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Robust Bayesian Functional Principal Component Analysis

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Abstract

We develop a robust Bayesian functional principal component analysis (FPCA) by incorporating skew elliptical classes of distributions. The proposed method effectively captures the primary source of variation among curves, even when abnormal observations contaminate the data. We model the observations using skew elliptical distributions by introducing skewness with transformation and conditioning into the multivariate elliptical symmetric distribution. To recast the covariance function, we employ an approximate spectral decomposition. We discuss the selection of prior specifications and provide detailed information on posterior inference, including the forms of the full conditional distributions, choices of hyperparameters, and model selection strategies. Furthermore, we extend our model to accommodate sparse functional data with only a few observations per curve, thereby creating a more general Bayesian framework for FPCA. To assess the performance of our proposed model, we conduct simulation studies comparing it to well-known frequentist methods and conventional Bayesian methods. The results demonstrate that our method outperforms existing approaches in the presence of outliers and performs competitively in outlier-free datasets. Furthermore, we illustrate the effectiveness of our method by applying it to environmental and biological data to identify outlying functional data. The implementation of our proposed method and applications are available at `https://github.com/SFU-Stat-ML/RBFPCA`.

Keywords: Functional data analysis, Robust estimation, Sparse functional data, Multivariate skew elliptical distribution, Outlier detection

Robust Bayesian Analysis

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Robust Bayesian Analysis:

Robust Bayesian Analysis Book Review: Unveiling the Power of Words

In a global driven by information and connectivity, the power of words has be more evident than ever. They have the capacity to inspire, provoke, and ignite change. Such may be the essence of the book **Robust Bayesian Analysis**, a literary masterpiece that delves deep to the significance of words and their effect on our lives. Published by a renowned author, this captivating work takes readers on a transformative journey, unraveling the secrets and potential behind every word. In this review, we shall explore the book is key themes, examine its writing style, and analyze its overall impact on readers.

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