

# Package ‘armiss’

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**Type** Package

**Title** Gaussian Imputation for AR Process with Missing Values

**Version** 1.0

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**Depends** mvtnorm

**Description** This package estimates parameters in an AR process using data with missing values

**License** GPL(>=2)

**Lazyload** yes

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ar.miss

*Gaussian Imputation of an AR(p) Process with Missing Observations*

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## Description

The function estimates parameters of an AR(p) process using data with missing observations. It first reorders the data into the observed and missing parts respectively using a permutation matrix. Imputation is done by generating observations from a conditional Gaussian distribution based on the observed data. The reconstructed series is then estimated using maximum likelihood with the order chosen by AIC.

**Usage**

```
ar.miss(data, epsilon = 0.001, order = NULL, max.iter = 100, sym = NA,
        control.optim = list(maxit = 200))
```

**Arguments**

<code>data</code>	A vector or time series object with numeric entries, can be a list if missing values are encoded with characters
<code>epsilon</code>	Controls the rate of convergence in the imputation and estimation algorithm. Defaults to 0.001. Please see the R tutorial vignette for more details.
<code>order</code>	Positive integer order of the AR process. If none is specified (default), then order is selected using AIC.
<code>max.iter</code>	The upper limit iteration for the imputation and estimation algorithm. Defaults to 100. Please see the R tutorial vignette for more details.
<code>sym</code>	The symbol used to represent missing values. Defaults to NA. Can be a character string or numeric
<code>control.optim</code>	Control variables for <code>optim</code> function used to do likelihood maximization. Here we set the BFGS iteration to have an upper limit of 200. See the help page on <code>optim</code> for more details.

**Details**

Please refer to the tutorial/manual R vignette for more details regarding the theoretical underpinnings of the algorithm.

**Value**

<code>mu</code>	MLE for AR(p) process mean
<code>phi</code>	A vector of MLE for AR(p) coefficients, where the order p was chosen by AIC
<code>sigma2</code>	MLE for innovation variance

**Note**

This is still work in progress. More functionality will be added in the future.

**Author(s)**

William Weimin Yoo

**References**

Yoo, W. W. and Ghosh, S. K. (2013): "Gaussian Imputation of an ARMA Process with Missing Observations", working paper.

**See Also**

[ar.mle](#), [arima](#), [optim](#)

## Examples

```
#generate AR(2) with missing values
#true mean = 0, AR coefficient = c(0.5, 0.2), innovation variance = 1
set.seed(1234)
N <- 365 #data length
ar2 <- arima.sim(n = N, list(ar = c(0.5, 0.2), sd = 1))
index <- sample(1:N, (N - 200), replace = FALSE) #165 missing data
ar2[index] <- NA

est <- ar.miss(ar2)
est
```

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arlsim

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*Simulated AR(1) time series with random missing observations*


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## Description

This is a simulated AR(1) time series. The true process mean is zero, the AR coefficient was set to 0.5 and the innovation variance is one. The length of this series is 365. A total of 165 observations were randomly sampled without replacement to denote as missing values, by replacing their values with NA. Hence we have a total of 200 observed data.

## Usage

```
data(arlsim)
```

## Format

Time-Series of length 365 with numeric entries for observed values but NA for missing values.\nFirst 5 entries: NA NA 0.9289 NA 0.0119 ...

## Examples

```
data(arlsim)
arlsim[1:20] #take a look at the data
```

---

armiss

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*Estimating parameters for an AR(p) process using missing data via Gaussian imputation.*


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## Description

Given a time series with missing observations, this package will reorder the series by dividing the data into the observed and missing parts respectively using a permutation matrix. The missing values are then imputed using conditional Gaussian distribution based on observed data. The reconstructed series is then used for parameter estimation.

## Details

Package: armiss  
 Type: Package  
 Version: 1.0  
 Date: 2013-01-27  
 License: GPL(>=2)

The package has three functions: `ar.miss`, `elem` and `covmat`. The function `ar.miss` implements the imputation and estimation procedures, and calls upon `elem` and `covmat` to construct the permutation matrix and AR(p) covariance matrix respectively. The function `ar.miss` accepts data in the form of vector or time series object with numeric values and outputs the parameter estimates. For further detail, please see the documentation page for `ar.miss`.

## Author(s)

William Weimin Yoo

Maintainer: William Weimin Yoo <wyoo@ncsu.edu>

## References

Yoo, W. W. and Ghosh, S. K. (2013): "Gaussian Imputation of an ARMA Process with Missing Observations", working paper.

## See Also

[ar.mle](#), [arima](#)

## Examples

```
#generate AR(1) with missing values
#true mean = 0, AR coefficient = 0.5, innovation variance = 1
set.seed(2345)
N <- 365
ar1 <- arima.sim(n = N, list(ar = 0.5, sd = 1))
index <- sample(1:N, (N - 200), replace = FALSE) #165 missing values
ar1[index] <- NA

est <- ar.miss(ar1)
est
```

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covmat

*Constructs the covariance matrix for an AR(p) process*

---

## Description

Given the AR coefficients and the innovation variance, this function constructs the corresponding covariance matrix for the process by calling upon the `ARMAacf` function in the base `stats` package.

**Usage**

```
covmat(phi, sigma2, N)
```

**Arguments**

phi	A vector of AR coefficients, where they have to satisfy the necessary stationarity conditions.
sigma2	The innovation variance, must be greater then zero.
N	Positive integer for data length.

**Details**

The method used can be found in Section 3.3 of Brockwell and Davis 1991.

**Value**

Returns the covariance matrix of an AR(p) process

**Author(s)**

William Weimin Yoo

**References**

Brockwell, P.J. and Davis, R.A. (1991) Time Series: Theory and Methods, Second Edition, Springer.

**See Also**

[ARMAacf](#)

**Examples**

```
ar <- c(0.5, 0.2)
sigma2 <- 1
Sigma <- covmat(phi = ar, sigma2 = sigma2, N = 5)
Sigma
```

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elem

*Permutation matrix*

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**Description**

Given a time series with missing observations, this function will reorder its elements into the observed and missing parts respectively.

**Usage**

```
elem(data, sym = NA)
```

**Arguments**

data	A vector or time series object with numeric entries. A list is also accepted if missing values are encoded with characters.
sym	Symbol used to represent missing values. Defaults to NA. Numeric and characters are allowed.

**Value**

Returns the permutation matrix that will separate observed and missing values in a time series.

**Author(s)**

William Weimin Yoo

**References**

Yoo, W. W. and Ghosh, S. K. (2013): "Gaussian Imputation of an ARMA Process with Missing Observations", working paper.

**Examples**

```
#example data with 8888 representing missing values
data <- c(1, 2, 8888, 4, 8888)
P <- elem(data = data, sym = 8888)
P
```

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