Package 'VMDecomp'

May 7, 2026

Type Package

Title Variational Mode Decomposition

Version 1.0.2

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BugReports https://github.com/mlampros/VMDecomp/issues

URL https://github.com/mlampros/VMDecomp

Description 'RcppArmadillo' implementation for the Matlab code of the 'Variational Mode Decomposition' and 'Two-Dimensional Variational Mode Decomposition'. For more information, see (i) 'Variational Mode Decomposition' by K. Dragomiretskiy and D. Zosso in IEEE Transactions on Signal Processing, vol. 62, no. 3, pp. 531-544, Feb.1, 2014, <doi:10.1109/TSP.2013.2288675>; (ii) 'Two-Dimensional Variational Mode Decomposition' by Dragomiretskiy, K., Zosso, D. (2015), In: Tai, XC., Bae, E., Chan, T.F., Lysaker, M. (eds) Energy Minimization Methods in Computer Vision and Pattern Recognition. EMMCVPR 2015. Lecture Notes in Computer Science, vol 8932. Springer, <doi:10.1007/978-3-319-14612-6_15>.

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SystemRequirements libarmadillo: apt-get install -y libarmadillo-dev (deb), libblas: apt-get install -y libblas-dev (deb), liblapack: apt-get install -y liblapack-dev (deb), libarpack++2: apt-get install -y libarpack++2-dev (deb), gfortran: apt-get install -y gfortran (deb)

Depends R(>= 3.5.0)

Imports Rcpp (>= 1.0.8.3), data.table, glue

LinkingTo Rcpp, RcppArmadillo

Suggests OpenImageR, R.matlab, testthat (>= 3.0.0), rmarkdown, knitr

RoxygenNote 7.3.2

Config/testthat/edition 3

VignetteBuilder knitr

NeedsCompilation yes

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Repository CRAN

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`arrhythmia` *Sample Arrhythmia Data from MIT Boston's Beth Israel Hospital (BIH) Database*

Description

Sample arrhythmia data from the MIT-BIH Arrhythmia Database

Usage

```
data(arrhythmia)
```

Format

An object of class `data.table` (inherits from `data.frame`) with 10000 rows and 2 columns.

Details

The data includes two columns "MLII" and "V1". According to https://www.physionet.org/files/mitdb/1.0.0/mitdbdir/intro.ht
"In most records, the upper signal is a modified limb lead II (MLII), obtained by placing the electrodes on the chest. The lower signal is usually a modified lead V1 (occasionally V2 or V5, and in one instance V4)."

The data was downloaded after installing the "wfdb" Python package. The Python code used to save the sample data is the following:

```
import wfdb
import pandas as pd
```

```
sample_annotat_200 = wfdb.rdrecord('200', sampfrom = 0, sampto = 10000, pn_dir = 'mitdb')
arrhythmia = pd.DataFrame(sample_annotat_200.p_signal, columns = sample_annotat_200.sig_name)
```

References

Moody GB, Mark RG. The impact of the MIT-BIH Arrhythmia Database. IEEE Eng in Med and Biol 20(3):45-50 (May-June 2001). (PMID: 11446209)

Goldberger, A., Amaral, L., Glass, L., Hausdorff, J., Ivanov, P. C., Mark, R., ... & Stanley, H. E. (2000). PhysioBank, PhysioToolkit, and PhysioNet: Components of a new research resource for complex physiologic signals. Circulation (Online). 101 (23), pp. e215–e220.

https://physionet.org/content/mitdb/1.0.0/

https://www.physionet.org/files/mitdb/1.0.0/mitdbdir/intro.htm

https://github.com/MIT-LCP/wfdb-python

https://github.com/MIT-LCP/wfdb-python/blob/main/demo.ipynb

Examples

```
require(VMDecomp)

data(arrhythmia)
```

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estimate_k_modes *Estimation of Intrinsic Mode Function (IMF) Number in Variational Mode Decomposition*

Description

Estimation of Intrinsic Mode Function (IMF) Number in Variational Mode Decomposition

Usage

```
estimate_k_modes(
  signal_1d,
  cor_thresh,
  default_vmd_params,
  min_K = 2,
  seed = 1,
  verbose = FALSE
)
```

