

# Package ‘maclogp’

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**Title** Measures of Uncertainty for Model Selection

**Version** 0.1.1

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**Description** Following the common types of measures of uncertainty for parameter estimation, two measures of uncertainty were proposed for model selection, see Liu, Li and Jiang (2020) <[doi:10.1007/s11749-020-00737-9](https://doi.org/10.1007/s11749-020-00737-9)>. The first measure is a kind of model confidence set that relates to the variation of model selection, called Mac. The second measure focuses on error of model selection, called LogP. They are all computed via bootstrapping. This package provides functions to compute these two measures. Furthermore, a similar model confidence set adapted from Bayesian Model Averaging can also be computed using this package.

**License** GPL (>= 3)

**URL** <https://github.com/YuanyuanLi96/maclogp>

**BugReports** <https://github.com/YuanyuanLi96/maclogp/issues>

**Encoding** UTF-8

**LazyData** true

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**Imports** BMA, plot.matrix, rlist, utils

**NeedsCompilation** no

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**Repository** CRAN

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bms	<i>Bayesian Model Confidence Set</i>
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### Description

This function allows you to obtain a bayesian model confidence set with approximate posterior model probability.

### Usage

```
bms(data, alpha, eps = 1e-06)
```

### Arguments

data	a list including <b>x</b> covariates matrix, of dimension nobs and nvars;each row is an observation vector. <b>y</b> response variable.
alpha	a vector of significance levels. The confidence levels are 1-alpha. Default value is 0.05.
eps	tolerance level in choosing models with total posteriors at least 1-alpha. Default value is 1e-6.

### Value

Returns a list containing:

models	A list with one entry for each model. Each entry is an integer vector that specifies the columns of matrix <b>x</b> to be used as a regressor in that model. Models is ordered with decreasing posteriors.
con_sets	a list with with one entry for a 1-alpha model confidence set. Each entry is an integer vector that specifies the models selected in this set. The model indexes used in con_sets are their orders in models.
length_con	lengths of confidence sets.
probs_inorder	Model posteriors in decreasing order.
beta_ls	a list with one entry for each model. Each entry is a vector of estimated coefficients for that model.

### References

Liu, X., Li, Y. & Jiang, J.(2020). Simple measures of uncertainty for model selection. *TEST*, 1-20.  
 Raftery, Adrian E. (1995). Bayesian model selection in social research (with Discussion). *Sociological Methodology* 1995 (Peter V. Marsden, ed.), pp. 111-196.

**See Also**[bic.glm](#)**Examples**

```
n= 50
B= 100
p= 5
x = matrix(rnorm(n*p, mean=0, sd=1), n, p)
true_b = c(1:3, rep(0,p-3))
y = x%% true_b+rnorm(n)
alpha=c(0.1,0.05,0.01)
data=list(x=x,y=y)
result=bms(data,alpha)
```

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diabetes

*Diabetes data*

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**Description**

These data consist of observations on 442 patients, with the response of interest being a quantitative measure of disease progression one year after baseline. There are ten baseline variables and have been normalized to have mean 0 and Euclidean norm 1. The response variable has been centered (mean 0).

**Usage**

diabetes

**Format**

A data frame with 442 rows and 11 variables:

- V1** age
- V2** sex
- V3** body-mass index
- V4** average blood pressure
- V5** blood serum measurement 1
- V6** blood serum measurement 2
- V7** blood serum measurement 3
- V8** blood serum measurement 4
- V9** blood serum measurement 5
- V10** blood serum measurement 6
- V11** disease progression

**Source**

<https://web.stanford.edu/~hastie/Papers/LARS/diabetes.sdata.txt>

**References**

Efron, Hastie, Johnstone and Tibshirani (2003), Least Angle Regression. *Annals of Statistics*.

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MAC

*Mac and LogP measure*

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**Description**

This function allows you to obtain a model confidence set using Mac procedure and the LogP uncertainty measure for a selection method based on an information criterion.

