Package ‘ordinalLBM’

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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

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R topics documented:

olbm ................................................................. 2
olbm_dat .......................................................... 3
plot.olbm ......................................................... 4
simu.olbm ......................................................... 4

Index 6
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

```r
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.
### olbm_dat

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>rho</code></td>
<td>the estimated row cluster proportions.</td>
</tr>
<tr>
<td><code>delta</code></td>
<td>the estimated column cluster proportions.</td>
</tr>
<tr>
<td><code>initR</code></td>
<td>the initial row cluster assignments provided to the C-EM algorithm.</td>
</tr>
<tr>
<td><code>initC</code></td>
<td>the initial column cluster assignments provided to the C-EM algorithm.</td>
</tr>
<tr>
<td><code>Y</code></td>
<td>the input ordinal matrix $Y$.</td>
</tr>
<tr>
<td><code>thresholds</code></td>
<td>the values (1.5, 2.5, ... , K-0.5) of the thresholds, defined inside the function <code>olbm</code>.</td>
</tr>
</tbody>
</table>

**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](https://hal.archives-ouvertes.fr/hal-01978174)

**Examples**

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

**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**

```R
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.
plot.olbm  

Plot OLBM

Description

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

Usage

```r
# 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

```r
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

```r
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)
Index

olbm, 2
olbm_dat, 3
plot.olbm, 4
simu.olbm, 4