observation matrix
mu0 initial state mean vector
Sigma0 initial state covariance matrix
Phi state transition matrix
cQ Cholesky-type decomposition of state error covariance matrix Q – see details below
cR Cholesky-type decomposition of observation error covariance matrix R – see details below

Details
Practically, the script only requires that Q or R may be reconstructed as t(cQ)**(cQ) or t(cR)**(cR), respectively, which allows more flexibility.
Value

xs  state smoothers
Ps  smoother mean square error
x0n initial mean smoother
P0n initial smoother covariance
J0 initial value of the J matrix
J  the J matrices
xp one-step-ahead prediction of the state
Pp mean square prediction error
xf filter value of the state
Pf mean square filter error
like the negative of the log likelihood
Kn last value of the gain

Author(s)

D.S. Stoffer

References

http://www.stat.pitt.edu/stoffer/tsa4/

See also http://www.stat.pitt.edu/stoffer/tsa4/chap6.htm for an explanation of the difference between levels 0, 1, and 2.

Description

Returns both the filtered and the smoothed values for the state-space model.

Usage

Ksmooth1(num, y, A, mu0, Sigma0, Phi, Ups, Gam, cQ, cR, input)
Arguments

- **num**: number of observations
- **y**: data matrix, vector or time series
- **A**: time-varying observation matrix, an array with dim=c(q,p,n)
- **mu0**: initial state mean
- **Sigma0**: initial state covariance matrix
- **Phi**: state transition matrix
- **Ups**: state input matrix; useUps = 0 if not needed
- **Gam**: observation input matrix; use Gam = 0 if not needed
- **cQ**: Cholesky-type decomposition of state error covariance matrix Q – see details below
- **cR**: Cholesky-type decomposition of observation error covariance matrix R – see details below
- **input**: matrix or vector of inputs having the same row dimension as y; use input = 0 if not needed

Details

Practically, the script only requires that Q or R may be reconstructed as t(cQ)**(cQ) or t(cR)**(cR), respectively, which allows more flexibility.

Value

- **xs**: state smoothers
- **Ps**: smoother mean square error
- **x0n**: initial mean smoother
- **P0n**: initial smoother covariance
- **J0**: initial value of the J matrix
- **J**: the J matrices
- **xp**: one-step-ahead prediction of the state
- **Pp**: mean square prediction error
- **xf**: filter value of the state
- **Pf**: mean square filter error
- **like**: the negative of the log likelihood
- **Kn**: last value of the gain

Author(s)

D.S. Stoffer
References

http://www.stat.pitt.edu/stoffer/tsa4/

See also http://www.stat.pitt.edu/stoffer/tsa4/chap6.htm for an explanation of the difference between levels 0, 1, and 2.

Ksmooth2

Kalman Filter and Smoother - General model, may have correlated errors

Description

Returns the filtered and smoothed values for the state-space model. This is the smoother companion to Kfilter2.

Usage

Ksmooth2(num, y, A, mu0, Sigma0, Phi, Ups, Gam, Theta, cQ, cR, S, input)

Arguments

num number of observations
y data matrix, vector or time series
A time-varying observation matrix, an array with dim=c(q,p,n)
mu0 initial state mean
Sigma0 initial state covariance matrix
Phi state transition matrix
Ups state input matrix; use Ups = 0 if not needed
Gam observation input matrix; use Gam = 0 if not needed
Theta state error pre-matrix
cQ Cholesky-type decomposition of state error covariance matrix Q – see details below
cR Cholesky-type decomposition of observation error covariance matrix R – see details below
S covariance matrix of state and observation errors
input matrix or vector of inputs having the same row dimension as y; use input = 0 if not needed

Details

Practically, the script only requires that Q or R may be reconstructed as t(cQ)%%(cQ) or t(cR)%%(cR), respectively, which allows more flexibility.
Value

- $xs$: state smoothers
- $Ps$: smoother mean square error
- $J$: the J matrices
- $xp$: one-step-ahead prediction of the state
- $Pp$: mean square prediction error
- $xf$: filter value of the state
- $Pf$: mean square filter error
- $like$: the negative of the log likelihood
- $Kn$: last value of the gain

Author(s)

D.S. Stoffer

References

http://www.stat.pitt.edu/stoffer/tsa4/

See also http://www.stat.pitt.edu/stoffer/tsa4/chap6.htm for an explanation of the difference between levels 0, 1, and 2.

