

# Package: longit (via r-universe)

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**Title** High Dimensional Longitudinal Data Analysis Using MCMC

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**Imports** AICcmodavg, missForest,R2jags,rjags,utils

**LazyData** Yes

**LazyDataCompression** xz

**ByteCompile** Yes

**Description** High dimensional longitudinal data analysis with Markov Chain Monte Carlo(MCMC). Currently support mixed effect regression with or without missing observations by considering covariance structures. It provides estimates by missing at random and missing not at random assumptions. In this R package, we present Bayesian approaches that statisticians and clinical researchers can easily use. The functions' methodology is based on the book ``Bayesian Approaches in Oncology Using R and OpenBUGS'' by Bhattacharjee A (2020) <doi:10.1201/9780429329449-14>.

**License** GPL-3

**Encoding** UTF-8

**NeedsCompilation** no

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Bysmixed

*Bayesian mixed effect model with MCMC*

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### Description

Bayesian mixed effect model with random intercepts and random slopes. Fits using MCMC on longitudinal data set.

### Usage

```
Bysmixed(m, n, t, group, chains, n.adapt, data)
```

### Arguments

m	Starting number of column from where repeated observations begin
n	Ending number of columns till where the repeated observations ends
t	Timepoint information on which repeated observations were taken
group	A categorical variable either 0 or 1. i.e. Gender - 1 male and 0 female
chains	Number of MCMC chains to be performed
n.adapt	Number of iterations to run in the JAGS adaptive phase.
data	High dimensional longitudinal data

### Value

Gives posterior means, standard deviation.

**Author(s)**

Atanu Bhattacharjee, Akash Pawar and Bhriгу Kumar Rajbongshi

**References**

Bhattacharjee, A. (2020). Bayesian Approaches in Oncology Using R and OpenBUGS. CRC Press.  
 Gelman, A., Carlin, J. B., Stern, H. S., Dunson, D. B., Vehtari, A., & Rubin, D. B. (2013). Bayesian data analysis. CRC press.  
 Fitzmaurice, G. M., Laird, N. M., & Ware, J. H. (2012). Applied longitudinal analysis (Vol. 998). John Wiley & Sons.

**Examples**

```
##
data(repdata)
Bysmixed(m=4, n=7, t="Age", group="Gender", chains=4, n.adapt=100, repdata)
##
```

---

BysmxDIC

*Bayesian mixed effect model for high dimensional longitudinal data with deviance information criterion (DIC).*

---

**Description**

Bayesian mixed effect model with random intercept and slopes provides inference with deviance information criterion (DIC). Data longitudinally measured missing value and having batched information. Fits using MCMC on longitudinal data set

**Usage**

```
BysmxDIC(m, tmax, t, group, chains, iter, out, data)
```

**Arguments**

m	Starting number of column from where repeated observations begin
tmax	Ending number of columns till where the repeated observations ends
t	Timepoint information on which repeated observations were taken
group	A categorical variable either 0 or 1. i.e. Gender - 1 male and 0 female
chains	Number of MCMC chains to be performed
iter	Number of iterations to be performed
out	DIC/HPD outcome
data	High dimensional longitudinal data

**Value**

Gives posterior means, standard deviation.

**Author(s)**

Atanu Bhattacharjee, Akash Pawar and Bhriгу Kumar Rajbongshi

**References**

Bhattacharjee, A. (2020). Bayesian Approaches in Oncology Using R and OpenBUGS. CRC Press.  
 Gelman, A., Carlin, J. B., Stern, H. S., Dunson, D. B., Vehtari, A., & Rubin, D. B. (2013). Bayesian data analysis. CRC press.  
 Fitzmaurice, G. M., Laird, N. M., & Ware, J. H. (2012). Applied longitudinal analysis (Vol. 998). John Wiley & Sons.

**Examples**

```
##
data(msrep)
BysmxDIC(m=c(4,8,12),tmax=4,t="Age",group="Gender",chains=4,iter=1000,out="DIC",data=msrep)
##
```

---

BysmxHPD

*Bayesian mixed effect model for high dimensional longitudinal data with highest posterior density interval (HPDI).*

---

**Description**

Bayesian mixed effect model with random intercept and slopes provides inference with highest posterior density interval (HPDI). Data longitudinally measured missing value and having batched information. Fits using MCMC on longitudinal data set

**Usage**

```
BysmxHPD(m, tmax, t, group, chains, iter, out, data)
```

**Arguments**

m	Starting number of column from where repeated observations begin
tmax	Ending number of columns till where the repeated observations ends
t	Timepoint information on which repeated observations were taken
group	A categorical variable either 0 or 1. i.e. Gender - 1 male and 0 female
chains	Number of MCMC chains to be performed
iter	Number of iterations to be performed
out	DIC/HPD outcome
data	High dimensional longitudinal data

**Value**

Gives posterior means, standard deviation.

