Package ‘RNGforGPD’

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Description Generation of univariate and multivariate data that follow the generalized Poisson distribution. The details of the univariate part are explained in Demirtas (2017), and the multivariate part is an extension of the correlated Poisson data generation routine that was introduced in Yahav and Shmueli (2012).
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Generates Univariate and Multivariate Generalized Poisson Variables

Description

This package is about generating univariate and multivariate data that follow the generalized Poisson distribution. There are seven functions in the package: GenUniGpois and GenMVGpois are the data generation functions that simulate univariate and multivariate Poisson variables, respectively; ValidCorrGpois checks the validity of the values of pairwise correlations; ComputeCorrGpois computes the lower and upper correlation bounds of a pairwise correlation between a pair of generalized Poisson variables; CorrNNGpois adjusts the target correlation for a pair of generalized Poisson variables; QuantileGpois computes the quantile of a given generalized Poisson distribution; CmatStarGpois computes an intermediate correlation matrix. To learn more about this package please refer to both the reference manual and the vignette file.

Details

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Author(s)

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References


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**CmatStarGpois**

**Computes Intermediate Correlation Matrix**

**Description**

CmatStarGpois computes an intermediate correlation matrix that will be used to obtain the target correlation matrix using the inverse CDF transformation method in GenMGpois. If the intermediate correlation matrix is not positive definite, the nearest positive definite matrix is used.

**Usage**

```r
CmatStarGpois(corMat, theta.vec, lambda.vec)
```

**Arguments**

- `corMat`: target correlation matrix.
- `theta.vec`: theta.vec rate parameters in the generalized Poisson distribution. It is assumed that the length of the vector is at least two, and each value has to be a positive number.
- `lambda.vec`: dispersion parameters in the generalized Poisson distribution. It is assumed that the length of the vector is at least two. All lambda values have to be < 1. For lambda < 0, lambda must be >= -theta/4.

**Value**

intermediate correlation matrix.

**References**


**Examples**

```r
lambda.vec = c(-0.2, 0.2, -0.3)
theta.vec = c(1, 3, 4)
M = c(0.352, 0.265, 0.342)
N = diag(3)
N[lower.tri(N)] = M
```
ComputeCorrGpois

\[
TV = N + t(N) \\
\text{diag}(TV) = 1 \\
cstar = \text{CmatStarGpois}(TV, \theta, \lambda) \\
cstar
\]

---

**Description**

ComputeCorrGpois computes the lower and upper correlation bounds of a pairwise correlation between any pair of generalized Poisson variables using the Generate, Sort, and Correlate (GSC) algorithm described in Demirtas and Hedeker (2011).

**Usage**

```
ComputeCorrGpois(theta.vec, lambda.vec)
```

**Arguments**

- `theta.vec` - rate parameters in the generalized Poisson distribution. It is assumed that the length of the vector is at least two, and each value has to be a positive number.
- `lambda.vec` - dispersion parameters in the generalized Poisson distribution. It is assumed that the length of the vector is at least two. All lambda values have to be < 1. For lambda < 0, lambda must be \( \geq -\theta/4 \).

**Value**

lower and upper correlation bounds.

**References**


**Examples**

```
ComputeCorrGpois(c(3,2,5,4),c(0.3,0.2,0.5,0.6))
ComputeCorrGpois(c(4,5),c(-0.45,-0.11))
```
CorrNNGpois

Adjusts the Target Correlation

Description

`CorrNNGpois` adjusts the actual/realized correlation to the target correlation bounds for a pair of generalized Poisson variables.

Usage

`CorrNNGpois(theta.vec, lambda.vec, r)`

Arguments

- `theta.vec`: rate parameters in the generalized Poisson distribution. It is assumed that the length of the vector is at least two, and each value has to be a positive number.
- `lambda.vec`: dispersion parameters in the generalized Poisson distribution. It is assumed that the length of the vector is at least two. All lambda values have to be < 1. For lambda < 0, lambda must be >= -theta/4.
- `r`: desired target correlation.

Value

the adjusted target correlation.

References


Examples

`CorrNNGpois(c(0.1,10), c(0.1, 0.2),0.5)`  
`CorrNNGpois(c(0.1,10), c(-0.01, -0.02),0.5)`  
`CorrNNGpois(c(4,2.3), c(-0.32,-0.3),0.7)`  
`CorrNNGpois(c(14,10), c(-0.8, -0.3),0.99)`
GenMVGpois  Generates Data from Multivariate Generalized Poisson Distribution

Description

GenMVGpois simulates a sample of size `sample.size` from a set of multivariate generalized Poisson variables with correlation matrix `cmat.star` and pre-specified marginals.

