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Title of Thesis: "Soft Computing Applications in Pattern Recognition for Security Purpose"

Abstract

The last decade has witnessed a trend towards an increasingly ubiquitous computing environment, where powerful and low cost computing systems are being integrated into almost every aspect of our lives.Research in automatic face recognition follows naturally.

Face is one of the most common biometric modality that humans use to identify the suspected persons and it has an advantage over other biometric traits as it can be acquired in a non intrusive way by a camera.

Iris is another biometric modality widely used because each iris is unique and pattern does not change even after youth. Furthermore, it is extremely difficult to surgically tamper with the iristexture information.

Motivated by the importance of both face and iris for the authentication of persons, the thesis makes an attempt in devising new features and testing them on some well known classifiers.

In this work a method is also developed to segment the face region into five different segments, viz. Forehead, eyes, nose, mouth and chin and also segment the eye into six different sectors.

The segmental Euclidean classifier has been developed to find out the recognition rate using the PCA features derived from the sectors of Iris and segments of face.

Features extraction also plays a major role in the recognition of face and iris. The two new fuzzy features are developed. The fuzzy logic is used to derive the Gabor fuzzy features from the Gabor filtered images and wavelet fuzzy features resulting from the decomposition of images. Two separate fuzzy features are fusedusing t and s norms of Hamacher and Yager.The performance of these features is evaluated on face using two different classifiers and improvement is achieved in recognition rate.

The new concept of Information sets is introduced to tap the uncertainty present in an image. Based on this, Principal Information Components (PIC) features are derived. An image is partitioned into windows and then membership function is fitted to the gray levels in the window. From the information values consisting of pair of gray level and membership function, PCA is applied to obtain PIC.

The filter similar to Gabor filter is developed so as to capture the frequency components present in an image.

An Iris contains texture so its segmentation from eye image is very difficult.An approach is developed to identify iris region and then convert into rectangular strip. A few information based features have been devised and tested. We have also used the majority voting method for combining the decisions of the individual classifiers.

The new classifier named as *'HanmanInner product classifier'*is proposed. The computational requirement of this classifier is very less as compared to that of SVMand the results are comparable to those of SVM.

The Hanman transform features are derived from Hanman-Anirban entropy function that captures the uncertainty present in the information values of an information set. The features are passed to the SVM, Bayesian, Inner product classifier.The results are found to be superior to those of Hanman filter features.