CHAPTER 5
CONCLUSIONS AND FUTURE SCOPE

In this research work, we have studied the issues attached with appropriate features recognition for automatic person identification using fingerprint and palmprint images. Specifically, we recognize the suitable orientation multi-resolution and multi-scale transforms for extracting the global and local features of fingerprint and palmprint as unimodal and multimodal biometrics. For this purpose various methods like Radon transform, Discrete dyadic wavelet transform and Orientation field have been included in the proposed thesis. Radon transform is found to be suitable for multimodal biometrics. Performance of fingerprint and palmprint found to be better and hence we have fused fingerprint and palmprint features computed using Radon transform. The algorithms were implemented and tested on the machine having 2.6 GHz Pentium-IV processor with 512 MB RAM and MATLAB environment. The identification system performance has been tested using the standard database sof FVC2000 and PolyU available on the website to compute recognition rate.

5.1 Conclusions

One of the major limitations in the biometric recognition system is low resolution of the images of the modalities in the database. Second limitation is the speed of identification due to large database. To tackle these constraints, an algorithm is required which is capable to extract the unique features. For this purpose, Radon transform, the discrete dyadic wavelet transform and Orientation field have been included in the proposed work. Principle lines within the palmprint and minutia in the fingerprint can be easily extracted even from the low resolutions images. Radon transform has the property to extract the orientation of lines which makes it robust in comparison to other algorithms.

The method of imprint identification using Radon transform extracts local and global textural features from fingerprint and palmprint images. The method is invariant to rotation and translation variation of the imprint images. Considering speed and accuracy the system attains good performance. As the enhanced texture information in the imprints is represented by local features, the use of the feature maps i.e. Radon transformed imprints perform better with regards to speed and accuracy.
Multi-resolution classification property of the wavelet transform is used to extract the features corresponding to high frequencies within the modalities. However, down-sampling process introduces undesirable artifacts in the matching of extracted features. Non-redundant representation of dyadic wavelet do not contains down sampling of the signal and hence it avoids these artifacts. Therefore Dyadic Wavelet based algorithm obtains distinct signature of fingerprint and palmprint images and revealed that the system achieves high rates of security.

The method shows stability, completeness and application to pattern recognition of zero-crossings based multi-scale representation. The reconstruction of the original signal from its zero-crossing representation is done by iterative algorithm. The zero-crossing representation completeness and stability can be confirmed since the reconstruction is independent from the choice of the initial point. The application of this representation to imprint matching shows a coarse to fine stereo-matching algorithm. In a zero-crossing representation the number of values to be coded depends upon the irregularity of the signal. This image representation provides a compact reorganization of the information for a large class of images. The proposed orientation features produce the discrimination between the imprints of different persons with only few computations. The proposed algorithm produces better results at lower and higher values of FAR as compared to other algorithms. As the algorithm takes fewer computations it could be implemented using the real time processor.

The proposed model based on the principal lines can be easily extracted even in low resolution images. The principal lines can be considered as small lines and therefore Radon transform is effectively having capability of extracting overlapping lines even in noisy environment. The histogram of Radon transform extracts the features of the principal lines of palmprints. To make the algorithm scale and rotation invariant, logarithm is calculated prior to calculation of histogram instead of normalization. The performance evaluation in terms of ROC curve shows the accuracy of proposed model. In comparison with other Radon based models, the proposed model is computationally efficient as it requires less number of calculations for Radon coefficients and its histogram. In the proposed model, extraction of Radon coefficients are highly sensitive to the principal line identified in spatial domain and hence can be integrated with the model having ability to extract the principal lines in more robust way. Radon coefficients represent the points corresponding to the principal lines and these points are obtained on palmprint image. From obtained palm points, polygon is formed as a feature vector. To recognize the query image, the area and periphery of polygon obtained from query image are compared with those of database.
images. Small difference between these two feature vectors recognizes the image. The model is accurate and computationally efficient in comparison with Gabor based model and other radon based algorithm.

The unimodal biometric system is vulnerable to various threats. The thesis proposes the multimodal biometric recognition model. By analyzing the characteristics of various modalities, it is found that fusion of palmprint and fingerprint features based algorithm yields better accuracy. The histogram of Radon based feature extraction model is utilized. To make the model invariant to scaling, logarithm of histogram is calculated. The Radon transform is sensitive to the rotation. Therefore correlation is obtained for each rotated modality and maximum correlation value gives the identification of individual which is invariant to the rotation. The fusion of palmprint and fingerprint is done at decision level. The proposed model fused the unique characteristics of palmprint and fingerprint for identification. The EER can be further decreased when more unique features are extracted.

5.2 Future scope

In spite of the fact that a good performance can be achieved in the identification system making a personal recognition, for making the system robust and more efficient in practice, we consider that still a number of problems need to be solved. The following are the guidelines which are important for improving the performance of the proposed system implementation:

• Using the global and local features for poor quality imprints the performance can be improved by enhancing the accuracy of the pre-processing and post-processing steps.
• The matching speed can be accelerated to a great extent by quick rejection of the unreasonable alignments.
• Palmprint image alignment is the major problem that can be solved by aligning the palmprints if they are rotated during capturing. Computation of the rotation may be achieved using various transforms like Hough transform or Radon transform.
• Person identification using global features is based on the accurate detection of the reference point that may fail on the very low quality palmprints. One can develop a new methodology without use of pegs for the same.
• For comparative study a variety of other transforms can be further implemented indicating which transform proves better in accurate identification at the same time reduces the computational complexity.
• Due to advent in scanners and are readily available in various shapes, sizes and operating principles. By using imprint images from various scanners one can relate which method suits best for the particular scanner.

• A use of dedicated DSP processor can reduce the computational complexity of the algorithm while operating the algorithm on the huge database.

• A handheld embedded system of compact size can be constructed by using the FPGA implementation of the proposed algorithms in VLSI.