---

**lag1.plot**  
*Lag Plot - one time series*

Description

Produces a grid of scatterplots of a series versus lagged values of the series.

Usage

`lag1.plot(series, max.lag = 1, corr = TRUE, smooth = TRUE)`

Arguments

- `series`: the data
- `max.lag`: maximum lag
- `corr`: if TRUE, shows the autocorrelation value in a legend
- `smooth`: if TRUE, adds a lowess fit to each scatterplot

Author(s)

D.S. Stoffer
References

http://www.stat.pitt.edu/stoffer/tsa4/

Examples

lag1.plot(soi, 9)

lag2.plot

Lag Plot - two time series

Description

Produces a grid of scatterplots of one series versus another. The first named series is the one that gets lagged.

Usage

lag2.plot(series1, series2, max.lag = 0, corr = TRUE, smooth = TRUE)

Arguments

series1 first series (the one that gets lagged)
series2 second series
max.lag maximum number of lags
corr if TRUE, shows the cross-correlation value in a legend
smooth if TRUE, adds a lowess fit to each scatterplot

Author(s)

D.S. Stoffer

References

http://www.stat.pitt.edu/stoffer/tsa4/

Examples

lag2.plot(soi, rec, 8)
LagReg  

Lagged Regression

Description

Performs lagged regression as discussed in Chapter 4.

Usage

\[
\text{LagReg(input, output, L = c(3, 3), M = 40, threshold = 0, inverse = FALSE)}
\]

Arguments

- **input**: input series
- **output**: output series
- **L**: degree of smoothing; see spans in the help file for \text{spec.pgram}.
- **M**: must be even; number of terms used in the lagged regression
- **threshold**: the cut-off used to set small (in absolute value) regression coefficients equal to zero
- **inverse**: if TRUE, will fit a forward-lagged regression

Details

For a bivariate series, input is the input series and output is the output series. The degree of smoothing for the spectral estimate is given by L; see spans in the help file for \text{spec.pgram}. The number of terms used in the lagged regression approximation is given by M, which must be even. The threshold value is the cut-off used to set small (in absolute value) regression coefficients equal to zero (it is easiest to run LagReg twice, once with the default threshold of zero, and then again after inspecting the resulting coefficients and the corresponding values of the CCF). Setting inverse=TRUE will fit a forward-lagged regression; the default is to run a backward-lagged regression. The script is based on code that was contributed by Professor Doug Wiens, Department of Mathematical and Statistical Sciences, University of Alberta.

Value

Graphs of the estimated impulse response function, the CCF, and the output with the predicted values superimposed.

- **beta**: Estimated coefficients
- **fit**: The output series, the fitted values, and the residuals

Author(s)

D.S. Stoffer
References

http://www.stat.pitt.edu/stoffer/tsa4/

LA Pollution-Mortality Study

Description

LA Pollution-Mortality Study (1970-1979, weekly data).

Format

The format is: mts [1:508, 1:11]

Details

columns are time series with names
(1) Total Mortality tmort
(2) Respiratory Mortality rmort
(3) Cardiovascular Mortality cmort
(4) Temperature tempr
(5) Relative Humidity rh
(6) Carbon Monoxide co
(7) Sulfur Dioxide so2
(8) Nitrogen Dioxide no2
(9) Hydrocarbons hycarb
(10) Ozone o3
(11) Particulates part

References

http://www.stat.pitt.edu/stoffer/tsa4/

Leading Indicator

Description

Leading indicator, 150 months; taken from Box and Jenkins (1970).
Usage

data(lead)

Format

The format is: Time-Series [1:150] from 1 to 150: 10.01 10.07 10.32 9.75 10.33 ...

Details

This is also the R time series BJsales.lead: The sales time series BJsales and leading indicator BJsales.lead each contain 150 observations. The objects are of class "ts".

See Also

sales

---

mvspec

**Univariate and Multivariate Spectral Estimation**

Description

This is *spec.pgram* with a few changes in the defaults and written so you can easily extract the estimate of the multivariate spectral matrix as \( f_{xx} \). The bandwidth calculation has been changed to the more practical definition given in the text. Can be used to replace *spec.pgram* for univariate series.

