Package ‘PoisNor’

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Type Package

Title Simultaneous generation of multivariate data with Poisson and normal marginals

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Description A package for simulating multivariate data with count and continuous variables with a pre-specified correlation matrix. The count and continuous variables are assumed to have Poisson and normal marginals, respectively. The data generation mechanism is a combination of the normal to anything principle and a connection between Poisson and normal correlations in the mixture.

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Description

The package implements a procedure for simultaneous generation of multivariate data with count and continuous variables with a pre-specified correlation matrix. The count and continuous variables are assumed to have Poisson and normal marginals, respectively. The data generation mechanism is a combination of the normal to anything principle and a connection between Poisson and normal correlations in the mixture. Data generation is accomplished by first calculating an intermediate correlation matrix \( \text{cmat.star} \) which is used to generate a sample from multivariate normal distribution. Then, the first few components (corresponding to number of Poisson variables) are transformed to Poisson variables via inverse CDF method. The resulting data are composed of a mixture of Poisson and normal variables that conform with pre-specified marginal distributions and correlation structure.

The function \texttt{Valid.correlation} returns the lower and upper bounds of the correlation coefficients of Poisson-Poisson and Poisson-normal pairs given their marginal distributions, i.e. returns the range of feasible pairwise correlations. The function \texttt{Validate.correlation} checks the validity of the values of pairwise correlations. Additionally, it checks positive definiteness, symmetry and correctness of the dimensions. The engine function \texttt{genPoisNor} generates mixed data in accordance with the specified marginal and correlational quantities.

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\texttt{cmat.star} \quad \textit{Computes the correlation of intermediate multivariate normal data before subsequent inverse CDF transformation.}
**Description**

The function computes an intermediate correlation matrix which leads to the target correlation matrix after inverse CDF transformation of the samples generated from a multivariate normal distribution with the intermediate correlation matrix.

**Usage**

```r
cmat.star(no.pois, no.norm, corMat, lamvec)
```

**Arguments**

- `no.pois` Number of Poisson variables in the data.
- `no.norm` Number of normal variables in the data.
- `corMat` A positive definite target correlation matrix whose entries are within the valid limits.
- `lamvec` Vector of Poisson rates (means).

**Value**

An intermediate correlation matrix of size \((\text{no.pois} + \text{no.norm}) \times (\text{no.pois} + \text{no.norm})\)

**References**


**See Also**

- `validate.correlation`

**Examples**

```r
## Not run:
lamvec= c(0.5,0.7,0.9)
M=c(0.352, 0.265, 0.342, 0.09, 0.141, 0.121, 0.297,
    -0.022, 0.177, 0.294, -0.044, 0.129, 0.1, 0.354, 0.386)

N=diag(6)
N[lower.tri(N)]=M
TV=N+t(N)
diag(TV)<-1
cstar = cmat.star(no.pois=3, no.norm=3, TV, lamvec)

## End(Not run)
```
Cor.PPN.Limit

Finds the feasible correlation range for a pair of Poisson and normal variables.

Description
The function computes the lower and upper bounds of a pairwise correlation between a Poisson and a normal variable via the method of Demirtas and Hedeker (2011).

Usage
Cor.PPN.Limit(lam)

Arguments
lam A marginal rate for a Poisson variable of the pair.

Value
A vector of two elements. The first element is the lower bound and the second element is the upper bound.

References

Examples
Cor.PPN.Limit(0.05)

Cor.PPL.Limit

Finds the feasible correlation range for a pair of Poisson variables.

Description
The function computes the lower and upper bounds of a pairwise correlation between a pair of Poisson variables.

Usage
Cor.PPL.Limit(lamvec)

Arguments
lamvec A vector of marginal rates for a pair of Poisson variables.
**Value**

A vector of two elements. The first element is the lower bound and the second element is the upper bound.

**Examples**

```r
cor.PP.Limit(c(0.05, 0.07) )
```

---

**Description**

The function simulates a sample of size \( n \) from a multivariate Poisson and normal variables with correlation matrix \( \text{corMat} \) and pre-specified marginals.

**Usage**

```r
genPoisNor(n, no.norm, no.pois, cmat.star, lamvec, sd.vec, mean.vec)
```

**Arguments**

- \( n \) Number of rows
- \( \text{no.pois} \) Number of Poisson variables.
- \( \text{no.norm} \) Number of normal variables.
- \( \text{cmat.star} \) The intermediate correlation matrix obtained from \( \text{cmat.star} \) function.
- \( \text{lamvec} \) A vector of marginal rates for Poisson variables.
- \( \text{mean.vec} \) A vector of means for the normal variables.
- \( \text{sd.vec} \) A vector of standard deviations for the normal variables.

