

Abstract

Biometric-based person identification is gaining its importance and now-a-days it is required to process a large amount of biometric data in the order of millions. As a consequence, the traditional approaches where the identity of a query template is decided by matching the query template with all stored templates are impractical. Further, the problem is compounded when we have to deal with two or more biometric traits. Objective of this thesis is to address these issues and investigate the indexing techniques for unimodal and multimodal biometric traits with large scale biometric data so that the matching process can be accomplished in a real time without compromising the accuracy of person identification.

In this work, we consider three biometric traits (iris, fingerprint and face). We propose an efficient indexing technique for each biometric trait and also propose the indexing method when these traits are used for a multimodal identification system. Our iris indexing mechanism uses Gabor energy features to generate a low dimensional index key from an iris template. A new index space organization for iris biometric trait is proposed to retrieve similar iris templates from the database.

In fingerprint indexing, we consider local topology of minutiae using two closest points triangle for index key generation. The features are invariant to rotation and scaling and hence, the approach can deal with fingerprints from different devices and sensors. We use clustering and k-d tree-based indexing techniques for fingerprint identification.

Our proposed face indexing technique is based on the SURF key points and SURF descriptors. We create a two level index space based on the key points and divide the index space into a number of cells. We apply hash function on the key points to decide the cell position of each SURF descriptors.

Our multimodal indexing method is based on the relative scores with respect to a set of reference subjects corresponding to each trait. We combine the scores using SVM-based score level fusion technique. These scores are used to generate index key for a subject. Based on the index code values, we store the subject identity into the database. We propose a new index space organization in the database and a technique to store and retrieve the subject identities into/from the database. We introduce a new rank level fusion technique on the retrieved candidate sets using SVM rank.

The major contributions of the thesis are generating index key and proposing new indexing mechanism for different biometric traits. With our indexing approaches, it is possible to retrieve a set of biometric templates similar to the query template in the order of milliseconds, is independent of size of databases, and with higher hit rate and lower penetration rate. Thus, the index space organization proves to be effective for fast and accurate retrieval. Moreover, our proposed multimodal indexing approach can be extended for any number of biometric modalities.

Keywords: *Iris data indexing, Fingerprint data indexing, Face data indexing, Multimodal biometric data indexing, Identification systems*