Usage

```
mvspec(x, spans = NULL, kernel = NULL, taper = 0, pad = 0, fast = TRUE, demean = FALSE, detrend = TRUE, plot = TRUE, na.action = na.fail, ...)
```

Arguments

- **x**: univariate or multivariate time series (i.e., the p columns of x are time series)
- **spans**: specify smoothing; same as *spec.pgram*
- **kernel**: specify kernel; same as *spec.pgram*
- **taper**: specify taper; same as *spec.pgram* with different default
- **pad**: specify padding; same as *spec.pgram*
- **fast**: specify use of FFT; same as *spec.pgram*
- **demean**: if TRUE, series is demeaned first; same as *spec.pgram*
- **detrend**: if TRUE, series is detrended first; same as *spec.pgram*
- **plot**: plot the estimate; same as *spec.pgram*
- **na.action**: same as *spec.pgram*
- ... additional arguments; same as *spec.pgram*
Details

This is `spec.pgram` with a few changes in the defaults and written so you can easily extract the estimate of the multivariate spectral matrix as `fxx`. The bandwidth calculation has been changed to the more practical definition given in the text, \((L_h/n.used) \times \text{frequency}(x)\). Although meant to be used to easily obtain multivariate spectral estimates, this script can be used for univariate time series. Note that the script does not taper by default (`taper=0`); this forces the user to do "conscious tapering".

Value

An object of class "spec", which is a list containing at least the following components:

- `fxx` spectral matrix estimates; an array of dimensions \(\text{dim} = c(p,p,nfreq)\)
- `freq` vector of frequencies at which the spectral density is estimated.
- `spec` vector (for univariate series) or matrix (for multivariate series) of estimates of the spectral density at frequencies corresponding to `freq`.
- `coh` NULL for univariate series. For multivariate time series, a matrix containing the squared coherency between different series. Column \(i + (j - 1) * (j - 2)/2\) of `coh` contains the squared coherency between columns \(i\) and \(j\) of `x`, where \(i < j\).
- `phase` NULL for univariate series. For multivariate time series a matrix containing the cross-spectrum phase between different series. The format is the same as `coh`.
- `Lh` Number of frequencies (approximate) used in the band, as defined in Chapter 4.
- `n.used` Sample length used for the FFT
- `series` The name of the time series.
- `snames` For multivariate input, the names of the component series.
- `method` The method used to calculate the spectrum.

The results are returned invisibly if `plot` is true.

References


Examples

```r
# univariate example
plot(co2) # co2 is an R data set
mvspec(co2, spans=c(5,5), taper=.5)

# multivariate example
ts.plot(mdeaths, fdeaths, col=1:2) # an R data set, male/female monthly deaths ...
dog = mvspec(cbind(mdeaths,fdeaths), spans=c(3,3), taper=.1)
dog$fxx # look a spectral matrix estimates
dog$bandwidth # bandwidth with time unit = year
dog$bandwidth/frequency(mdeaths) # ... with time unit = month
plot(dog, plot.type="coherency") # plot of squared coherency
```
### nyse

Returns of the New York Stock Exchange

**Description**


**Usage**

data(nyse)

**Format**

The format is: Time-Series [1:2000] from 1 to 2000: 0.00335 -0.01418 -0.01673 0.00229 -0.01692 ... 

**Source**

S+GARCH module - Version 1.1 Release 2: 1998

---

### oil

Crude oil, WTI spot price FOB

**Description**

Crude oil, WTI spot price FOB (in dollars per barrel), weekly data from 2000 to mid-2010.

**Format**

The format is: Time-Series [1:545] from 2000 to 2010: 26.2 26.1 26.3 24.9 26.3 ... 

**Details**

pairs with the series gas

**Source**

http://tonto.eia.doe.gov/dnav/pet/pet_pri_spt_s1_w.htm

**References**

http://www.stat.pitt.edu/stoffer/tsa4/

**See Also**

gas
part

Particulate levels from the LA pollution study

Description

Particulate series corresponding to cmort from the LA pollution study.

Format

The format is: Time-Series [1:508] from 1970 to 1980: 72.7 49.6 55.7 55.2 66 ...