**Author(s)**

Atanu Bhattacharjee, Akash Pawar and Bhriгу Kumar Rajbongshi

**References**

- Bhattacharjee, A. (2020). Bayesian Approaches in Oncology Using R and OpenBUGS. CRC Press.
- Gelman, A., Carlin, J. B., Stern, H. S., Dunson, D. B., Vehtari, A., & Rubin, D. B. (2013). Bayesian data analysis. CRC press.
- Fitzmaurice, G. M., Laird, N. M., & Ware, J. H. (2012). Applied longitudinal analysis (Vol. 998). John Wiley & Sons.

**Examples**

```
##
data(msrep)
BysmxHPD(m=c(4,8,12),tmax=4,t="Age",group="Gender",chains=4,iter=1000,out="hpD",data=msrep)
##
```

---

Bysmxms	<i>Bayesian mixed model with random intercepts and random slopes for high dimensional longitudinal data</i>
---------	---

---

**Description**

Bayesian mixed effect model with random intercepts and slopes with longitudinally measured missing data. Fits using MCMC on longitudinal data set

**Usage**

```
Bysmxms(m, n, time, group, chains, n.adapt, data)
```

**Arguments**

m	Starting number of column from where repeated observations begin
n	Ending number of columns till where the repeated observations ends
time	Timepoint information on which repeated observations were taken
group	A categorical variable either 0 or 1. i.e. Gender - 1 male and 0 female
chains	Number of MCMC chains to be performed
n.adapt	Number of iterations to run in the JAGS adaptive phase.
data	High dimensional longitudinal data

**Value**

Gives posterior means, standard deviation.

**Author(s)**

Atanu Bhattacharjee, Akash Pawar and Bhriku Kumar Rajbongshi

**References**

- Bhattacharjee, A. (2020). Bayesian Approaches in Oncology Using R and OpenBUGS. CRC Press.
- Gelman, A., Carlin, J. B., Stern, H. S., Dunson, D. B., Vehtari, A., & Rubin, D. B. (2013). Bayesian data analysis. CRC press.
- Fitzmaurice, G. M., Laird, N. M., & Ware, J. H. (2012). Applied longitudinal analysis (Vol. 998). John Wiley & Sons.

**Examples**

```
##
data(mesrep)
Bysmxms(m=4,n=7,time="Age",group="Gender",chains=4,n.adapt=100,data=mesrep)
##
```

---

Bysmxmss

*Bayesian mixed model with random intercepts and random slopes for high dimensional longitudinal data with batch size.*

---

**Description**

Bayesian mixed effect model with random intercept and slopes. Data longitudinally measured missing value and having batched information. Fits using MCMC on longitudinal data set

**Usage**

```
Bysmxmss(m, tmax, timepoints, group, chains, iter, data)
```

**Arguments**

m	Starting number of column from where repeated observations begin
tmax	Maximum batch of visits considered as repeated measurements
timepoints	Timepoint information on which repeated observations were taken
group	A categorical variable either 0 or 1. i.e. Gender - 1 male and 0 female
chains	Number of MCMC chains to be performed
iter	Number of iterations to be performed
data	High dimensional longitudinal data

**Value**

Gives posterior means, standard deviation.

**Author(s)**

Atanu Bhattacharjee and Akash Pawar

**References**

Bhattacharjee, A. (2020). Bayesian Approaches in Oncology Using R and OpenBUGS. CRC Press.  
 Gelman, A., Carlin, J. B., Stern, H. S., Dunson, D. B., Vehtari, A., & Rubin, D. B. (2013). Bayesian data analysis. CRC press.  
 Fitzmaurice, G. M., Laird, N. M., & Ware, J. H. (2012). Applied longitudinal analysis (Vol. 998). John Wiley & Sons.

