Abstract

The need for reliable identification of genuine user is obvious. Biometrics offers a natural and reliable solution to many aspects of identity management by the use of fully automated or semi-automated schemes to recognize individuals based on their inherent physical and/or behavioral characteristics. Most of the current biometric systems deployed in real-world application are unimodal. Unimodal biometric system depends on the evidence of one of biometric traits such as fingerprints, hand geometry, iris, retina, face, etc. to authenticate an identity.

The unimodal systems have to contend with a variety of problems. This in turn increases False Acceptance Rate (FAR) and False Reject Rate (FRR). A good system needs very low FAR and very low FRR. This can be achieved by the multimodal system. The multimodal system is a subset of multibiometric system which establishes identity based on the evidence of multiple biometric traits. Unique Identification Number (UID) or AADHAAR in India is best example for a multibiometric system. Thus, in this thesis, we address critical issues in designing a multi-biometric biometric system i.e., feature extraction algorithms and fusion strategies for different systems (multi-instance systems, multi-modal systems, feature extraction algorithms and fusion strategies).

The choice of feature extraction algorithms to be employed for biometric trait is one of the most significant stages in biometric systems. For our work we have chosen different types of algorithms (texture based, appearance based and kernel based methods). Fusion methodologies have been exploited for addressing different combinations of multimodal systems. In all the experiments fusion carried out at three levels of fusion (feature level, score level and decision level).

To evaluate the performance of a multi-instance system a hand-based biometric technique, finger-knuckle-print (FKP) have been used, FKP refers to the image pattern of the outer surface around the phalangeal joint of one’s finger. The experiments are developed for personal authentication using DZhang FKP database.

To evaluate the performance of a multi-modal system, we have chosen four physical modalities. (i) Face modality of AR Database which consists of 4000 face images corresponding to 120 users (70 men and 50 women). (ii) Palmprint of PolyU Database which contains 7752 gray scale images corresponding to 386 different users palm in BMP image format. (iii) Iris of CASIA Database Version 1.0 (CASIA-IrisV1) which includes 756 iris images from 108 eyes. (v) Finger knuckle print (FKP) of DZhang PolyU Database FKP images were collected from 165 volunteers, including 125 males and 40 females. The database contains FKP from four different fingers, right index, right middle, left index, and left middle fingers.
To evaluate the performance of a multi-algorithm system, we have chosen six different algorithms: two texture based (Log-Gabor and Local Phase Quantization (LPQ)), two appearance based (Principal Component Analysis (PCA) and Locality Preserving Projection (LPP)), and two kernel based (Kernel Principal Component Analysis Kernel (KPCA) and Kernel discriminant analysis (KDA)).

In all the experiments of the proposed systems are evaluated in terms of False Acceptance Rate (FAR) values at 0.01%, 0.1% and 1%, along with its corresponding Genuine Acceptance Rate (GAR in %).