MICHIGAN STATE UNIVERSITY
Department of Statistics and Probability

COLLOQUIUM

Rongrong Wang
Michigan State University

Manifold Denoising by Nonlinear Robust Principal Component Analysis

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Abstract

Manifold learning are nowadays widely used in computer vision, image processing, and biological data analysis on tasks such as classification, anomaly detection, data interpolation, and denoising. In most applications, the data has a nonlinear structure and lies on a manifold with non-zero curvatures. Many state-of-the-art manifold learning techniques for visualization such as LLE and Isomap are not rubout to noise or outliers, while nonlinear denoising and outlier detection methods are largely lacking in the literature. In this work, we proposed an efficient method to remove the outliers from the nonlinear data by extending the robust principal component analysis to nonlinear manifolds. Suppose that the observed data matrix is the sum of a sparse component and a component drawn from some low dimensional manifold. Is it possible to separate them by using the low-dimensionality and the sparsity? We propose an optimization formulation and obtain its theoretical error bound when the tangent spaces of the manifold satisfy certain incoherence conditions.

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