Title:
Transposable Regularized Covariance Models with Applications to High-Dimensional Data

Abstract:
High-dimensional data is becoming more prevalent with the advent of new technologies in biomedical sciences, imaging and the internet. Many examples of this data often contain complex relationships between and among sets of variables. When arranged in the form of a matrix, this data is transposable, meaning that either the rows, columns or both can be treated as features. To model transposable data, we present a modification of the matrix-variate normal, the mean-restricted matrix-variate normal, and introduce Transposable Regularized Covariance Models by placing penalties on inverse covariance matrices. We give theoretical results exploiting the structure of our transposable models that give computationally feasible algorithms for parameter estimation and calculation of conditional expectations. Two applications of our transposable model, missing data imputation and modeling correlations in a multiple testing framework, are presented. Examples are given on the Netflix movie-rating data, microarrays and functional MRIs, demonstrating the flexibility and functionality of our models.