ABSTRACT

The development of accurate and reliable security systems is a matter of wide interest, and nowadays, modern societies give higher relevance to systems that contribute to the increase of security and reliability, essentially due to terrorism and other extremism or illegal acts. In this context, the use of biometric systems has been increasingly encouraged by public and private entities in order to replace or improve traditional security systems and also highly effective automatic mechanism for personal identification. A biometric system provides automatic identification of an individual based on unique features or characteristic possessed by the individual such as face, iris, and fingerprint and voice recognition. Basically, the aim is to establish an identity based on who the person is, rather than on what the person possesses or what the person remembers. No proper identification can be done if the quality of involved samples is poor.

Iris recognition, as an emerging biometric recognition approach, is becoming very active topic in both research and practical applications. The motivation for this endeavor stems from the observation that the human iris provides a particularly interesting structure on which to base a technology for noninvasive biometric assessment. The iris is the colored portion of the eye that surrounds the pupil and controls the amount of light that can enter the eye. The variations within the patterns of the iris are unique between eyes, which allows for accurate identification of an individual.

The main objective in this thesis involved developing an iris recognition system in order to verify both the uniqueness of the human iris and also its performance as a biometric. In general, a typical iris recognition system includes iris imaging, iris liveness detection, and recognition. After analyzing the existing iris recognition methods and finding that they have small robustness to noise factors, the current work was oriented towards the proposal of a more robust iris recognition methods that must be able to
deal with noise and achieve accurate recognition, with improved error rates.

In this work the main contribution is proposal of novel segmentation method that is based on the statistical approaches, and is able to localize the circular iris and pupil region, occluding eyelids and eyelashes, and reflections by a technique Image cropping.

Proposed segmentation method is followed with investigation of five feature extraction techniques, viz. Statistical approaches, GLCM, Wavelet transforms, Lifting wavelet transforms and finally Contourlet transform to extract features and to encode the unique pattern of the iris into a bit-wise biometric template. Among these five feature extraction methods, applciion of lifting wavelets (with improved vanishing moment) and contour wavelets for iris is a complete unexplored domain by other researchers. A comparative analysis is done for these techniques with the proposed segmentation method.

The Euclidean distance, Distance measure and Separable Power was employed for classification of iris templates, and two templates were found to match if a test of statistical independence was failed. The proposed iris recognition method that uses contourlets for feature extraction performed with a near-perfect recognition on a set of 35,000 eye images (CASIA I, II and III dataset); another set of 500(MMU dataset); 400(IITA, Czech Republic dataset); with false accept and false reject rates of 0.005 % and 0.238 % respectively.

This research demonstrates that combination of proposed segmentation approach and Contourlet feature extraction method in this work helps to improve overall performance and significant increase in the recognition accuracy. The algorithm is robust for noisy conditions such as errors, elliptical pupils, excess eyelash occlusion errors and bad contrast.