

Occlusion Invariant Face Recognition Using Two-Dimensional PCA

Tae Young Kim¹, Kyoung Mu Lee², Sang Uk Lee², and Chung-Hyuk Yim³

¹ Samsung Electronics Co. Ltd., Suwon, Korea
ty514.kim@samsung.com

² School of Electrical Eng., ASRI, Seoul National University, 151-600, Seoul Korea
kyoungmu@snu.ac.kr, sanguk@ipl.snu.ac.kr

³ School of Mechanical Design and Automation Engineering,
Seoul National University of Technology
139-143, Seoul Korea
chyim@snut.ac.kr

Abstract. Subspace analysis such as the Principal Component Analysis (PCA) and Linear Discriminant Analysis (LDA) are widely used feature extraction methods for face recognition. However, since most of them employ holistic basis, local information can not be represented in the subspace. Therefore, in general, they cannot cope with the occlusion problem in face recognition. In this paper, we propose a new method that uses the two-dimensional principal component analysis (2D PCA) for occlusion invariant face recognition. In contrast to 1D PCA, 2D PCA projects a 2D image directly onto the 2D PCA subspace, and each row of the resulting feature matrix exhibits the distribution of corresponding row of the image. Therefore by classifying each row of the feature matrix independently, we can easily identify the locally occluded parts in a face image. The proposed occlusion invariant face recognition algorithm consists of two parts: occlusion detection and partial matching. To detect occluded regions, we apply a novel combined k-NN and 1-NN classifier to each row of the feature matrix of the test face. And for partial matching, similarity between feature matrices is evaluated after removing the rows identified as the occluded parts. Experimental results on AR face database demonstrate that the proposed algorithm outperforms other existing approaches.

Keywords: Face recognition, occlusion invariance, 2DPCA.

1 Introduction

Face recognition has been one of the most challenging and active research topics in computer vision for several decades (Zhao, 2000). The goal of face recognition is to identify one or more persons, given still or video scenes using stored faces in a database. A face recognition system should recognize a face robustly and independently as possible to the image variations such as pose, illumination, expression, and occlusion.

Face recognition approaches can be divided into two categories: feature based methods (Gao, 2002)-(Park, 2005) and appearance based methods (Turk, 1991)-(Georghiadis, 2001). In the feature based methods, some features such as eyes, nose,