

Package ‘CircularDDM’

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Title Circular Drift-Diffusion Model

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Depends R (>= 3.0.2)

Description Circular drift-diffusion model for continuous reports.

License GPL-2

LazyData TRUE

Imports Rcpp (>= 0.12.3)

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besselzero*Find First k Positive Zeros for the Bessel Functions*

Description

Find first k positive zeros of the Bessel function $J(n,x)$ or $Y(n,x)$ using Halley's method.

Usage

```
besselzero(nu, k, kind)
```

Arguments

nu	The order of the corresponding Bessel function.
k	an integer for first k positive zeros.
kind	0, 1, or 2. A switch selects besselI , besselJ or besselY

Value

a vector

References

[besselzero.m](#)

Examples

```
nu <- seq(0, 5, length.out=10)
output <- matrix(numeric(5*length(nu)), nrow=5)
  for(i in 1:length(nu)) {
    output[,i] <- besselzero(nu[i], 5, 1)
  }
output

output <- matrix(numeric(5*length(nu)), nrow=5)
  for(i in 1:length(nu)) {
    output[,i] <- besselzero(nu[i], 5, 2)
  }
output
```

CircularDDM

*Circular Drift-diffusion Model***Description**

Circular drift-diffusion model for continuous report.

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References

Smith, P. L. (2016). Diffusion Theory of Decision Making in Continuous Report, *Psychological Review*, 123(4), 425–451.

dcddm

*The Circular Drift-diffusion Distribution***Description**

Density function and random generation for the circular drift-diffusion model with theta vector equal to pVec. dcddm is the equation (23) on page 433 in Smith (2016).

Usage

```
dcddm(x, pVec, k = 141L)
```

```
rcddm(n, pVec, p = 0.15)
```

Arguments

x	a matrix storing a first column as RT and a second column of continuous responses/reports/outcomes. Each row is a trial.
pVec	a parameter vector with the order [a, vx, vy, t0, s], or [thresh, mu1, mu2, ndt, sigmasq]. The order matters.
k	a precision for calculating the infinite series in dcddm. The larger the k is, the larger the memory space is required. Default is 141.
n	number of observations.
p	a precision for random walk step in rcddm. Default is 0.15 second

Value

dcddm gives a log-likelihood vector. rddm generates random deviates, returning a $n \times 3$ matrix with the columns: RTs, choices and then angles.

References

Smith, P. L. (2016). Diffusion Theory of Decision Making in Continuous Report, Psychological Review, 123 (4), 425–451.

Examples

```
## dcddm example
x <- cbind(
  RT= c(1.2595272, 0.8693937, 0.8009044, 1.0018933, 2.3640007, 1.0521304),
  R = c(1.9217430, 1.7844653, 0.2662521, 2.1569724, 1.7277440, 0.8607271)
)
pVec <- c(a=2.45, vx=1.5, vy=1.25, t0=.1, s=1)
dcddm(x, pVec)

## rcddm example
pVec <- c(a=2, vx=1.5, vy=1.25, t0=.25, s=1)
den <- rcddm(1e3, pVec);
hist(den[,1], breaks = "fd", xlab="Response Time", main="Density")
hist(den[,3], breaks = "fd", xlab="Response Angle", main="Density")
```

logLik_dt

Log-Likelihood for Circular First Passage Time

Description

Calculate circular log-likelihood of the first passage time, using equation (22) on p 432.

Usage

```
logLik_dt(x, pVec, k = 141L)
```

Arguments

x	a matrix storing a first column as RT and a second column of continuous responses/reports/outcomes. Each row is a trial.
pVec	a parameter vector with the order [a, vx, vy, t0, s], a stands for response threshold, vx is the drift rate along x axis, vy is the drift rate along y axis, t0 is the non-decision time, and s is the within-trial standard deviation.
k	a precision for bessell function. The larger the k is, the larger the memory space is required. Default is 141.

Value

a vector

References

Smith, P. L. (2016). Diffusion Theory of Decision Making in Continuous Report, *Psychological Review*, 123 (4), 425–451.

Examples

```
x <- cbind(
  RT=c(1.2595272, 0.8693937, 0.8009044, 1.0018933, 2.3640007, 1.0521304),
  R =c(1.9217430, 1.7844653, 0.2662521, 2.1569724, 1.7277440, 0.8607271)
)
pVec <- c(a=2.45, vx=1.5, vy=1.25, t0=.1, s=1)
den <- logLik_dt(x, pVec=pVec);
den
```

logLik_resp

Log-Likelihood for Continuous Reports

Description

Calculate log-likelihood of the continuous reports, using part part in equation (23) on p 433.

Usage

```
logLik_resp(x, pVec)
```

Arguments

x a matrix storing a first column as RT and a second column of continuous responses/reports/outcomes. Each row is a trial.

pVec a parameter vector with the order [a, vx, vy, t0, s], or [thresh, mu1, mu2, ndt, sigmasq], using alternative names.

Value

a vector

References

Smith, P. L. (2016). Diffusion Theory of Decision Making in Continuous Report, *Psychological Review*, 123 (4), 425–451.

Examples

```
x <- cbind(
  RT=c(1.2595272, 0.8693937, 0.8009044, 1.0018933, 2.3640007, 1.0521304),
  R =c(1.9217430, 1.7844653, 0.2662521, 2.1569724, 1.7277440, 0.8607271)
)
pVec <- c(a=2.45, vx=1.5, vy=1.25, t0=.1, s=1)
den <- logLik_resp(x, pVec=pVec); den
```

rvm

Generate random deviates for the von Mises distribution

Description

Generate random deviates for the von Mises distribution.

Usage

```
rvm(n, mu, k)
```

Arguments

n	number of observations.
mu	mean direction of the distribution.
k	non-negative numeric value for the concentration parameter of the distribution

Details

A random variable for circular normal distribution has the form:

$$f(\theta; \mu, \kappa) = 1/(2 * \pi * I_0(\kappa)) * \exp(\kappa * \cos(\theta - \mu))$$

θ is within 0 and $2 * \pi$.

$I_0(\kappa)$ in the normalizing constant is the modified Bessel function of the first kind and order zero.

Value

a vector

Examples

```
n <- 100
mu <- 0
k <- 10
vm3_de <- rvm(n, mu, k)      ## in degree unit
vm3_pi <- vm3_de %*% (2 * pi) ## in radian unit
```

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