N-Feature Neural Network Human Face Recognition

Javad Haddadnia [1], Karim Faez [2], Majid Ahmadi [3]

[1,3] Electrical and Computer Engineering Department, University of Windsor,
Windsor, Ontario, Canada, N9B 3P4
{javad, ahmadi}@uwindsor.ca
[2] Electrical Engineering Department, Amirkabir University of Technology, Tehran, Iran, 15914
kfaez@cic.aku.ac.ir

Abstract

This paper introduces a novel method for human face recognition that employs a set of different kind of features from the face images with Radial Basis Function (RBF) neural network called the Hybrid N-Feature Neural Network (HNFNN) human face recognition system. The face image is projected in each appropriately selected transform methods in parallel. The output of the RBF classifiers are fused together to make a decision. Experimental results for human face recognition confirm that the proposed method lends itself to higher classification accuracy relative to existing techniques.

1. Introduction

Face recognition may seem an easy task for humans, and yet computerized face recognition system still can not achieve a completely reliable performance. The difficulties arise due to large variation in facial appearance, head size, orientation and change in environment conditions. Such difficulties make face recognition one of the fundamental problems in pattern analysis. In recent years there has been a growing interest in machine recognition of faces due to potential commercial application such as film processing, law enforcement, person identification, access control systems, etc. A recent survey of the face recognition systems can be found in references [1-2].

A complete conventional human face recognition system should include three stages. The first stage involves detecting the location of face in arbitrary images [3-4]. The second stage requires extraction of pertinent features from the localized image obtained in the first stage. Finally the third stage involves classification of facial images based on the derived feature vector obtained in the previous stage.

In order to design a high accuracy recognition system, the choice of feature extractor is very crucial. Two main approaches to feature extraction have been extensively used in conventional techniques [2]. The first one is based on extracting structural facial features that are local structure of face images, for example, the shapes of the eyes, nose and mouth. The structure-based approaches deal with local information instead of global information. Therefor they are not affected by irrelevant information in an image. It has been shown that the structure-based approaches by explicit modeling of facial features have been troubled by the unpredictability of face appearance and environmental condition [2]. The second one is based on statistical approaches when features are extracted from the whole image and therefore use global information instead of local information. Since the global data of an image are used to determine the feature elements, data that are irrelevant to facial portion such as hair, shoulders and background may contribute to creation of erroneous feature vectors that can affect the recognition results [5].

In the field of pattern recognition, the combination of an ensemble of classifiers has been proposed to achieve image classification systems with higher performance in comparison with the best performance achievable employing a single classifier. This has been verified experimentally in the literature [6-7]. A number of image classification systems based on the combination of outputs of different classifier systems have been proposed. Different structures for combining classifier systems can be grouped in three configurations [8-9]. In the first group, the classifier systems are connected in cascade to create pipeline structure. In the second one, the classifier systems are used in parallel and their outputs are combined named it parallel structure. Finally the hybrid structure is a combination of the pipeline and parallel