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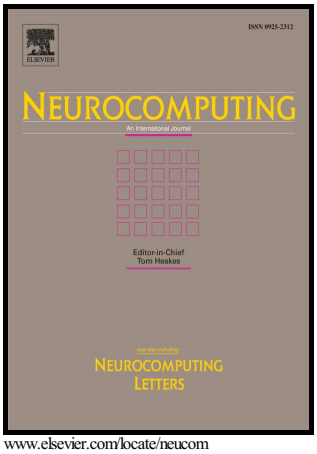

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PII: S0925-2312(16)00159-4
DOI: http://dx.doi.org/10.1016/j.neucom.2016.01.060
Reference: NEUCOM16716

To appear in: *Neurocomputing*

Received date: 2 November 2015
Revised date: 25 December 2015
Accepted date: 15 January 2016

Cite this article as: Jiliang Hua, Huan Wang, Mingwu Ren and Heyan Huang Dimension Reduction Using Collaborative Representation Reconstruction Base Projections, *Neurocomputing,* http://dx.doi.org/10.1016/j.neucom.2016.01.060

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Dimension Reduction Using Collaborative Representation Reconstruction Based Projections

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Abstract: This paper develops a collaborative representation reconstruction based projections (CRRP) method for dimension reduction. Collaborative representation based classification (CRC) is much faster than sparse representation based classification (SRC) while owning the similar recognition performance to SRC. Both CRC and SRC utilize the class reconstruction error for classification. First, CRRP characterizes the between-class/within-class reconstruction error using collaborative representation; Second, CRRP seeks the projections by maximizing the between-class reconstruction error to the within-class reconstruction error. So the proposed method is called CRRP. The experimental results on AR, Yale B and CMU PIE face databases demonstrate that CRRP is an effective dimension reduction method.

Keywords: CRC, CRRP, dimension reduction, face recognition

1. Introduction

The data appears in a high dimensional form in many applications (e.g. image recognition, information retrieval etc.). Dimension reduction could get the efficient low dimensional representation of these data [1,2], which helps to visualization, classification, calculation and storage. The typical dimension reduction methods could be divided into two categories: unsupervised methods and supervised methods [1,2].

Principal components analysis (PCA) [3] and kernel PCA (KPCA) [4] are the two most popular unsupervised methods. PCA is simple and effective in applications. PCA could not effectively handle the data with nonlinear variants (e.g. illumination, view and noise etc.). Fisher LDA (FLDA) [5] and Kernel FLDA (KFLDA) [6] are the two most famous supervised methods. FLDA calculates the projection matrix by maximizing the ratio of the between class scatter to the within class scatter. PCA is optimal in reconstruction view and FLDA is optimal in classification view. FLDA often meets small sample size (SSS) problem [7] in applications since the within class scatter matrix is singular. Many FLDA variants [8-14] are given to overcome the SSS problem. KPCA is nonlinear version of PCA via kernel tricks and could handle implicitly deal with the nonlinear data. KFLDA is the nonlinear version of FLDA via kernel tricks. J. Yang

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