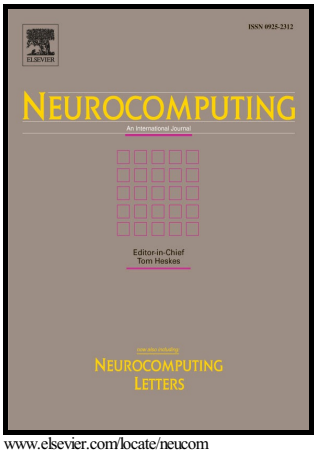

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Exponential Discriminant Locality Preserving Projection for Face Recognition

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Abstract

How to determine the low dimensional manifold is a challenging problem. Locality Preserving Projections (LPP) can gracefully deal with it. With the help of discriminant information provided by Discriminant Locality Preserving Projection (DLPP), the performance of face recognition can be significantly improved. In the real world, the DLPP has the Small Sample Size (SSS) problem. To deal with this issue, we utilize the matrix exponential to obtain more effective information, which can avoid the singular matrix's disadvantages. Thus, in this paper, we propose an effective and efficient algorithm called Exponential Discriminant Locality Projections (EDLPP) for face recognition. The experimental results on three challenging benchmark datasets (ORL, YALE and LFW) demonstrate that the proposed EDLPP algorithm outperforms favorably against several state-of-the-art methods.

Key words: Face recognition; low dimensional manifold; small sample size; matrix exponential; exponential discriminant locality projections

1 Introduction

FACE recognition is an significant and challenging computer vision topic, and several popular methods have been proposed over the past years [1] [2] [3] [4]. Like many other real objects, face images, can be analyzed well in a high dimensional space but with high computational cost. The common practice is managing to reduce the feature dimension into a meaningful and equivalent low dimensional subspace with dimension-reduce techniques. The two typical methods, the Principal Component Analysis (PCA) [5] and Linear Disciminant Analysis (LDA) [6] are usually used to reduce feature dimensionality. By employing the maximal variance, the PCA can figure out the optimal projection directions. By maximizing the ratio between the inter-class and within-class scatters, the LDA uses the discriminant information to determine the most effective discriminant directions.

However, in practice, either PCA or LDA can not determine the underlying manifold structure of high dimensional face images. For face recognition, by using Locality Preserving Projections (LPP) [8] to obtain laplacianfaces [7] to determine the essential manifold structure of the face images, the locality, i.e., the neighbor relationship between samples, of sample images can be preserved. To improve the discriminant performance of LPP, the Discriminant Locality Preserving Projections (DLPP) [9] [10] [11] [12] [13] methods encode the discriminant information into LPP.

Unfortunately, the above methods have the Small Sample Size (SSS) problem especially in cases when the number of dimension face images is greater than the number of samples. To deal with this problem, many methods has been proposed. He et al. [7] firstly reduce the dimension of sample by using the PCA criterion, and then recognize face by utilizing the LPP criterion. But in