

# Package: ordinalLBM (via r-universe)

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**Title** Co-Clustering of Ordinal Data via Latent Continuous Random Variables

**Version** 1.0

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**Description** It implements functions for simulation and estimation of the ordinal latent block model (OLBM), as described in Corneli, Bouveyron and Latouche (2019).

**Imports** reshape2, RColorBrewer

**Depends** R (>= 3.4.0)

**License** GPL (>= 2)

**Encoding** UTF-8

**LazyData** true

**RoxygenNote** 6.1.0

**NeedsCompilation** no

**Config/pak/sysreqs** libicu-dev

**Repository** <https://marcogenni.r-universe.dev>

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**RemoteRef** HEAD

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olbm

*Fitting OLBM to the data***Description**

It estimates the OLBM model parameters as well as the most likely posterior cluster assignments by maximum likelihood.

**Usage**

```
olbm(Y, Q, L, init = "kmeans", eps = 1e-04, it_max = 500,
      verbose = TRUE)
```

**Arguments**

|         |                                                                                                                               |
|---------|-------------------------------------------------------------------------------------------------------------------------------|
| Y       | An M x P ordinal matrix, containing ordinal entries from 1 to K. Missing data are coded as zeros.                             |
| Q       | The number of row clusters.                                                                                                   |
| L       | The number of column clusters.                                                                                                |
| init    | A string specifying the initialisation type. It can be "kmeans" (the default) or "random" for a single random initialisation. |
| eps     | When the difference between two consecutive values of the log-likelihood is smaller than eps, the M-EM algorithms will stop.  |
| it_max  | The maximum number of iterations that the M-EM algorithms will perform (although the minimum tolerance eps is not reached).   |
| verbose | A boolean specifying whether extended information should be displayed or not (TRUE by default).                               |

**Value**

It returns an S3 object of class "olbm" containing

|        |                                                                                                                                                                        |
|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| estR   | the estimated row cluster memberships.                                                                                                                                 |
| estC   | the estimated column cluster memberships.                                                                                                                              |
| likeli | the final value of the log-likelihood.                                                                                                                                 |
| icl    | the value of the ICL criterion.                                                                                                                                        |
| Pi     | the Q x L estimated connectivity matrix.                                                                                                                               |
| mu     | a Q x L matrix containing the estimated means of the latent Gaussian distributions.                                                                                    |
| sd     | a Q x L matrix containing the estimated standard deviations of the latent Gaussian distributions.                                                                      |
| eta    | a Q x L x K array whose entry (q,l,k) is the estimated probability that one user in the q-th row cluster assign the score k to one product in the l-th column cluster. |

|            |                                                                                         |
|------------|-----------------------------------------------------------------------------------------|
| rho        | the estimated row cluster proportions.                                                  |
| delta      | the estimated column cluster proportions.                                               |
| initR      | the initial row cluster assignments provided to the C-EM algorithm.                     |
| initC      | the initial column cluster assignments provided to the C-EM algorithm.                  |
| Y          | the input ordinal matrix Y.                                                             |
| thresholds | the values (1.5, 2.5, ... , K-0.5) of the thresholds, defined inside the function olbm. |

## References

Corneli M., Bouveyron C. and Latouche P. (2019) *Co-Clustering of ordinal data via latent continuous random variables and a classification EM algorithm*. (<https://hal.archives-ouvertes.fr/hal-01978174>)

## Examples

```
data(olbm_dat)
res <- olbm(olbm_dat$Y, Q=3, L=2)
```

---

|          |                            |
|----------|----------------------------|
| olbm_dat | <i>OLBM simulated data</i> |
|----------|----------------------------|

---

## Description

It is a list containing i) an ordinal toy data matrix simulated according to OLBM and ii) the row/column cluster assignments. To see how the data are simulated, you can type "?simu.olbm" in the R console and look at "Examples".

## Usage

```
data(olbm_dat)
```

## Format

A list containing three items.

**Y** : an ordinal data matrix simulated according to OLBM.

**Rclus** : the actual row cluster assignments.

**Cclust** : the actual column cluster assignments.

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plot.olbm

*Plot OLBM*


---

### Description

It plots the re-organized incidence matrix and/or the estimated Gaussian densities.

### Usage

```
## S3 method for class 'olbm'
plot(x, type = "hist", ...)
```

### Arguments

|      |                                                                                                                 |
|------|-----------------------------------------------------------------------------------------------------------------|
| x    | The "olbm" object output of the function olbm.                                                                  |
| type | A string specifying the type of plot to be produced. The currently supported values are "hist" and "incidence". |
| ...  | Additional parameters to pass to sub-functions.                                                                 |

### Examples

```
data(olbm_dat)
res <- olbm(olbm_dat$Y, Q=3, L=2)
plot(res, "hist")
plot(res, "incidence")
```

---

simu.olbm

*Simulate OLBM data*


---

### Description

It simulates an ordinal data matrix according to OLBM.

### Usage

```
simu.olbm(M, P, Pi, rho, delta, mu, sd, thresh)
```

### Arguments

|     |                                                                                         |
|-----|-----------------------------------------------------------------------------------------|
| M   | The number of rows of the ordinal matrix Y.                                             |
| P   | The number of columns of the ordinal matrix Y.                                          |
| Pi  | A Q x L connectivity matrix to manage missing data (coded as zeros in Y).               |
| rho | A vector of length Q, containing multinomial probabilities for row cluster assignments. |

|        |                                                                                                                                                                                                    |
|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| delta  | A vector of length L, containing multinomial probabilities for column cluster assignments.                                                                                                         |
| mu     | A Q x L matrix containing the means of the latent Gaussian distributions.                                                                                                                          |
| sd     | A Q x L matrix containing the standard deviations of the latent Gaussian distributions.                                                                                                            |
| thresh | A K+1 vector containing the sorted thresholds used to simulate the ordinal entries in Y, where K is the number of ordinal modalities. The first entry in thresh must be -Inf, the last entry +Inf. |

### Value

It returns a list containing:

|       |                                                                                                              |
|-------|--------------------------------------------------------------------------------------------------------------|
| Y     | An M x P matrix. The observed ordinal entries are integers between 1 and K. Missing data are coded as zeros. |
| Rclus | A vector of length M containing the row cluster memberships.                                                 |
| Cclus | A vector of length P containing the column cluster memberships.                                              |

### References

Corneli M., Bouveyron C. and Latouche P. (2019) *Co-Clustering of ordinal data via latent continuous random variables and a classification EM algorithm*. (<https://hal.archives-ouvertes.fr/hal-01978174>)

### Examples

```
M <- 150
P <- 100
Q <- 3
L <- 2

## connectivity matrix
Pi <- matrix(.7, nrow = Q, ncol = L)
Pi[1,1] <- Pi[2,2] <- Pi[3,2] <- .5

## cluster memberships proportions
rho <- c(1/3, 1/3, 1/3)
delta <- c(1/2, 1/2)

# Thresholds
thresh <- c(-Inf, 2.37, 2.67, 3.18, 4.33, Inf) # K = 5

## Gaussian parameters
mu <- matrix(c(0, 3.4, 2.6, 0, 2.6, 3.4), nrow = Q, ncol = L)
sd <- matrix(c(1.2, 1.4, 1.0, 1.2, 1.4, 1.0), nrow = Q, ncol = L)

## Data simulation
dat <- simu.olbm(M, P, Pi, rho, delta, mu, sd, thresh)
```

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