**Usage**

```
MAC(models, data, B, alpha, method = "bic", delta = 1e-04, eps = 1e-06)
```

**Arguments**

models	A list with one entry for each model. Each entry is an integer vector that specifies the columns of matrix $\text{data}[x]$ to be used as a regressor in that model. An intercept will be fitted automatically.
data	a list including $\mathbf{x}$ covariates matrix, of dimension $\text{nobs}$ and $\text{nvars}$ ; each row is an observation vector. $\mathbf{y}$ response variable.
B	number of bootstrap replicates to perform; Default value is 200.
alpha	a vector of significance levels. The confidence levels of the model confidence sets are $1-\alpha$ . Default value is 0.05.
method	Information criterion. Users can choose from "bic", "aic". Default value is "bic".
delta	A small positive number added inside of LogP when the bootstrap probability of selected model is 1. Default value is $1e-4$ .
eps	tolerance level in choosing models with total bootstrap probabilities at least $1-\alpha$ . Default value is $1e-6$ .

**Value**

Returns an object of class “MAC”. An object of class “MAC” is a list containing at least the following components:

hat_M	numeric index of selected model.
con_sets	a list with with one entry for a 1-alpha model confidence set. Each entry is an integer vector that specifies the models selected in this set. The model indexes used in con_sets are their orders in models.
length_con	lengths of confidence sets.
order	Model indexes with increasing information scores based on original data.
probs_inorder	Bootstrap probabilities for the models in order.
beta_ls	a list with one entry for each model. Each entry is a vector of estimated coefficients based on original data for that model.
hat_prob	the Bootstrap probability for single selected model.
hat_logp	the LogP measure.

**References**

Liu, X., Li, Y. & Jiang, J.(2020). Simple measures of uncertainty for model selection. *TEST*, 1-20.

**See Also**

[plot\\_MAC](#)

**Examples**

```
set.seed(0)
n= 50
B= 100
p= 5
x = matrix(rnorm(n*p, mean=0, sd=1), n, p)
true_b = c(1:3, rep(0,p-3))
y = x%% true_b+rnorm(n)
alpha=c(0.1,0.05,0.01)
data=list(x=x,y=y)
models=Models_gen(1:p)
result=MAC(models, data, B, alpha)
```

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Models\_gen

*Generate all subset models*

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**Description**

This function generates a list including all subset models given a vector of candidate predictors.

**Usage**

```
Models_gen(predictors)
```

**Arguments**

`predictors` a vector including the indexes of all predictors, such as 1:p.

**Value**

Returns a list with one entry for each model. Each entry is an integer vector that specifies the columns of matrix  $x$  to be used as a regressor in that model.

**See Also**

[combn](#), [list.flatten](#)

**Examples**

```
Models_gen(1:5)
```

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plot\_MAC

*Visualize model confidence sets*

---

**Description**

This function generates a heat map for a given model confidence set. Each row represents a model in the confidence set, and colored cell represents the variables in that model.

**Usage**

```
plot_MAC(models, alpha, con_sets, p, xnames = NULL, color = "lightblue")
```

**Arguments**

<code>models</code>	A list with one entry for each model. Each entry is an integer vector that specifies the columns of matrix $X$ without intercept to be used as a regressor in that model. Intercept will be fitted automatically for every model. such as 1:p.
<code>alpha</code>	Significance levels. The confidence levels for confidence sets are 1-alpha.
<code>con_sets</code>	a list with with one entry for a 1-alpha model confidence set. Each entry is an integer vector that specifies the models selected in this set. The model indexes used in <code>con_sets</code> are their orders in <code>models</code> .
<code>p</code>	the number of candidate variables.
<code>xnames</code>	variable names of all candidate variables. Default is 1:p.
<code>color</code>	the color that indicates a variable is selected. Default is "lightblue".

**Value**

Returns a logical matrix per confidence set with one row per model and one column per variable indicating whether that variable is in the model.

Generates a corresponding heat map per confidence set with one row per model and one column per variable indicating whether that variable is in the model. A cell in white means the variable is not in that model; a cell in user-specified color means the variable is in that model.

**See Also**

[MAC](#)

**Examples**

```
n= 50
B= 100
p= 5
x = matrix(rnorm(n*p, mean=0, sd=1), n, p)
true_b = c(1:3, rep(0,p-3))
y = x%% true_b+rnorm(n)
alpha=c(0.1,0.05,0.01)
data=list(x=x,y=y)
models=Models_gen(1:p)
result=MAC(models, data, B, alpha)
plot_MAC(models, alpha, result$con_sets, p)
result2=bms(data, alpha)
plot_MAC(result2$models, alpha, result2$con_sets, p)
```

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