**Value**

A matrix of size \( n \times (\text{no.pois} + \text{no.norm}) \), of which first \( \text{no.pois} \) are Poisson variables.

**Examples**

```r
## Not run:
lamvec= c(0.05,0.07,0.09)
M=c(0.352, 0.265, 0.342, 0.09, 0.141, 0.121, 0.297,
-0.022, 0.177, 0.294, -0.044, 0.129, 0.1, 0.354, 0.386)
N=diag(6)
N[lower.tri(N)]=M
TV=N+t(N)
diag(TV)<-1
cstar = cmat.star(no.pois=3, no.norm=3, TV, lamvec)
```
Valid.correlation  

Computes the lower and upper correlation bounds in the form of two matrices.

Description

The function computes the lower and upper bounds for the target correlations based on the marginal rates.

Usage

Valid.correlation(no.pois, no.norm, lamvec)

Arguments

- no.pois       Number of Poisson variables.
- no.norm       Number of normal variables.
- lamvec        A vector of marginal rates for Poisson variables.

Details

The function returns a list of two matrices. The min contains the lower bounds and the max contains the upper bounds of the feasible correlations.

Examples

```r
lamvec = c(0.05, 0.07, 0.09)
Valid.correlation(no.pois=3, no.norm=3, lamvec)
```
Validate.correlation  Checks the target correlation matrix.

Description

The function checks the validity of the values of pairwise correlations. Additionally, it checks positive definiteness, symmetry and correctness of the dimensions.

Usage

Validate.correlation(no.pois, no.norm, corMat, lamvec)

Arguments

- no.pois: Number of Poisson variables.
- no.norm: Number of normal variables.
- corMat: The target correlation matrix which must be positive definite and within the valid limits.
- lamvec: A vector of marginal rates for Poisson variables.

Details

In addition to being positive definite and symmetric, the values of pairwise correlations in the target correlation matrix must also fall within the limits imposed by the marginal distributions in the system. The function ensures that the supplied correlation matrix is valid for simulation. If a violation occurs, an error message is displayed that identifies the violation. The function returns a logical value TRUE when no such violation occurs.

Examples

```r
# Not run:
# An example with a valid target correlation matrix.

lamvec = c(0.05, 0.07, 0.09)
M = c(0.352, 0.265, 0.342, 0.09, 0.141, 0.121, 0.297, 
     -0.022, 0.177, 0.294, -0.044, 0.129, 0.1, 0.354, 0.386)

N = diag(6)
N[lower.tri(N)] = M
TV = N+t(N)
diag(TV) <- 1

Validate.correlation(no.pois=3, no.norm=3, corMat=TV, lamvec)

# An example with an invalid target correlation matrix (bound violation).

lamvec = c(0.05, 0.07, 0.09)
```
Validate.correlation

M <- c(-0.151, -0.085, -0.11, 0.29, 0.6, 0.132, 0.161, 0.139, -0.088, 0.075, -0.025, -0.293, -0.67, -0.03, 0.61)
N <- diag(6)
N[lower.tri(N)] <- M
TV1 <- N + t(N)
diag(TV1) <- 1
Validate.correlation(no.pois = 3, no.norm = 3, corMat = TV1, lamvec)

# Examples with an incorrect dimension specification.

lamvec <- c(0.05, 0.07, 0.09)
Validate.correlation(no.pois = 3, no.norm = 2, corMat = TV1, lamvec)
Validate.correlation(no.pois = 2, no.norm = 3, corMat = TV1, lamvec)

# An example with a non-positive definite correlation matrix.

TV1 <- TV
TV1[5, 1] <- TV1[1, 5] = 1.5
Validate.correlation(no.pois = 3, no.norm = 3, corMat = TV1, lamvec)

# An example with a non-symmetric correlation matrix.

TV1 <- TV
TV1[5, 1] = 0.1
Validate.correlation(no.pois = 3, no.norm = 3, corMat = TV1, lamvec)

# An example with an invalid diagonal element in the correlation matrix.

TV1 <- TV
TV1[5, 5] = 2
Validate.correlation(no.pois = 3, no.norm = 3, corMat = TV1, lamvec)

## End (Not run)
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