

DEPARTMENT OF STATISTICS COLLOQUIUM SERIES

Texas A&M University

ZHAOSONG LU

Assistant Professor of Operations Research
Department of Mathematics
Simon Fraser University

AN AUGMENTED LAGRANGIAN APPROACH FOR SPARSE PRINCIPAL COMPONENT ANALYSIS

ABSTRACT:

Principal component analysis (PCA) is a widely used technique for data analysis and dimension reduction with numerous applications in science and engineering. However, the standard PCA suffers from the fact that the principal components (PCs) are usually linear combinations of all the original variables, and it is thus often difficult to interpret the PCs. To alleviate this drawback, various sparse PCA approaches were proposed in literature. Despite success in achieving sparsity, some important properties enjoyed by the standard PCA are lost in these methods such as uncorrelation of PCs and orthogonality of loading vectors. Also, the total explained variance that they attempt to maximize can be too optimistic. In this talk we first review the existing methods. Then we propose a new formulation for sparse PCA, aiming at finding sparse and nearly uncorrelated PCs with orthogonal loading vectors while explaining as much of the total variance as possible. We also develop a novel augmented Lagrangian method for solving a class of nonsmooth constrained optimization problems, which is well suited for our formulation of sparse PCA and many other optimization models in statistics. Finally, we compare our sparse PCA approach with several existing methods on synthetic, random, and real data, respectively.

The computational results demonstrate that the sparse PCs produced by our approach substantially outperform those by other methods in terms of total explained variance, correlation of PCs, and orthogonality of loading vectors. This is joint work with Yong Zhang at Simon Fraser University.

DATE: Thursday, October 8, 2009

TIME: 11:10 a.m. – 12:10 p.m.

PLACE: Room 150, Blocker

Refreshments will be served in the Statistics Conference Room at 10:30 am for those attending the seminar.