Hybrid Algorithms for Iris Recognition

A Thesis Submitted to Assam University
in Partial Fulfilment of the Requirements
for the Degree of

Doctor of Philosophy
in
Computer Science

by

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September 2017

Chapter 7
Conclusions and Future Work

This chapter presents thesis summary and also future scope of work highlighting several open questions in the resarch field.

7.1 Summary and Conclusions

The objective of the research presented herein is to develop hybrid iris segmentation and recognition algorithms for iris recognition system which can perform well during both identification and verification of an iris image. A detailed investigation has been carried out on existing statistical methods, soft computing methods and hybrid techniques with an application to iris recognition. Soft computing methods *viz.* QPSO, ANN, Modular ANN, Fuzzy Inference System and hybrid techniques for iris-based biometric system are studied extensively and reviewed.

One of the main contributions of this thesis is the development and evaluation of hybrid iris recognition algorithms for efficient iris segmentation and recognition using soft computing techniques.

Chapter 1 provides an introduction to the thesis along with the motivation behind undertaking the present research work, the objectives, methodology adopted to carry out the research and the thesis organization.

An essence of comprehensive literature survey on iris recognition algorithms based on different methodologies has been presented in chapter 2. The related work on iris

image acquisition, iris segmentation, feature extraction and iris matching has been presented in this chapter.

An iris segmentation approach based on Adaptive Histogram Equalization and median filter is proposed in chapter 3. This approach is efficient with regard to processing time but at the cost of some loss of iris data. The computation of algorithmic parameters such as threshold values for image binarization in the iris recognition system is usually based on fixed values. In order to improve the overall performance of the iris recognition system, a hybrid iris segmentation appraoch comprising of Quantum-behaved Particle Swaarm Optimization (QPSO), circle geometry and Circular Hough Transform (CHT) is developed and presented in chapter 4. This method is capable of accurate iris segmenation of noisy iris images in comparison to some of the existing methods over the considered datasets.

The recognition accuracy of iris recognition system is not solely decided by iris segmentation or feature extraction. In fact, it also depends on the recognition algorithm. Three different hybrid iris recognition approaches have been proposed in this thesis for identification and verification of an input iris image. The first approach adopts hybridization of ensemble of neural network and statistical city block distance where the task of iris recognition is compartmentalized among the networks to perform the recognition efficiently. However, the perfomance of this method deteriorates when iris information is degraded by noise such as eyelids, eyelashes and reflection. To address this problem and to further enhance the iris recognition performance, in the second approach, a Modular Neural Network (MNN) with score level fusion is proposed in chapter 5. The modular neural network has the capability to learn different task simultaneously and to reduce the system complexity. The experimental results demonstrate the efficiency of the proposed approach.

The task of iris recognition system is to recognize an iris image precisely and accurately with less FAR and FRR. Finally, in order to reduce the FAR and FRR of the recognition system, a hybrid approach based on modular neural network and fuzzy inference system is presented in chapter 6. This approach deals with recognition of an iris where score level fusion strategy based on fuzzy logic has been adopted in order to

reduce the FAR and FRR of the system. Modular Neural Networks have been used as a recognizer and the outputs are fused together with the fuzzy inference system to determine the actual class (identity) of an iris. The system consists of six modules of neural networks and the fuzzy inference system. During enrolment, iris image is divided into six segments and each Module is trained with their corresponding segment. During recognition, six segments of query iris are fed into their corresponding trained module where each module responds with the class of the segments. These outputs go through the fuzzy inference process for final recognition. The recognition performance is analyzed in both identification and verification mode. From the experimental results, it is observed that the proposed approach outperforms other approaches in terms of FAR and FRR for both identification and verification of iris images and is a promising approach for iris recognition over the considered datasets.

The research work carried out in this thesis contributes to the development of hybrid algorithms for iris recognition system which can be employed for reliable authentication based on iris biometric and can further advance the iris-based biometrics technology.

7.2 Future Scope of Work

The research results presented in the present work demonstrate the superior performance of the proposed hybrid approaches for iris segmentation and iris recognition that will facilitate the design of reliable and secure biometric systems. However, the hybrid algorithms presented in this thesis can be improvised. The following points can be considered for future work:

i. The performance of iris recognition systems is affected by input image quality. Any practical recognition system is vulnerable when iris information is degraded by noise such as eyelids, eyelashes and reflection. Therefore, further research needs to be carried out to address the issues of iris image acquisition.

ii. The proposed approaches are for iris biometric; its use can be further extended for other biometric models and multimodal systems thus increasing the general applicability of the techniques presented in this thesis.

iii. In iris recognition system, features extractor such as DCT, wavelet transform etc., are used to extract a set of predetermined features from an individual iris image. These feature extractors cannot learn to extract discriminating features from the set of images. This disadvantage can be overcome by using deep learning neural network which can be trained to extract more discriminating features from the set of iris images. It is expected that the performance of the iris recognition system can be significantly improved by training a deep network specifically for iris recognition.