See Also

lap

PLT

Platelet Levels

Description

PLT: Measurements made for 91 days on the three variables, log(white blood count) [WBC], log(platelet) [PLT] and hematocrit [HCT]. Missing data code is 0 (zero).

Usage
data(PLT)

Format

The format is: Time-Series [1:91] from 1 to 91: 4.47 4.33 4.09 4.6 4.41 ...

Details

See Examples 6.1 and 6.9 for more details.

Source


References

http://www.stat.pitt.edu/stoffer/tsa4/

See Also

blood, HCT, WBC
prodn

### Monthly Federal Reserve Board Production Index

**Description**

Monthly Federal Reserve Board Production Index (1948-1978, n = 372 months).

**Usage**

data(prodn)

**Format**

The format is: Time-Series [1:372] from 1948 to 1979: 40.6 41.1 40.5 40.1 40.4 41.2 39.3 41.6 42.3 43.2 ...

**References**

http://www.stat.pitt.edu/stoffer/tsa4/

---

qinf1

### Quarterly Inflation

**Description**

Quarterly inflation rate in the Consumer Price Index from 1953-I to 1980-II, n = 110 observations.

**Format**

The format is: Time-Series [1:110] from 1953 to 1980: 1.673 3.173 0.492 -0.327 -0.333 ...

**Details**

pairs with qintr (interest rate)

**Source**


**References**

http://www.stat.pitt.edu/stoffer/tsa4/

**See Also**

qintr
### qintr

**Quarterly Interest Rate**

**Description**
Quarterly interest rate recorded for Treasury bills from 1953-I to 1980-II, n = 110 observations.

**Format**
The format is: Time-Series [1:110] from 1953 to 1980: 1.98 2.15 1.96 1.47 1.06 ...

**Details**
pairs with qinfl (inflation)

**Source**

**References**

**See Also**
- qinfl

### rec

**Recruitment (number of new fish)**

**Description**
Recruitment (number of new fish) for a period of 453 months ranging over the years 1950-1987.

**Usage**

data(rec)

**Format**
The format is: Time-Series [1:453] from 1950 to 1988: 68.6 68.6 68.6 68.6 68.6 68.6 68.6 ...

**Details**
can pair with soi (Southern Oscillation Index)
Source

Data furnished by Dr. Roy Mendelssohn of the Pacific Fisheries Environmental Laboratory, NOAA (personal communication).

References

http://www.stat.pitt.edu/stoffer/tsa4/

See Also

soi

<table>
<thead>
<tr>
<th>sales</th>
<th>Sales</th>
</tr>
</thead>
</table>

Description

Sales, 150 months; taken from Box and Jenkins (1970).

Format

The format is: Time-Series [1:150] from 1 to 150: 200 200 199 199 199 ...

Details

This is also the R data set BJsales: The sales time series BJsales and leading indicator BJsales.lead each contain 150 observations. The objects are of class "ts".

See Also

lead

<table>
<thead>
<tr>
<th>salt</th>
<th>Salt Profiles</th>
</tr>
</thead>
</table>

Description

Salt profiles taken over a spatial grid set out on an agricultural field, 64 rows at 17-ft spacing.

Usage

data(salt)

Format

The format is: Time-Series [1:64] from 1 to 64: 6 6 6 3 3 3 4 4 4 1.5 ...
Details

pairs with saltemp, temperature profiles on the same grid

References

http://www.stat.pitt.edu/stoffer/tsa4/

See Also

saltemp

---

**saltemp**  
*Temperature Profiles*

Description

Temperature profiles over a spatial grid set out on an agricultural field, 64 rows at 17-ft spacing.

Usage

data(saltemp)

Format

The format is: Time-Series [1:64] from 1 to 64: 5.98 6.54 6.78 6.34 6.96 6.51 6.72 7.44 7.74 6.85 ...

Details

pairs with salt, salt profiles on the same grid

References

http://www.stat.pitt.edu/stoffer/tsa4/

See Also

salt
Description

Fits ARIMA models (including improved diagnostics) in a short command. It can also be used to perform regression with autocorrelated errors. This is a front end to arima() with a different back door.

