# Package: scDECO (via r-universe)

September 13, 2024

**Type** Package

**Title** Estimating Dynamic Correlation

**Version** 0.1.0

**Description** Implementations for two different Bayesian models of differential co-expression. scdeco.cop() fits the bivariate Gaussian copula model from Zichen Ma, Shannon W. Davis, Yen-Yi Ho (2023) <doi:10.1111/biom.13701>, while scdeco.pg() fits the bivariate Poisson-Gamma model from Zhen Yang, Yen-Yi Ho (2022) <doi:10.1111/biom.13457>.

**Imports** MASS, rjags, msm

**License** GPL (>= 3)

**Encoding** UTF-8

**LazyData** true

**RoxygenNote** 7.3.1

**URL** https://github.com/YenYiHo-Lab/scDECO

**BugReports** https://github.com/YenYiHo-Lab/scDECO/issues

**Suggests** knitr, rmarkdown

**VignetteBuilder** knitr

**Repository** https://yenyiho-lab.r-universe.dev

**RemoteUrl** https://github.com/yenyiho-lab/scdeco

**RemoteRef** HEAD

**RemoteSha** afa8d434c1dd27fbd6377657b77bb83795f340a6

## Contents

scdeco.cop *Copula dynamic correlation fitting function*

## Description

Copula dynamic correlation fitting function

## Usage

```
scdeco.cop(y, x, marginals, w = NULL, n.mcmc = 5000, burn = 1000, thin = 10)
```

## Arguments

| | |
|---|---|
| y | 2-column matrix of observations |
| x | covariates |
| marginals | length-2 vector with strings of the two marginals |
| w | (optional) |
| n.mcmc | number of mcmc iterations to run |
| burn | how many of the mcmc iterations to burn |
| thin | how much to thin the mcmc iterations |

## Value

matrix with mcmc samples as rows and columns corresponding to the different parameters

## Examples

```
n <- 1000
x.use = rnorm(n)
w.use = runif(n,-1,1)
eta1.use = c(-2.2, 0.7)
eta2.use = c(-2, 0.8)
beta1.use = c(1,0.5)
beta2.use = c(1,1)
alpha1.use = 7
alpha2.use = 3
tau.use = c(-0.2, .3)

marginals.use <- c("ZINB", "ZIGA")

y.use <- scdeco.sim.cop(marginals=marginals.use, x=x.use,
                    eta1.true=eta1.use, eta2.true=eta2.use,
                    beta1.true=beta1.use, beta2.true=beta2.use,
                    alpha1.true=alpha1.use, alpha2.true=alpha2.use,
                    tau.true=tau.use, w=w.use)
mcmc.out <- scdeco.cop(y=y.use, x=x.use, marginals=marginals.use, w=w.use,
                      n.mcmc=10, burn=0, thin=1) # n.mcmc=1000, burn=100, thin=5)
```

```
lowerupper <- t(apply(mcmc.out, 2, quantile, c(0.025, 0.5, 0.975)))
estmat <- cbind(lowerupper[,1],
            c(eta1.use, eta2.use, beta1.use, beta2.use, alpha1.use, alpha2.use, tau.use),
                lowerupper[,c(2,3)])
colnames(estmat) <- c("lower", "trueval", "estval", "upper")
estmat
```

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scdeco.pg *ZENCO Poisson Gamma dynamic correlation fitting function*

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## Description

ZENCO Poisson Gamma dynamic correlation fitting function

## Usage

```
scdeco.pg(
  dat,
  b0,
  b1,
  adapt_iter = 100,
  update_iter = 100,
  coda_iter = 1000,
  coda_thin = 5,
  coda_burnin = 100
)
```

## Arguments

| | |
|---|---|
| dat | matrix containing expression values as first two columns and covariate as third column |
| b0 | intercept of zinf parameter |
| b1 | slope of zinf parameter |
| adapt_iter | number of adaptation iterations in the jags.model function |
| update_iter | update iterations in the update function |
| coda_iter | number of iterations for the coda.sample function |
| coda_thin | how much to thin the resulting MCMC output |
| coda_burnin | how many iterations to burn before beginning coda sample collection |

