

Package ‘Compositionalzerocens’

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Type Package

Title Modelling Zero Values in Compositional Data Using a Censored Model

Version 1.1

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Depends R (>= 4.0)

Imports Compositional, far, Rfast, stats, TruncatedNormal

Suggests Rfast2

Description Modelling structural zeros in compositional data assuming a latent Gaussian model, where MLE is performed via the EM algorithm. The relevant paper is Tsagris and Alharbi (2026) <[doi:10.48550/arXiv.2208.13073](https://doi.org/10.48550/arXiv.2208.13073)>.

License GPL (>= 2)

NeedsCompilation no

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Compositionalzerocens-package

Modelling Zero Values in Compositional Data Using a Censored Model

Description

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Details

Package: Compositionalzerocens
 Type: Package
 Version: 1.1
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Maintainers

Michail Tsagris <mtsagris@uoc.gr>.

Author(s)

Michail Tsagris <mtsagris@uoc.gr>

References

Tsagris M. and Alharbi N. (2026). Modelling structural zeros in compositional data via a zero-censored multivariate normal model.

<https://arxiv.org/pdf/2208.13073>

dzerocens

Density of the zero-censored model

Description

Density of the zero-censored model.

Usage

```
dzerocens(x, mu, sigma, logdens = FALSE)
```

Arguments

x	A vector or a matrix with compositional data.
mu	The mean vector in R^{D-1} .
sigma	The covariance matrix in R^{D-1} .
logdens	If you want the log of the density set this TRUE, otherwise leave it FALSE.

Details

The function computes the density values of the zero-censored model.

Value

The density values at the given compositional data x.

Author(s)

R implementation and documentation: Michail Tsagris <mtsagris@uoc.gr>.

References

Tsagris M. and Alharbi N. (2026). Modelling structural zeros in compositional data via a zero-censored multivariate normal model.

<https://arxiv.org/pdf/2208.13073>

Examples

```
mu <- c(0.325, 0.121)
sigma <- matrix(c(0.149, -0.200,
                 -0.200, 0.323), 2, 2)
x <- rzerocens(100, mu, sigma)
mod <- zerocens.em(x)
mu <- mod$mu
sigma <- mod$sigma
f <- dzerocens(x, mu, sigma)
```

gof.zerocens

Goodness-of-fit test for the zero-censored model

Description

Goodness-of-fit test for the zero-censored model.

Usage

```
gof.zerocens(x, mu, sigma, B = 999, nsim = 1e+6)
```

Arguments

x	A a matrix with compositional data.
mu	The mean vector in R^{D-1} .
sigma	The covariance matrix in R^{D-1} .
B	The number of bootstrap samples to generate.
nsim	The number of draws to use in the Monte Carlo estimation of the zero-censoring probability.

Details

The function performs a goodness-of-fit test for the observed number of zero patterns (Tsagris and Alharbi, 2026).

Value

The p-value of the test.

Author(s)

R implementation and documentation: Michail Tsagris <mtsagris@uoc.gr>.

References

Tsagris M. and Alharbi N. (2026). Modelling structural zeros in compositional data via a zero-censored multivariate normal model.
<https://arxiv.org/pdf/2208.13073>

Examples

```
mu <- c(0.325, 0.121)
sigma <- matrix( c(0.149, -0.200, -0.200, 0.323), ncol = 2)
x <- rzerocens(100, mu, sigma)
gof.zerocens(x, mu, sigma, B = 49, nsim = 1e+3)
```

prob.zerocens

Estimation of the zero-censoring probability

Description

Estimation of the zero-censoring probability.

Usage

```
prob.zerocens(mu, sigma, theoretical = FALSE, nsim = 1e+6)
```

Arguments

mu	The mean vector in R^{D-1} .
sigma	The covariance matrix in R^{D-1} .
theoretical	Do you want the theoretical probability?
nsim	The number of draws to use in the Monte Carlo estimation of the zero-censoring probability.

Details

The function performs a goodness-of-fit test for the zero-censored model via a simulated χ^2 test using parametric bootstrap (Tsagris and Alharbi, 2026).

Value

The (theoretical) probability of zero-censoring at each component.

Author(s)

R implementation and documentation: Michail Tsagris <mtsagris@uoc.gr>.

References

Tsagris M. and Alharbi N. (2026). Modelling structural zeros in compositional data via a zero-censored multivariate normal model.
<https://arxiv.org/pdf/2208.13073>

Examples

```
mu <- c(0.325, 0.121)
sigma <- matrix(c(0.149, -0.200,
                 -0.200, 0.323), 2, 2)
prob.zerocens(mu, sigma, theoretical = TRUE)
```

rzerocens

Maximum likelihood estimation of the zero-censored model

Description

Maximum likelihood estimation of the zero-censored model.

Usage

```
rzerocens(n, mu, sigma)
```

Arguments

n	The sample size.
mu	The mean vector in R^{D-1} .
sigma	The covariance matrix in R^{D-1} .

Details

The function generates compositional data from the zero-censored model (Tsagris and Alharbi, 2026). The drawback is that only 1 zero, at most, is allowed in each compositional vector.

Value

A numerical matrix with compositional data.

Author(s)

R implementation and documentation: Michail Tsagris <mtsagris@uoc.gr>.

References

Tsagris M. and Alharbi N. (2026). Modelling structural zeros in compositional data via a zero-censored multivariate normal model.

<https://arxiv.org/pdf/2208.13073>

Examples

```
mu <- c(0.325, 0.121)
sigma <- matrix(c(0.149, -0.200, -0.200, 0.323), ncol = 2)
x <- rzerocens(1000, mu, sigma)
```

zerocens.em

Maximum likelihood estimation of the zero-censored model

Description

Maximum likelihood estimation of the zero-censored model.

Usage

```
zerocens.em(x, tol = 1e-6, maxit = 1000)
zerocens.mle(x)
```

Arguments

x	A numerical matrix with compositional data. Only one zero value is allowed in each row.
tol	The tolerance value to terminate the EM algorithm.
maxit	The maximum number of iterations allowed for the EM algorithm.

Details

The function fits the zero-censored model (Tsagris, 2026) to compositional data with zero values. The drawback is that only 1 zero, at most, is allowed in each compositional vector. The `zerocens.em()` function fits the model using the EM algorithm and it is quite efficient, whereas the second function, `zerocens.mle()` uses `optim()` and is quite slow.

Value

A list including:

<code>loglik</code>	The log-likelihood value.
<code>iters</code>	The number of iterations required by the EM algorithm.
<code>mu</code>	The estimated mean vector.
<code>sigma</code>	The estimated covariance matrix.

Author(s)

R implementation and documentation: Michail Tsagris <mtsagris@uoc.gr>.

References

Tsagris M. and Alharbi N. (2026). Modelling structural zeros in compositional data via a zero-censored multivariate normal model.

<https://arxiv.org/pdf/2208.13073>

Examples

```
mu <- c(0.325, 0.121)
sigma <- matrix(c(0.149, -0.200,
                 -0.200, 0.323), 2, 2)
x <- rzerocens(100, mu, sigma)
zerocens.em(x)
zerocens.mle(x)
```

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