Package 'vMF'

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Type Package

Title Sampling from the von Mises-Fisher Distribution

Version 0.0.4

Date 2025-12-01

Description Provides fast sampling from von Mises-Fisher distribution using the method proposed by Andrew T.A Wood (1994) <doi:10.1080/03610919408813161>.

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Encoding UTF-8

BugReports https://github.com/ahoundetoungan/vMF/issues

URL https://github.com/ahoundetoungan/vMF

Depends R (>= 3.5.0)

Imports Rcpp

LinkingTo Rcpp, RcppArmadillo

Suggests movMF, rbenchmark, knitr, rmarkdown, ggplot2

RoxygenNote 7.3.2

VignetteBuilder knitr

NeedsCompilation yes

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Repository CRAN

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Contents

vMF-package *Sample from von Mises - Fisher distribution*

Description

vMF samples from von Mises-Fisher distribution and performs some operations. Unlike the movMF package, vMF does not consider mixtures of von Mises-Fisher distribution. vFM particularly focuses on sampling from the distribution and performs it very quickly. This is useful to carry out fast simulations in directional statistics. vMF also computes the density and normalization constant of the von Mises-Fisher distribution.

Author(s)

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References

Wood, A. T. (1994). Simulation of the von Mises Fisher distribution. *Communications in statistics-simulation and computation*, 23(1), 157-164. doi:10.1080/03610919408813161.

Hornik, K., & Grun, B. (2014). **movMF**: An R package for fitting mixtures of von Mises-Fisher distributions. *Journal of Statistical Software*, 58(10), 1-31. doi:10.18637/jss.v058.i10.

See Also

Useful links:

- https://github.com/ahoundetoungan/vMF
- Report bugs at https://github.com/ahoundetoungan/vMF/issues

CpvMF *Normalization constant of von Mises - Fisher distribution.*

Description

CpvMF returns the normalization constant of von Mises - Fisher density.

Usage

```
CpvMF(p, k)
```

Arguments

p	as sphere dimension.
k	as the intensity parameter.

Details

The probability density function of the von Mises - Fisher distribution is defined by :

$$f(z|theta) = C_p(|theta|) \exp(ztheta)$$

$|theta|$ is the intensity parameter and $\frac{theta}{|theta|}$ the mean directional parameter. The normalization constant $C_p()$ depends on the Bessel function of the first kind. See more details here.

Value

the normalization constant.

References

Wood, A. T. (1994). Simulation of the von Mises Fisher distribution. *Communications in statistics-simulation and computation*, 23(1), 157-164. doi:10.1080/03610919408813161.

Hornik, K., & Grun, B. (2014). **movMF**: An R package for fitting mixtures of von Mises-Fisher distributions. *Journal of Statistical Software*, 58(10), 1-31. doi:10.18637/jss.v058.i10.

See Also

`rvMF` and `dvMF`

Examples

```
CpvMF(2,3.1)
```

---

dvMF *PDF of the von Mises - Fisher distribution.*

Description

`dvMF` computes the density of the von Mises - Fisher distribution, given a set of spherical coordinates and the distribution parameters.

Usage

```
dvMF(z, theta)
```

Arguments

`z`	as the set of points at which the spherical coordinate will be evaluated. z may be an one row matrix or vector if it contain one spherical coordinates or a matrix whose each row is one spherical coordinates.
`theta`	as the distribution parameter.

Details

The probability density function of the von Mises - Fisher distribution is defined by :

$$f(z|theta) = C_p(|theta|) \exp(ztheta)$$

$|theta|$ is the intensity parameter and $\frac{theta}{|theta|}$ the mean directional parameter. The normalization constant $C_p()$ depends on the Bessel function of the first kind. See more details here.

Value

the densities computed at each point

Author(s)

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References

Wood, A. T. (1994). Simulation of the von Mises Fisher distribution. *Communications in statistics-simulation and computation*, 23(1), 157-164. doi:10.1080/03610919408813161.

Hornik, K., & Grun, B. (2014). **movMF**: An R package for fitting mixtures of von Mises-Fisher distributions. *Journal of Statistical Software*, 58(10), 1-31. doi:10.18637/jss.v058.i10.

See Also

rvMF and CpvMF

Examples

```
{}
# Draw 1000 vectors from vM-F with parameter 1, (1,0)
z <- rvMF(1000,c(1,0))

# Compute the density at these points
dvMF(z,c(1,0))

# Density of (0,1,0,0) with the parameter 3, (0,1,0,0)
dvMF(c(0,1,0,0),c(0,3,0,0))
```

---

rvMF *Sample from von Mises - Fisher distribution.*

Description

rvMF returns random draws from von Mises - Fisher distribution.

Usage

```
rvMF(size, theta)
```

Arguments

`size`	as the number of draws needed.
`theta`	as the distribution parameter.

Details

The parameter theta is such that $dim(theta)$ is the sphere dimension, $|theta|$ the intensity parameter and $\frac{theta}{|theta|}$ the mean directional parameter.

Value

A matrix whose each row is a random draw from the distribution.

References

Wood, A. T. (1994). Simulation of the von Mises Fisher distribution. *Communications in statistics-simulation and computation*, 23(1), 157-164. doi:10.1080/03610919408813161.

Hornik, K., & Grun, B. (2014). **movMF**: An R package for fitting mixtures of von Mises-Fisher distributions. *Journal of Statistical Software*, 58(10), 1-31. doi:10.18637/jss.v058.i10.

Examples

```
# Draw 1000 vectors from vM-F with parameter 1, (1,0)
rvMF(1000,c(1,0))

# Draw 10 vectors from vM-F with parameter sqrt(14), (2,1,3)
rvMF(10,c(2,1,3))

# Draw from the vMF distribution with mean direction proportional
# to c(1, -1) and concentration parameter 3
rvMF(10, 3 * c(1, -1) / sqrt(2))
```

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