Arguments

signal_1d	a numeric vector specifying the 1-dimensional input signal
cor_thresh	a numeric value specifying the minimum (positive or negative) correlation coefficient threshold where decomposition will be stopped (a value between 0.0 and 1.0)
default_vmd_params	a list of parameters consisting of the (remaining) Variational Mode Decomposition default parameters (except for 'data' and 'K')
min_K	a numeric value specifying the minimum value of the K (modes) parameter (from which decomposition starts)
seed	a numeric value specifying the seed (for reproducibility purposes)
verbose	a boolean. If TRUE then information will be printed in the console

Details

Correlation Coefficient Method:

- Correlation coefficient (CC) between the mode components and the original signal will be obtained. Decomposition will be stopped when the minimum correlation coefficient is less than the given threshold, and then the value of K will be determined

Value

a numeric value specifying the optimal K parameter

References

https://doi.org/10.1155/2020/8304903

Examples

```
## Not run:

require(VMDecomp)
data(arrhythmia)

default_vmd_params = list(alpha = 2000,
                          tau = 0,
                          DC = FALSE,
                          init = 1,
                          tol = 1e-6)

res_k = estimate_k_modes(signal_1d = arrhythmia[['MLII']],
                         cor_thresh = 0.1,
                         default_vmd_params = default_vmd_params,
                         min_K = 2,
                         seed = 1,
                         verbose = TRUE)
res_k
```

```
## End(Not run)
```

---

vmd *Variational Mode Decomposition (1- or 2-dimensional)*

Description

Variational Mode Decomposition (1- or 2-dimensional)

Usage

```
vmd(data, alpha, tau, K, DC, init, tol, verbose = FALSE)
```

Arguments

data	either a vector or a matrix (of type numeric or integer)
alpha	a numeric value specifying the balancing parameter of the data-fidelity constraint
tau	a numeric value specifying the time-step of the dual ascent (pick 0 for noise-slack)
K	a numeric value specifying the number of modes to be recovered
DC	a boolean. If true the first mode is put and kept at DC (0-freq)
init	a numeric value. This parameter differs depending on the input 'data' parameter (1-dimensional and 2-dimensional). See the details section for more information
tol	a numeric value specifying the tolerance of convergence criterion (typically this parameter is around 1e-6 for the 1-dimensional and 1e-7 for the 2-dimensional data)
verbose	a boolean. If TRUE then information will be printed in the console

Details

The 'init' parameter takes the following values for,

- 1-dimensional data:
  - 0 = all omegas start at 0
  - 1 = all omegas start uniformly distributed
  - 2 = all omegas initialized randomly
- 2-dimensional data:
  - 0 = all omegas start at 0
  - 1 = all omegas start initialized randomly

Value

a list object of length three which includes the

- 'u' (collection of decomposed modes)
- 'u_hat' (spectra of the modes)
- 'omega' (estimated mode center-frequencies) objects

References

https://math.montana.edu/dzosso/code/

Examples

```
require(VMDecomp)

#.............
# 1-dimensional
#.............

N = 250

set.seed(1)
rand_unif = runif(n = N, min = 0, max = 1.0)

f_sig1 = 6 * rand_unif
f_sig2 = cos(x = 8 * pi * rand_unif)
f_sig3 = 0.5 * cos(x = 40 * pi * rand_unif)

f_sig = f_sig1 + f_sig2 + f_sig3

alpha = 2000
tau = 0
K = 3
DC = FALSE
init = 1
tol = 1e-6

set.seed(2)
res_1d = vmd(data = f_sig,
             alpha = alpha,
             tau = tau,
             K = K,
             DC = DC,
             init = init,
             tol = tol,
             verbose = FALSE)

#.............
# 2-dimensional
#.............
```

```
rows_cols = 10

set.seed(3)
data = matrix(runif(rows_cols^2), rows_cols, rows_cols)
alpha = 5000
tau = 0.25
K = 2
DC = TRUE
init = 1
tol = 1e-7

set.seed(4)
res_2d = vmd(data = data,
             alpha = alpha,
             tau = tau,
             K = K,
             DC = DC,
             init = init,
             tol = tol,
             verbose = FALSE)
```

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