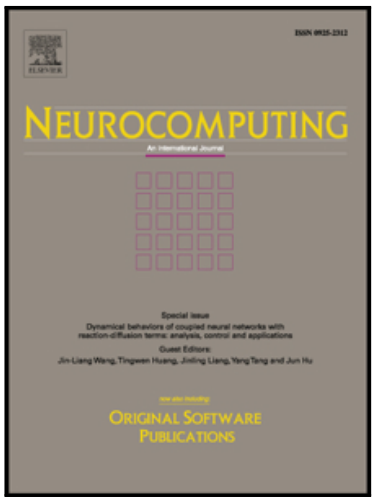

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Learning More Distinctive Representation by Enhanced PCA Network

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Abstract: Subspace learning approaches extract features by a simple linear transformation, which can viewed as a shallow network, and they cannot reveal the deep structure embedded in pixels of image. To solve this problem, a deep principal component analysis (PCA) network, namely enhanced PCA Network (EPCANet), is proposed to explore more distinctive representation for face images. EPCANet adds a spatial pooling layer between the first layer and second layer in the PCANet. The spatial pooling layer reveals more spatial and distinctive information by down-sampling or pixel offset for the first layer output and original images. Extensive experimental results in several databases illustrate the efficiency of our proposed methods.

Index Term — PCA, Deep Learning, Face Recognition, Convolutional Neural Network (CNN).

1. Introduction

Feature extraction is one of the important and fundamental problems in pattern recognition. Principal Component Analysis (PCA) [1] and Linear Discriminant Analysis (LDA) [2] are two of the most representative unsupervised and supervised techniques for feature extraction. PCA has been widely investigated and become one of the successful approaches in pattern analysis especially image recognition. It is an unsupervised feature extraction method and aims to find a set of projection vectors so that the projected data can provide an efficient representation for data. LDA is a supervised method and seeks to find a set of projection vectors that maximize the between-class distance and minimize the within-class distance simultaneously, however, it cannot achieve good performance when the number of the labeled data is small [1-3].

To well uncover local intrinsic geometric structure, many manifold learning based subspace methods have been developed [4-7], among which locality preserving projection (LPP) [5] and neighborhood preserving projection (NPE) [6] are two of the most representative linear