Package: rvMF (via r-universe)

October 24, 2024

Title Fast Generation of von Mises-Fisher Distributed Pseudo-Random Vectors

Version 0.1.0

Description Generates pseudo-random vectors that follow an arbitrary von Mises-Fisher distribution on a sphere. This method is fast and efficient when generating a large number of pseudo-random vectors. Functions to generate random variates and compute density for the distribution of an inner product between von Mises-Fisher random vector and its mean direction are also provided. Details are in Kang and Oh (2024) <doi:10.1007/s11222-024-10419-3>.

URL `https://github.com/seungwoo-stat/rvMF`

BugReports `https://github.com/seungwoo-stat/rvMF/issues`

License GPL (>= 3)

Encoding UTF-8

Roxygen list(markdown = TRUE)

RoxygenNote 7.3.1

LinkingTo Rcpp

Imports Bessel (>= 0.6-0), Rcpp (>= 1.0.10), Rfast (>= 2.0.6), scModels (>= 1.0.4)

Repository https://seungwoo-stat.r-universe.dev

RemoteUrl https://github.com/seungwoo-stat/rvmf

RemoteRef HEAD

RemoteSha 05e23165a8d04bc026a561d699faf483eed544b1

Contents

rvMF *von Mises–Fisher Distributed Pseudo-Random Vector Generator*

Description

rvMF() generates von Mises–Fisher distributed pseudo-random vectors, without resorting to the rejection-based sampling method proposed by Wood (1994). See Kang and Oh (2024) for details. This function partly uses the code from the function Rfast::rvmf() and the article Marsaglia et al. (2004).

Usage

```
rvMF(n, mu, k)
```

Arguments

n	number of pseudo-random vectors to generate.
mu	mean direction.
k	concentration parameter. $k \geq 0$.

Value

matrix where each row independently follows the specified von Mises-Fisher distribution. The number of columns equals the length of mu, and the number of rows equals n for rvMF.

References

S. Kang and H.-S. Oh. Novel sampling method for the von Mises–Fisher distribution. *Statistics and Computing*, 34(3):106, 2024.

K. V. Mardia and P. E. Jupp. *Directional Statistics*, volume 494. John Wiley & Sons, Chichester, 1999.

G. Marsaglia, W. W. Tsang, and J. Wang. Fast generation of discrete random variables. *Journal of Statistical Software*, 11(3):1–11, 2004.

M. Papadakis, M. Tsagris, M. Dimitriadis, S. Fafalios, I. Tsamardinos, M. Fasiolo, G. Borboudakis, J. Burkardt, C. Zou, K. Lakiotaki, and C. Chatzipantsiou. *Rfast: A Collection of Efficient and Extremely Fast R Functions*, 2022. https://CRAN.R-project.org/package=Rfast. R package version 2.0.6.

A. T. Wood. Simulation of the von Mises Fisher distribution. *Communications in Statistics– Simulation and Computation*, 23(1):157–164, 1994.

See Also

rvMFangle(), dvMFangle(), Rfast::rvmf().

Examples

```
rvMF(10, c(0,0,1), 10)
rvMF(10, c(1,1)/sqrt(2), 0)
```

`vMFangle` *Inner Product of von Mises–Fisher Random Vector and Mean Direction*

Description

These functions provide information about the distribution of an inner product between von Mises–Fisher random vector and its mean direction. Specifically, if X follows a von Mises–Fisher distribution with mean direction μ, the inner product $X'\mu$ will be a random variable following some distribution. See page 170 of Mardia and Jupp (1999). `rvMFangle()` generates random variates using the algorithm proposed in Kang and Oh (2024), and `dvMFangle` gives the density from this distribution. This function partly uses the code from the article Marsaglia et al. (2004).

Usage

```
rvMFangle(n, p, kappa)

dvMFangle(r, p, kappa)
```

Arguments

`n`	number of random vectors to generate.
`p`	dimension of the sphere. i.e., S^{p-1}, $p \geq 2$.
`kappa`	concentration parameter. `kappa > 0`. Setting `kappa = 0` may cause errors.
`r`	vector of quantiles. $-1 \leq r \leq 1$.

Value

- `rvMFangle()` returns a vector whose components independently follow the aforementioned distribution. The length of the result is determined by `n` for `rvMFangle()`.
- `dvMFangle()` returns a vector of density function value. The length of the result is determined by the length of `r` for `dvMFangle()`.

References

S. Kang and H.-S. Oh. Novel sampling method for the von Mises–Fisher distribution. *Statistics and Computing*, 34(3):106, 2024.

K. V. Mardia and P. E. Jupp. *Directional Statistics*, volume 494. John Wiley & Sons, Chichester, 1999.

G. Marsaglia, W. W. Tsang, and J. Wang. Fast generation of discrete random variables. *Journal of Statistical Software*, 11(3):1–11, 2004.

See Also

rvMF() wrapper of rvMFangle().

Examples

```
rvMFangle(10, 2, 10)
rvMFangle(10, 3, 0.1)
dvMFangle(seq(-1,1,by=0.01), 2, 10)
dvMFangle(seq(0,1,by=0.01), 3, 0.1)
```

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