Usage

sarima(xdata, p, d, q, P = 0, D = 0, Q = 0, S = -1, details = TRUE, xreg=NULL, Model=TRUE, tol = sqrt(.Machine$double.eps), no.constant = FALSE)

Arguments

xdata univariate time series
p AR order
d difference order
q MA order
P SAR order; use only for seasonal models
D seasonal difference; use only for seasonal models
Q SMA order; use only for seasonal models
S seasonal period; use only for seasonal models
xreg Optionally, a vector or matrix of external regressors, which must have the same number of rows as xdata.
Model if TRUE (default), the model orders are printed on the diagnostic plot.
details turns on or off the output from the nonlinear optimization routine, which is optim. The default is TRUE, use details=FALSE to turn off the output.
tol controls the relative tolerance (reftol in optim) used to assess convergence. The default is sqrt(.Machine$double.eps), the R default.
no.constant controls whether or not sarima includes a constant in the model. In particular, if there is no differencing (d = 0 and D = 0) you get the mean estimate. If there is differencing of order one (either d = 1 or D = 1, but not both), a constant term is included in the model. These two conditions may be overridden (i.e., no constant will be included in the model) by setting this to TRUE; e.g., sarima(x,1,1,0,no.constant=TRUE). Otherwise, no constant or mean term is included in the model. If regressors are included (via xreg), this is ignored.
Details

If your time series is in x and you want to fit an ARIMA(p,d,q) model to the data, the basic call is `sarima(x,p,d,q)`. The results are the parameter estimates, standard errors, AIC, AICc, BIC (as defined in Chapter 2) and diagnostics. To fit a seasonal ARIMA model, the basic call is `sarima(x,p,d,q,P,D,Q,S)`. For example, `sarima(x,2,1,0)` will fit an ARIMA(2,1,0) model to the series in x, and `sarima(x,2,1,0,0,1,1,12)` will fit a seasonal ARIMA(2,1,0) * (0,1,1)_{12} model to the series in x.

Value

- **fit**: the arima object
- **degrees_of_freedom**: Error degrees of freedom
- **ttable**: a little t-table with two-sided p-values
- **AIC**: value of the AIC
- **AICc**: value of the AICc
- **BIC**: value of the BIC

References


See Also

- `sarima.for`

Examples

```r
sarima(log(AirPassengers),0,1,1,0,1,1,12)
(dog <- sarima(log(AirPassengers),0,1,1,0,1,1,12))
summary(dog$fit)  # fit has all the returned arima() values
plot(resid(dog$fit))  # plot the innovations (residuals)
```

Description

ARIMA forecasting - this is a wrapper for R’s `predict.Arima`.

Usage

```r
sarima.for(xdata, n.ahead, p, d, q, P = 0, D = 0, Q = 0, S = -1, 
  tol = sqrt(.Machine$double.eps), no.constant = FALSE)
```
Arguments

- **xdata**: univariate time series
- **n.ahead**: forecast horizon (number of periods)
- **p**: AR order
- **d**: difference order
- **q**: MA order
- **P**: SAR order; use only for seasonal models
- **D**: seasonal difference; use only for seasonal models
- **Q**: SMA order; use only for seasonal models
- **S**: seasonal period; use only for seasonal models
- **tol**: controls the relative tolerance (reltol) used to assess convergence. The default is \( \sqrt{\text{Machine}\$\text{double.}\text{eps}} \), the R default.
- **no.constant**: controls whether or not a constant is included in the model. If no.constant=TRUE, no constant is included in the model. See `sarima` for more details.

Details

For example, `sarima.for(x,5,1,0,1)` will forecast five time points ahead for an ARMA(1,1) fit to x. The output prints the forecasts and the standard errors of the forecasts, and supplies a graphic of the forecast with +/- 1 and 2 prediction error bounds.

Value

- **pred**: the forecasts
- **se**: the prediction (standard) errors

References


See Also

- `sarima`

Examples

`sarima.for(log(AirPassengers),12,0,1,0,1,1,1)`
SigExtract  

**Signal Extraction And Optimal Filtering**

**Description**

Performs signal extraction and optimal filtering as discussed in Chapter 4.

