

# Package ‘CircularDDM’

June 18, 2018

**Version** 0.1.0

**Date** 2018-06-18

**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)

**LinkingTo** Rcpp (>= 0.12.3), RcppArmadillo (>= 0.6.700.6.0)

**RoxygenNote** 6.0.1

**NeedsCompilation** yes

**Repository** CRAN

**Date/Publication** 2018-06-18 04:30:26 UTC

## R topics documented:

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

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**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 <a href="#">besselI</a> , <a href="#">besselJ</a> or <a href="#">besselY</a> |

**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 bessel 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
```

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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:

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

$\theta$  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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