Package: rvMF (via r-universe)

November 2, 2026

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

Version 0.1.2

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

RoxygenNote 7.3.3

LinkingTo Rcpp

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

SystemRequirements gmp (>= 4.2.3), mpfr (>= 3.0.0)

SystemRequirementsNote 'MPFR' (MP Floating-Point Reliable Library, https://www.mpfr.org/) and 'GMP' (GNU Multiple Precision library, https://gmplib.org/)

NeedsCompilation yes

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Config/pak/sysreqs libgmp3-dev libmpfr-dev

Repository https://cran.r-universe.dev

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`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)
```

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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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