Usage

GenMVGpois(sample.size, no.gpois, cmat.star, theta.vec, lambda.vec, details = TRUE)

Arguments

- `sample.size`: desired sample size (number of rows) for the multivariate generalized Poisson data.
- `no.gpois`: dimension of the multivariate generalized Poisson distribution.
- `cmat.star`: intermediate correlation matrix.
- `theta.vec`: rate parameters in the generalized Poisson distribution. It is assumed that the length of the vector is at least two, and each value has to be a positive number.
- `lambda.vec`: dispersion parameters in the generalized Poisson distribution. It is assumed that the length of the vector is at least two. All lambda values have to be < 1. For lambda < 0, lambda must be >= -theta/4.
- `details`: index of whether to display the specified and empirical values of parameters. Default is set to be TRUE.

Value

data that follow multivariate generalized Poisson distribution.

References


GenUniGpois

Examples

```r
sample.size = 10000; no.gpois = 3
lambda.vec = c(0.2, 0.2, 0.3); theta.vec = c(1, 3, 4)
M = c(0.352, 0.265, 0.342); N = diag(3); N[lower.tri(N)] = M
TV = N + t(N); diag(TV) = 1
cstar = CmatStarGpois(TV, theta.vec, lambda.vec)
data = GenMVGpois(sample.size, no.gpois, cstar, theta.vec, lambda.vec, details = FALSE)
apply(data, 2, mean) # empirical means
theta.vec / (1 - lambda.vec) # theoretical means
apply(data, 2, var) # empirical variances
theta.vec / (1 - lambda.vec)^3 # theoretical variances
cor(data) # empirical correlation matrix
TV # specified correlation matrix
```

---

GenUniGpois

*Generates Univariate Generalized Poisson Variates*

Description

GenUniGpois generates univariate random variables from the generalized Poisson distribution using one of the five methods including Inversion, Branching, Normal-Approximation, Build-Up, Chop-Down.

Usage

```r
GenUniGpois(theta, lambda, n, details = TRUE, method)
```

Arguments

- `theta` the rate parameter in the generalized Poisson distribution. It has to be a positive number.
- `lambda` the dispersion parameter in the generalized Poisson distribution. It has to be < 1. For lambda < 0, lambda must be greater than or equal to -theta/4.
- `n` number of data points that is to be generated.
- `details` index to indicate whether or not to print out the estimates of parameters. The default is set as TRUE.
- `method` index to specify one of the five methods: "Inversion", "Branching", "Normal-Approximation", "Build-Up" and "Chop-Down".

Details

All five methods come from Demirtas (2017). When lambda equals 0, it is the ordinary Poisson distribution, so there is no need to specify the method. "Branching" only works when lambda is positive. When theta is less than 10, a "Normal-Approximation" may not be reliable.
Value

a list that includes generated data, specified and empirical values of theta and lambda.

References


Examples

```r
GenUniGpois(2, 0.9, 100, method = "Branching")
GenUniGpois(5, -0.4, 100, method = "Inversion")
GenUniGpois(12, 0.5, 100, method = "Normal-Approximation")
data <- GenUniGpois(10, 0.4, 10, method = "Chop-Down", details = FALSE)
data <- GenUniGpois(3, 0.9, 10000, method = "Build-Up", details = FALSE)
```

---

QuantileGpois

**Description**

QuantileGpois computes the quantile for the generalized Poisson distribution for specified values of percentile, lambda and theta parameters.

**Usage**

```r
QuantileGpois(p, theta, lambda, details = FALSE)
```

**Arguments**

- `p`: percentile of the generalized Poisson distribution.
- `theta`: the rate parameter in the generalized Poisson distribution. It has to be a positive number.
- `lambda`: the dispersion parameter in the generalized Poisson distribution. It has to be < 1. For lambda < 0, lambda must be >= -theta/4.
- `details`: show the detailed information of probability and cumulative probability. Default is set as FALSE.

**Value**

quantile of the specified distribution if the parameter `details` is set as FALSE. quantile and the detailed information of probability and cumulative probability if the parameter `details` is set as TRUE.

**References**

ValidCorrGpois

Examples
QuantileGpois(0.98,1,-0.2,details = TRUE)
QuantileGpois(0.80,2,0.025,details = FALSE)

ValidCorrGpois

Validates Pairwise Correlations

Description
ValidCorrGpois checks the validity of the values of pairwise correlations including positive definiteness, symmetry, and correctness of the dimensions.

Usage
ValidCorrGpois(corMat, theta.vec, lambda.vec)

Arguments
corMat a positive definite target correlation matrix whose entries are within the valid correlation bounds.
theta.vec rate parameters in the generalized Poisson distribution. It is assumed that the length of the vector is at least two, and each value has to be a positive number.
lambda.vec dispersion parameters in the generalized Poisson distribution. It is assumed that the length of the vector is at least two. All lambda values have to be < 1. For lambda < 0, lambda must be >= -theta/4.

Value
TRUE or FALSE.

References

Examples
ValidCorrGpois(matrix(c(1, 0.9, 0.9, 1), byrow = TRUE, nrow = 2), c(0.5, 0.5), c(0.1, 0.105))
ValidCorrGpois(matrix(c(1, 0.9, 0.9, 1), byrow = TRUE, nrow = 2), c(3, 2), c(-0.3, -0.2))
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