Nonlinear Dimension Reduction with Kernel Sliced Inverse Regression

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Abstract

Dimension reduction is an important topic in machine learning and data mining. The most popular dimension reduction method is probably the principal component analysis (PCA), which is an unsupervised method. In the contrast, the sliced inverse regression (SIR) extracts the dimension reduction subspace based on the covariance matrix of input attributes inversely regressed on the responses. SIR can be viewed as a supervised companion to PCA for linear dimension reduction. Like other linear methods, SIR can extends to nonlinear setting via the ``kernel trick''. In this article we focus on the problem of fast implementation of kernel SIR and study its numerical behavior and performance in classification and regression. Numerical experiments show that kernel SIR is an effective dimension reduction technique and it can be combined with other linear algorithms to form a powerful toolkit for massive data analysis.