**Examples**

```
##
data(repdat)
```

---

creg	<i>Bayesian multivariate regression with unstructured covariance matrix for high dimensional longitudinal data.</i>
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---

**Description**

Multivariate Regression with unstructured covariance matrix in longitudinal dataset with high dimensional.

**Usage**

```
creg(m, n, chains, n.adapt, data)
```

**Arguments**

m	Starting number of column from where repeated observations begin
n	Ending number of columns till where the repeated observations ends
chains	Number of MCMC chains to be performed
n.adapt	Number of iterations to be performed
data	High dimensional longitudinal data

**Value**

Results of posterior means and standard deviation.

**Author(s)**

Atanu Bhattacharjee, Akash Pawar and Bhriugu Kumar Rajbongshi

## References

- Bhattacharjee, A. (2020). Bayesian Approaches in Oncology Using R and OpenBUGS. CRC Press.
- Gelman, A., Carlin, J. B., Stern, H. S., Dunson, D. B., Vehtari, A., & Rubin, D. B. (2013). Bayesian data analysis. CRC press.
- Fitzmaurice, G. M., Laird, N. M., & Ware, J. H. (2012). Applied longitudinal analysis (Vol. 998). John Wiley & Sons.

## Examples

```
##  
data(repdata)  
creg(m=4,n=7,chains=4,n.adapt=100,data=repdata)  
##
```

---

gh

gh

---

## Description

High dimensional data on three consecutive measurements for and treatment arm information column.

## Usage

```
data(gh)
```

## Format

A tibble with 4 columns which are :

**y1** Observation on first timepoint

**y2** Observation on second timepoint

**y3** Observation on first timepoint

**Treatment** Treatment arm of the patient



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hdmarjg	<i>Missing at ranom by MCMC</i>
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---

**Description**

Missing at ranom by MCMC

**Usage**

```
hdmarjg(m, n, treatment, n.chains, n.iter, dat)
```

**Arguments**

<code>m</code>	Starting column number of the Y observations
<code>n</code>	Ending column number of the Y observations
<code>treatment</code>	Variable/column name containing the Treatment observations
<code>n.chains</code>	Number of MCMC chains
<code>n.iter</code>	Number of MCMC iterations
<code>dat</code>	Data set containing treatment column and repeated observations arrange by columns observations

**Value**

A data table listing the posterior mean and sigma results

**Author(s)**

Atanu Bhattacharjee, Akash Pawar and Bhriгу Kumar Rajbongshi

**References**

Bhattacharjee, A. (2020). Bayesian Approaches in Oncology Using R and OpenBUGS. CRC Press.

Gelman, A., Carlin, J. B., Stern, H. S., Dunson, D. B., Vehtari, A., & Rubin, D. B. (2013). Bayesian data analysis. CRC press.

Fitzmaurice, G. M., Laird, N. M., & Ware, J. H. (2012). Applied longitudinal analysis (Vol. 998). John Wiley & Sons.

**Examples**

```
##  
data(gh)  
hdmarjg(m=1, n=3, treatment="Treatment", n.chains=2, n.iter=10, dat=gh)  
##
```

---

`hdmnarjg`*Missing not at random by MCMC*

---

**Description**

Missing not at random by MCMC

**Usage**

```
hdmnarjg(m, n, treatment, n.chains, n.iter, dat)
```

**Arguments**

<code>m</code>	Starting column number of repeated observations
<code>n</code>	Ending column number of the repeated observations
<code>treatment</code>	Variable/column name containing the Treatment observations
<code>n.chains</code>	Number of MCMC chains
<code>n.iter</code>	Number of MCMC iterations
<code>dat</code>	Data set containing treatment column and repeated observations

**Value**

Results containing a data table listing the means and sigma results

**Author(s)**

Atanu Bhattacharjee, Akash Pawar and Bhriгу Kumar Rajbongshi

**References**

Bhattacharjee, A. (2020). Bayesian Approaches in Oncology Using R and OpenBUGS. CRC Press.

Gelman, A., Carlin, J. B., Stern, H. S., Dunson, D. B., Vehtari, A., & Rubin, D. B. (2013). Bayesian data analysis. CRC press.

Fitzmaurice, G. M., Laird, N. M., & Ware, J. H. (2012). Applied longitudinal analysis (Vol. 998). John Wiley & Sons.