## Value

MCMC samples that have been adapted, burned, and thinned

## Examples

```
phi1_use <- 4
phi2_use <- 4
phi3_use <- 1/7
mu1_use <- 15
mu2_use <- 15
mu3_use <- 7
b0_use <- -3
b1_use <- 0.1
tau0_use <- -2
tau1_use <- 0.4

simdat <- scdeco.sim.pg(N=1000, b0=b0_use, b1=b1_use,
                        phi1=phi1_use, phi2=phi2_use, phi3=phi3_use,
                        mu1=mu1_use, mu2=mu2_use, mu3=mu3_use,
                        tau0=tau0_use, tau1=tau1_use)

zenco_out <- scdeco.pg(dat=simdat,
                       b0=b0_use, b1=b1_use,
                       adapt_iter=1, # 500,
                       update_iter=1, # 500,
                       coda_iter=5, # 5000,
                       coda_thin=1, # 10,
                       coda_burnin=0) # 1000

boundsmat <- cbind(zenco_out$quantiles[,1],
                   c(1/phi1_use, 1/phi2_use, 1/phi3_use,
                   mu1_use, mu2_use, mu3_use,
                   tau0_use, tau1_use),
                   zenco_out$quantiles[,c(3,5)])

colnames(boundsmat) <- c("lower", "true", "est", "upper")

boundsmat
```

---

`scdeco.sim.cop` *Simulating from copula model*

---

## Description

Simulating from copula model

## Usage

```
scdeco.sim.cop(
  marginals,
  x,
  eta1.true,
```

```
  eta2.true,
  beta1.true,
  beta2.true,
  alpha1.true,
  alpha2.true,
  tau.true,
  w = NULL
)
```

## Arguments

| | |
|---|---|
| marginals | provide vector of length 2 of which marginals to use |
| x | covariate matrix |
| eta1.true | zero-inflation parameters for marginal 1 |
| eta2.true | zero-inflation parameters for marginal 2 |
| beta1.true | mean coefficients for marginal 1 |
| beta2.true | mean coefficients for marginal 2 |
| alpha1.true | second parameter coefficients for marginal 1 |
| alpha2.true | second parameter coefficients for marginal 2 |
| tau.true | coefficients for correlation |
| w | (optional) covariate matrix for zero-inflation portion |

## Value

matrix with values simulated from copula model

## Examples

```
n <- 2500
x.use = rnorm(n)
w.use = runif(n,-1,1)
eta1.use = c(-2.2, 0.7)
eta2.use = c(-2, 0.8)
beta1.use = c(1,0.5)
beta2.use = c(1,1)
alpha1.use = 7
alpha2.use = 3
tau.use = c(-0.2, .3)

marginals.use <- c("ZINB", "ZIGA")

y.use <- scdeco.sim.cop(marginals=marginals.use, x=x.use,
                    eta1.true=eta1.use, eta2.true=eta2.use,
                    beta1.true=beta1.use, beta2.true=beta2.use,
                    alpha1.true=alpha1.use, alpha2.true=alpha2.use,
                    tau.true=tau.use, w=w.use)

y.use[1:10,]
```

scdeco.sim.pg *Simulating from ZENCO Model*

## Description

Simulating from ZENCO Model

## Usage

```
scdeco.sim.pg(
  N,
  b0,
  b1,
  phi1,
  phi2,
  mu1,
  mu2,
  tau0,
  tau1,
  mu3,
  phi3,
  tau2 = NULL,
  tau3 = NULL,
  xc = NULL
)
```

## Arguments

| | |
|---|---|
| N | size of sample to be generated |
| b0 | intercept of zinf parameter |
| b1 | slope of zinf parameter |
| phi1 | over-dispersion parameter of first marginal |
| phi2 | over-dispersion parameter of second marginal |
| mu1 | mean parameter of first marginal |
| mu2 | mean parameter of second marginal |
| tau0 | intercept of correlation |
| tau1 | slope of of correlation |
| mu3 | mean parameter of covariate vector |
| phi3 | over-dispersion parameter of covariate vector |
| tau2 | (optional) correlation coefficient on optional xc covariate vector |
| tau3 | (optional) correlation coefficient on interaction between x3 and xc |
| xc | (optional) secondary covariate to be regressed |

## Value

a matrix with expressions as first two columns and covariates as remaining columns

## Examples

```
phi1_use <- 4
phi2_use <- 4
phi3_use <- 1/6
mu1_use <- 15
mu2_use <- 15
mu3_use <- 7
b0_use <- 0.6882
b1_use <- -0.2995
tau0_use <- 0.07
tau1_use <- 0.05

simdat <- scdeco.sim.pg(N=1000, b0=b0_use, b1=b1_use,
                        phi1=phi1_use, phi2=phi2_use, phi3=phi3_use,
                        mu1=mu1_use, mu2=mu2_use, mu3=mu3_use,
                        tau0=tau0_use, tau1=tau1_use)
simdat[1:10,]
```

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