**Usage**

SigExtract(series, L = c(3, 3), M = 50, max.freq = 0.05)

**Arguments**

- **series**: univariate time series to be filtered
- **L**: degree of smoothing (may be a vector); see spans in spec.pgram for more details
- **M**: number of terms used in the lagged regression approximation
- **max.freq**: truncation frequency, which must be larger than 1/M.

**Details**

The basic function of the script, and the default setting, is to remove frequencies above 1/20 (and, in particular, the seasonal frequency of 1 cycle every 12 time points). The sampling frequency of the time series is set to unity prior to the analysis.

**Value**

Returns plots of (1) the original and filtered series, (2) the estimated spectra of each series, (3) the filter coefficients and the desired and attained frequency response function. The filtered series is returned invisibly.

**Note**

The script is based on code that was contributed by Professor Doug Wiens, Department of Mathematical and Statistical Sciences, University of Alberta.

**Author(s)**

D.S. Stoffer

**References**

http://www.stat.pitt.edu/stoffer/tsa4/
so2

SO2 levels from the LA pollution study

Description
Sulfur dioxide levels from the LA pollution study

Format
The format is: Time-Series [1:508] from 1970 to 1980: 3.37 2.59 3.29 3.04 3.39 2.57 2.35 3.38 1.5 2.56 ...

See Also
lap

soi

Southern Oscillation Index

Description
Southern Oscillation Index (SOI) for a period of 453 months ranging over the years 1950-1987.

Format
The format is: Time-Series [1:453] from 1950 to 1988: 0.377 0.246 0.311 0.104 -0.016 0.235 0.137 0.191 -0.016 0.29 ...

Details
pairs with rec (Recruitment)

Source
Data furnished by Dr. Roy Mendelssohn of the Pacific Fisheries Environmental Laboratory, NOAA (personal communication).

References
http://www.stat.pitt.edu/stoffer/tsa4/

See Also
rec
soiltemp  Spatial Grid of Surface Soil Temperatures

Description
A 64 by 36 matrix of surface soil temperatures.

Format
The format is: num [1:64, 1:36] 6.7 8.9 5 6.6 6.1 7 6.5 8.2 6.7 6.6 ...

References
http://www.stat.pitt.edu/stoffer/tsa4/

sp500w  Weekly Growth Rate of the Standard and Poor's 500

Description
Weekly closing returns of the SP 500 from 2003 to September, 2012.

Format
An 'xts' object on 2003-01-03 to 2012-09-28; Indexed by objects of class: [Date] TZ: UTC

References
http://www.stat.pitt.edu/stoffer/tsa4/

speech  Speech Recording

Description
A small .1 second (1000 points) sample of recorded speech for the phrase "aaa...hhh".

Format
The format is: Time-Series [1:1020] from 1 to 1020: 1814 1556 1442 1416 1352 ...

References
http://www.stat.pitt.edu/stoffer/tsa4/
star

Variable Star

Description

The magnitude of a star taken at midnight for 600 consecutive days. The data are taken from the classic text, The Calculus of Observations, a Treatise on Numerical Mathematics, by E.T. Whittaker and G. Robinson, (1923, Blackie and Son, Ltd.).

Format

The format is: Time-Series [1:600] from 1 to 600: 25 28 31 32 33 33 32 ...

References

http://www.stat.pitt.edu/stoffer/tsa4/

stoch.reg

Frequency Domain Stochastic Regression

Description

Performs frequency domain stochastic regression discussed in Chapter 7.

Usage

stoch.reg(data, cols.full, cols.red, alpha, L, M, plot.which)

Arguments

data data matrix
cols.full specify columns of data matrix that are in the full model
cols.red specify columns of data matrix that are in the reduced model (use NULL if there are no inputs in the reduced model)
alpha test size
L smoothing - see spans in spec.pgram
M number of points in the discretization of the integral
plot.which coh or F.stat, to plot either the squared-coherencies or the F-statistics, respectively
Value

- `power.full`: spectrum under the full model
- `power.red`: spectrum under the reduced model
- `Bbetahat`: regression parameter estimates
- `eF`: pointwise (by frequency) F-tests
- `coh`: coherency

Note

The script is based on code that was contributed by Professor Doug Wiens, Department of Mathematical and Statistical Sciences, University of Alberta. See Example 7.1 on page 417 for a demonstration.

