

Matlab Package “Envelope Algorithms”

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1 Introduction

“EnvelopeAlgorithms” is a collection of MATLAB functions for estimating an envelope for various multivariate statistical problems. This package contains the computation algorithms for obtaining a generic envelope: the $\mathbf{M}$ -envelope of $\text{span}(\mathbf{U})$, denoted as $\mathcal{E}_{\mathbf{M}}(\mathbf{U})$. Given two symmetric $p \times p$ matrices, $\mathbf{M} > 0$ and $\mathbf{U} \geq 0$, the $\mathbf{M}$ -envelope of $\text{span}(\mathbf{U})$ is the intersection of all reducing subspace of $\mathbf{M}$ that contains the column space of $\mathbf{U}$.

More specifically, the package implemented the algorithms described in the following two papers.

- Cook, R. D. and Zhang, X. (2016+), “Fast Envelope Algorithms”, Submitted.
- Cook, R. D., and Zhang, X. (2016), “Algorithms for envelope estimation”, *Journal of Computational and Graphical Statistics*, In Press.

2 Prerequisites and dependence

- LDR pacakge (<https://sites.google.com/site/lilianaforzani/ldr-package>)

3 Download and installation

1. Install MATLAB if it has not been installed on the computer.
2. Download “EnvelopeAlgorithms.zip”
3. Unzip the zipped file and put the folder into the directory you’d like
4. Download and unzip the LDR package (<https://sites.google.com/site/lilianaforzani/ldr-package>)
5. Put the LDR folder as a subfolder inside your “EnvelopeAlgorithms” folder
6. To see an example, go to “Algorithms_ html.m” inside the “4_ Tutorial” subfolder

4 Copyright and Warranty

This program is free software; you can re-distribute and/or modify it under the terms of the GNU GPL-v2 (GNU General Public License version 2; <http://www.gnu.org/licenses/old-licenses/gpl-2.0.en.html>). This program is distributed for research purposes, but without any warranty, see the GNU General

Public License for more details. There is no warranty (explicit or implicit) attached to the "EnvelopeAlgorithms" software. If you find that it does not work correctly, please compile a description of the error and e-mail to: henry@stat.fsu.edu.

5 Additional information and references

Additional methodological developments (not implemented in this package) in envelope models and methods can be found, for example, in the following papers.

- Cook, R. D., and Zhang, X. (2015), "Foundations for Envelope Models and Methods", *Journal of the American Statistical Association*, **109**, 599–611.
- Cook, R. D., Helland, I. S., and Su, Z. (2013). "Envelopes and Partial Least Squares Regression", *Journal of the Royal Statistical Society: Series B*, **75**, 851–877.
- Cook, R. D., Li, B., and Chiaromonte, F. (2010). "Envelope Models for Parsimonious and Efficient Multivariate Linear Regression (with discussion)", *Statistica Sinica*, **20**, 927–960.

Matlab package *envlp*(<https://code.google.com/archive/p/envlp/> by Cook, Su and Yang) is developed for fitting a variety of envelope linear models including the basic response and predictor envelopes, "inner envelope", "partial envelope", "scaled envelope", etc. Matlab package *EnvelopeMLM*(<https://stat.fsu.edu/~henry/Software/>) is developed for fitting several envelope regression in multivariate linear models, including the basic response and predictor envelopes, "simultaneous envelope" and "reduced-rank envelope".