ABSTRACT

The adoption of automatic authentication system is gaining momentum and more focus. Reliability in the personal authentication is the key to the security in the networked society. Many physiological characteristics of human, i.e., biometrics, are typically time invariant, easy to acquire and unique for every individual. Biometric features such as face, iris, fingerprint, hand geometry, palmprint, signature, etc. have been suggested for the security in access control. Most of the current researches in biometrics have been focused on fingerprint and face. The reliability of personal identification using face is currently low as the researchers today continue to grapple with the problems of pose, lighting, orientation and gesture. Fingerprint identification is widely used in personal identification as it has worked well in most cases in the past. However, it is difficult to acquire fingerprint features i.e. minutiae, for certain class of persons such as manual labourers, elderly people, etc. As a result, other biometric characteristics are receiving increasing attention. Moreover, additional biometric features, such as palmprints, can be easily integrated with the existing authentication system to provide enhanced level of confidence in personal authentication.

Biometric systems that operate using any single biometric characteristic have some limitations which may lead to poor identification results due to the following reasons.
Some of the limitations imposed by unimodel biometric systems can be overcome by using multiple biometric modalities (such as face and fingerprint of a person or multiple fingers of a person). Such systems, known as hybrid model biometric systems, are expected to be more reliable due to the presence of multiple, independent pieces of evidence. These systems are also able to meet the stringent performance requirements imposed by various applications.

Hybrid model biometric systems address the problem of nonuniversality, since multiple traits ensure sufficient population coverage. Further, hybrid model biometric systems provide antispooﬁng measures by making it diﬃcult for an intruder to simultaneously spoof the multiple biometric traits of a legitimate user. By asking the user to present a random subset of biometric traits, the system ensures that a ‘live’ user is indeed present at the point of data acquisition. Thus, a challenge-response type of authentication can be facilitated using hybrid model biometric systems.

This research addresses various kinds of existing biometrics based identification systems and discusses their strength, weak

(i) Noise in sensed data
(ii) Intra-class variations
(iii) Distinctiveness
(iv) Nonuniversality
(v) Spoof attacks
areas. This research will elusively address a hybrid model biometrics based human identification system using hand geometry and the palmprint of the human hand.

The different techniques involved in the intermediate steps of typical recognition process such as hand image segmentation and feature extraction have also been addressed.

Image segmentation is the first step in most image analysis and pattern recognition systems. It is the process of dividing an image into different regions such that each region is homogeneous. It is also a critical and essential component of the image analysis.

In this research work, the following modified versions of segmentation algorithms have been implemented and explored their suitability towards practical applications, such as

- K-means clustering based colour image segmentation algorithm.
- Pulse Coupled Neural Network (PCNN) based gray image segmentation algorithm.
- Simple Filtering, Edge Detection and Region Labeling (FEDRL) based Segmentation Algorithm.
In this proposed approach, the binary image prepared from the segmented hand image is cropped exactly to contain the hand only area using the detected finger tips and fourteen more significant features are extracted. Only some of the hand attributes are used from the fourteen selected for extracting the palmprint area of the hand. Subsequently, factor analysis is used to find the principal factors of the palmprint images which can be considered as feature vectors of the palmprint. Then the combined feature vector is obtained by concatenating the hand geometry features and palm print features using fusion process.

A novel matching policy namely fuzzy weighted attribute set based Euclidean distance metric for matching the input hand attributes with the attributes of hands in the database, is also proposed. The overall contribution of this research is fast and efficient hybrid model for hand based human identification.