Author(s)

D.S. Stoffer

References


---

**sunspotz**

*Biannual Sunspot Numbers*

Description

Biannual smoothed (12-month moving average) number of sunspots from June 1749 to December 1978; n = 459. The "z" on the end is to distinguish this series from the one included with R (called `sunspots`).

Format

The format is: Time Series: Start = c(1749, 1) End = c(1978, 1) Frequency = 2

References

**SVfilter**

**Switching Filter (for Stochastic Volatility Models)**

**Description**

Performs a special case switching filter when the observational noise is a certain mixture of normals. Used to fit a stochastic volatility model.

**Usage**

SVfilter(num, y, phi0, phi1, sQ, alpha, sR0, mu1, sR1)

**Arguments**

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>num</td>
<td>number of observations</td>
</tr>
<tr>
<td>y</td>
<td>time series of returns</td>
</tr>
<tr>
<td>phi0</td>
<td>state constant</td>
</tr>
<tr>
<td>phi1</td>
<td>state transition parameter</td>
</tr>
<tr>
<td>sQ</td>
<td>state standard deviation</td>
</tr>
<tr>
<td>alpha</td>
<td>observation constant</td>
</tr>
<tr>
<td>sR0</td>
<td>observation error standard deviation for mixture component zero</td>
</tr>
<tr>
<td>mu1</td>
<td>observation error mean for mixture component one</td>
</tr>
<tr>
<td>sR1</td>
<td>observation error standard deviation for mixture component one</td>
</tr>
</tbody>
</table>

**Value**

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>xp</td>
<td>one-step-ahead prediction of the volatility</td>
</tr>
<tr>
<td>Pp</td>
<td>mean square prediction error of the volatility</td>
</tr>
<tr>
<td>like</td>
<td>the negative of the log likelihood at the given parameter values</td>
</tr>
</tbody>
</table>

**Author(s)**

D.S. Stoffer

**References**

http://www.stat.pitt.edu/stoffer/tsa4/
tempr  Temperatures from the LA pollution study

Description

Temperature series corresponding to cmort from the LA pollution study.

Format

The format is: Time-Series [1:508] from 1970 to 1980: 72.4 67.2 62.9 72.5 74.2 ...

See Also

lap

unemp  U.S. Unemployment

Description


Usage

data(unemp)

Format

The format is: Time-Series [1:372] from 1948 to 1979: 235 281 265 241 201 ...

References

http://www.stat.pitt.edu/stoffer/tsa4/
### UnempRate  
**U.S. Unemployment Rate**

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monthly U.S. unemployment rate in percent unemployed (Jan, 1948 - Nov, 2016, n = 827)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Format</th>
</tr>
</thead>
<tbody>
<tr>
<td>The format is: Time-Series [1:827] from 1948 to 2017: 4 4.7 4.5 4 3.4 3.9 3.9 3.6 3.4 2.9 ...</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td><a href="https://data.bls.gov/timeseries/LNU04000000/">https://data.bls.gov/timeseries/LNU04000000/</a></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td><a href="http://www.stat.pitt.edu/stoffer/tsa4/">http://www.stat.pitt.edu/stoffer/tsa4/</a></td>
</tr>
</tbody>
</table>

### varve  
**Annual Varve Series**

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sedimentary deposits from one location in Massachusetts for 634 years, beginning nearly 12,000 years ago.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Format</th>
</tr>
</thead>
<tbody>
<tr>
<td>The format is: Time-Series [1:634] from 1 to 634: 26.3 27.4 42.3 58.3 20.6 ...</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td><a href="http://www.stat.pitt.edu/stoffer/tsa4/">http://www.stat.pitt.edu/stoffer/tsa4/</a></td>
</tr>
</tbody>
</table>
WBC: Measurements made for 91 days on the three variables, log(white blood count) [WBC], log(platelet) [PLT] and hematocrit [HCT]. Missing data code is 0 (zero).

Format

The format is: Time-Series [1:91] from 1 to 91: 2.33 1.89 2.08 1.82 1.82 ...

Details

See Examples 6.1 and 6.9 for more details.

Source


References

http://www.stat.pitt.edu/stoffer/tsa4/

See Also

blood, HCT, PLT
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