CONCLUSION AND FUTURE SCOPE

Personal authentication is need of hour for access control. Common methods of identification/verification are passwords, access cards, Pin numbers etc. The limitations of these methods are the need to remember too many passwords, to carry card etc. They can be easily stolen or forgotten and thus can be used by unauthorised users. Solution to all these problems is to use biometrics. Biometrics is fast replacing all the existing authentication methods.

The work in the thesis has successfully achieved following objectives:

1) A simple unimodal hand geometry based algorithm using existing geometrical features is established. Analysis is carried out to find interclass similarity and intraclass variations of all geometrical features and accordingly weights are assigned to the features. Proposed method is found better than the conventional methods which assign equal weights to all the geometrical features.

2) A unimodal hand shape based algorithm is proposed which depends only on global, signature and spectral shape features of hand. The proposed algorithm does not as much depend on the location of landmark points as geometry based algorithm. Hand shape features may vary if the users don’t cooperate and misplace hand on the acquisition device. Both the above algorithms depend on only one biometric trait that is either only hand geometry or hand shape, so will not be able to provide the robustness in applications of high security.

3) Multimodal approach is implemented in two ways. First method fuses distance and orientation map of hand shape. Second approach is implemented by second level fusion of scores generated from distance and orientation map of hand shape with geometrical features of hand. Best advantage of this method is that the input for all the biometrics can be acquired at one point using same input device. Both of these traits, hand geometry and hand shape, needed hand contour as input and the most crucial benefit will be that the complex
preprocessing which involves hand orientation registration and finger registration proved to be beneficial for both traits. All these advantages of multimodal system are availed at a very small increase in computational complexity due to increased number of features and fusion of score values, in comparison to unimodal system.

4) A method to connect the disjoint fingers in preprocessing is presented. Both shape and geometry features are extracted with respect to a stable reference point at the wrist line of the hand contour. Different fusion techniques, normalization methods, distance metrics and sample size databases are used for testing the proposed algorithms.

**Scope of Future Work**

The future direction of this work includes the consideration of the characteristics of the palm lines and fingerprint. The contact based and contact free databases are considered in this simulation, but in future the infrared hand images can also be included. The efficient fusion techniques at representation level and score level are to be designed. Multimodal system using hand geometry, hand shape, fingerprint and palmprint can be used for high security applications of personal identification.