Abstract

The problem of automatic holistic analysis, understanding and recognition of face images are addressed in this thesis. Face recognition lies at the core of the discipline of pattern recognition and face recognition system is expected to identify faces present in images and videos automatically. Two novel and new methods for representation of face images are proposed in this thesis. Two new features based on the new representations are also introduced by this work. The proposed representations are proved to be effective in capturing intraclass and interclass variations and hence are useful for developing face recognition systems. Based on these new representations, novel methods of face recognition are investigated.

A comparatively large face image database consisting of 6600 face image samples of 110 individuals using mobile camera is created for recognition study. In addition to this database standard AT&T face database is also used for comparative study.

A novel, robust and new paradigm for feature extraction based on non-linear dynamical system model for face recognition has been investigated in this thesis. To this end Reconstructed State Spaces for face images are generated using different space variations. The method of extracting State Space Point Distribution (SSPD) features from the reconstructed state space of face samples are also designed.

Another novel method of the representation for face images using a new biologically inspired model (Wavelet based Artificial Light Receptor Model) is investigated and presented in this thesis. The knowledge about the distribution of light receptors, cones and rods, over the surface of the retina, and the way how they are associated with the nerve ends for pattern vision forms the basis
for the design of this model. A combination of classical wavelet decomposition and wavelet packet decomposition is used to simulate the functional model of cones and rods in pattern vision. The derived feature using this model is called as ALR feature vector which is used for final face recognition system.

A study of effectiveness of the features (SSPD feature vector and ALR feature vector) extracted are carried out by conducting experimental studies using various longstanding classification algorithms in pattern recognition researches. The classical recognition algorithms like, c-Means clustering, k-NN, Bayesian, ANN and SVM classifiers are used for this purpose. Formation of a hybrid feature vector based on the derived new features is also given in this thesis. Finally, all the recognition results obtained using the newly generated features are compared with other well known existing methods.