ABSTRACT

This thesis proposes models for automatic face recognition using moment-based orthogonal polynomial transforms and artificial neural networks. The major issues in automatic face recognition system are face localization, feature extraction and classification. To strengthen the performance of automatic face recognition, a feature invariant face localization procedure is developed to separate the face from the background. It uses the elliptical shape of the face to localize the face region.

Three types of face recognition models are proposed in the work. The first approach employs Generalized Pseudo-Zernike Polynomial (GPZP) and Tchebichef Polynomial (TP) for feature extraction to satisfy the minimal requirement of a face recognition system, namely to overcome the curse of dimensionality, invariant to size and tilt of the face and invariant to natural lighting condition. The classifier model used is the Radial Basis Function (RBF) neural network. RBF network has more compact topology with fast learning speed and produces good results in the classification phase.
The second type of approach adopts hybrid features using Krawtchouk Moment (KM) and Two Dimensional Principal Component Analysis (2DPCA) to overcome the variation due to illumination, expression and noise. An ensemble of RBF networks is employed for classification. The outputs of the different RBF networks are combined using Sugeno Fuzzy Integral (FI) which produces better performance compared to fixed rule like the product and sum methods.

In the third approach, Wavelet Transform (WT) is used as a feature extractor and a modular Autoassociative Neural Network (AANN) face model is proposed to capture the distribution of the extracted features. The proposed system gives better performance to face variation due to illumination, expression and occlusion.

The performances of the proposed methods are evaluated using Olivetti Research Laboratory (ORL), Yale, Own and Carnegie Mellon University Pose Illumination Expression (CMU PIE) databases and the results are promising.