Abstract

Face recognition has drawn substantial interest from number of researchers in the pattern recognition vicinity for the past few decades. The recognition of faces has become very significant because of its impending usage in law enforcement and commercial applications, such as in the area of access control systems, video surveillance, user authentication and retrieval of identity from a data base for criminal investigations. Although there are a number of face recognition systems which show better performance in constrained environments, face recognition is still a very challenging problem in real time applications. Many problems crop up in face recognition process because of the unpredictability of many parameters, such as face illumination, expression, pose, scale, low resolution, partial face (occlusion) and other environmental conditions. However, low resolution face recognition and partial face recognition (occlusion) remain as major challenges in face recognition and these two problems affect the performance of face recognition in, access control, authentication, and surveillance applications. To meet these challenges, the present study proposes a face recognition system using the hybrid approach in which both holistic and structural information is considered in feature extraction, Principal Component Analysis (PCA) or Linear Discriminate Analysis (LDA) for dimensional reduction and Artificial Neural Network (ANN) for classification purpose.

In existing methods of hybrid face recognition systems, maximum face recognition rate is only 95.8% on ORL (Olivetti Research Laboratory) database and all these systems work well only at high resolution. At low resolution, maximum percentage of recognition is found to be only 80% with 12X14 resolutions. In partial face recognition, only a little work has been done in
literature and maximum recognition rate using eyes is 83.1%, nose is 50%, mouth is 53%. To get better performance of face recognition at different resolutions, and for both full and partial face recognition, in this work, two face recognition methods are proposed. In both the methods, features are extracted from pre-processed face image by using hybrid approach, in which, feature vector is formed by combining multi-scale facial components such as eyes, nose, mouth, and remaining portion of face/whole face into single column vector. In multi-scaling process different components of face are down sampled by using different resolution ratios based on face component significance in recognition (example: eye 1:1, nose 1:2, mouth 1:4 and whole face 1:8).

In the first method of face recognition, feature vector is directly applied as input to ANN (BPNN & RBFN) for classification. In the second method, feature vector formed by combining multi-scale face components is projected on PCA or LDA feature space to obtain feature weight vector, and this feature weight vector is given as input to ANN classifier. Performance of these two methods is evaluated and compared with the existing face recognition methods for different resolutions of face image, and a suitable model for recognizing face and partial face images at different resolutions is suggested.