**Examples**

```
##  
data(gh)  
hdmnarjg(m=1, n=3, treatment="Treatment", n.chains=2, n.iter=10, dat=gh)  
##
```

---

longitdata	<i>Repeatedly measured protein expression data</i>
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---

**Description**

Longitudinal observation on single variable from different observations. Observations arranged in a column as the patient with corresponding column of ID.

**Usage**

```
data(longitdata)
```

**Format**

A tibble with 2 columns which are :

**ID** Patient ID

**y** Repeated observations on the patient arranged in a row as per a subject

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msrep	<i>longitudinal data</i>
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**Description**

Longitudinal observation on single variable at different timepoints. Observations arranged in a column as the patient with corresponding column of ID.

**Usage**

```
data(msrep)
```

**Format**

A tibble with 7 columns which are :

**Subject** Patient ID

**Gender** Categorical numeric variable, 1 if Males and 0 if female

**Age** Time or age at which observations were taken from every subjects

**x1,...,x4** Columns stating number of observations at age 18,10,12 and 14

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mvncovar1	<i>Bayesian multivariate regression with independent covariance matrix for high dimensional longitudinal data.</i>
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---

### Description

Multivariate Regression with independent covariance matrix in longitudinal datasetup with high dimensional.

### Usage

```
mvncovar1(m, n, time, group, chains, iter, data)
```

### Arguments

m	Starting number of column from where repeated observations begin
n	Ending number of columns till where the repeated observations ends
time	Timepoint information on which repeated observations were taken
group	A categorical variable either 0 or 1. i.e. Gender - 1 male and 0 female
chains	Number of MCMC chains to be performed
iter	Number of iterations to be performed
data	High dimensional longitudinal data

### Value

mvncovarout lists posterior omega and sigma values.

### Author(s)

Atanu Bhattacharjee, Akash Pawar and Bhrigu Kumar Rajbongshi

### References

Bhattacharjee, A. (2020). Bayesian Approaches in Oncology Using R and OpenBUGS. CRC Press.

Gelman, A., Carlin, J. B., Stern, H. S., Dunson, D. B., Vehtari, A., & Rubin, D. B. (2013). Bayesian data analysis. CRC press.

Fitzmaurice, G. M., Laird, N. M., & Ware, J. H. (2012). Applied longitudinal analysis (Vol. 998). John Wiley & Sons.

### Examples

```
##
data(repdata)
mvncovar1(m=4,n=7,time="Age",group="Gender",chains=10,iter=100,repdata)
##
```

---

mvncovar2	<i>Bayesian multivariate normal regression with unstructured covariance matrix for high dimensional longitudinal data.</i>
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---

**Description**

Multivariate normal regression with group covaraites and unstructured covariance matrix.

**Usage**

```
mvncovar2(m, n, time, group, chains, iter, data)
```

**Arguments**

m	Starting number of column from where repeated observations begin
n	Ending number of columns till where the repeated observations ends
time	Timepoint information on which repeated observations were taken
group	A categorical variable either 0 or 1. i.e. Gender - 1 male and 0 female
chains	Number of MCMC chains to be performed
iter	Number of iterations to be performed
data	High dimensional longitudinal data

**Value**

mvncovarout

**Author(s)**

Atanu Bhattacharjee, Akash Pawar and Bhrigu Kumar Rajbongshi

**References**

Bhattacharjee, A. (2020). Bayesian Approaches in Oncology Using R and OpenBUGS. CRC Press.

Gelman, A., Carlin, J. B., Stern, H. S., Dunson, D. B., Vehtari, A., & Rubin, D. B. (2013). Bayesian data analysis. CRC press.

Fitzmaurice, G. M., Laird, N. M., & Ware, J. H. (2012). Applied longitudinal analysis (Vol. 998). John Wiley & Sons.

**Examples**

```
##
data(repdata)
mvncovar2(m=4,n=7,time="Age",group="Gender",chains=4,iter=100,data=repdata)
##
```

---

repdata

*longitudinal data*

---

### Description

Longitudinal observation on single variable at different timepoints. Observations arranged in a column as the patient with corresponding column of ID.

### Usage

```
data(repdata)
```

### Format

A tibble with 7 columns which are :

**Subject** Patient ID

**Gender** Categorical numeric variable, 1 if Males and 0 if female

**Age** Time or age at which observations were taken from every subjects

**x1,...,x4** Columns stating number of observations at age 18,10,12 and 14

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