A conceptual framework of non-circular segmentation using modified greedy algorithm for iris recognition

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ABSTRACT – This paper attempts to show the non-circular segmentation, which conceptually designed using modified greedy algorithm. Studies shown that greedy algorithm is accurately segmented the iris. However, limitations occurred as two or more iris templates from the same person is compared during matching phase. In fact, accuracy of the proposed method is higher instead of circular method. Thus, this work is to propose a conceptual framework for non-circular segmentation based on modified greedy. The future implementation of modified greedy algorithm will using MATLAB to segment the iris template according to the original shape and size before stored them into the database.

1. INTRODUCTION

In iris recognition system consists of phases such as iris image acquisition, segmentation, normalization, extraction and matching as illustrated in Figure 1. The typical iris recognition system is useful for human detection either the user of the system is real user or not real user or unknown.

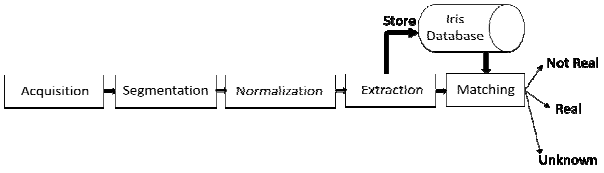

Figure 1 Iris recognition block diagram

Nevertheless, segmentation phase is the most critical part in iris recognition systems, since errors in this initial stage are propagated to subsequent processing stages. Indeed, the performance of iris segmentation algorithms is paramount to the performance of biometric recognition system, since errors during iris segmentation cannot be corrected at a later stage in the processing chain.

Traditionally, iris segmentations algorithms are based on circular iris boundaries. Circular iris detection is a good assumption given ideal environments and cooperative users and a consequent frontal iris image recording. However, unaware or uncooperative users (e.g. a surveillance scenario) or non-optimal environments (e.g. biometrics on the move, or gate based access systems) produce an off angle iris images with bad illumination and stronger occlusions due to hair or cilia. To overcome several problems encountered at the circular segmentation, the non-circular segmentation method is explored to resolve the non-ideal and almost round shape of iris images.

Non-circular is an important method in the segmentation phase, and plays a key role in iris recognition system[1]. The non-circular segmentation of iris template is proposed[2], since circular method consume higher computational processing time and energy usage during extracting the iris templates. Moreover, non-circular segmentation provides better accuracy performance than circular segmentation[3]. The existing techniques mostly applied in the non-circular segmentation are Random Sample Consensus (RANSAC)[4][5], and Greedy algorithm [6] as shown in theoretical diagram in Figure 2.

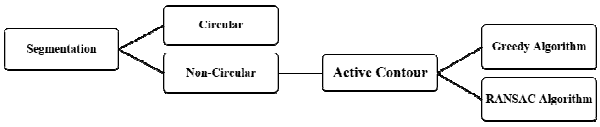

Figure 2 Non-circular segmentation theoretical diagram

Greedy algorithm has been used in many image processing applications in various fields, but few works done in iris recognition. Thus, greedy algorithm is applied into the iris recognition with modification to its algorithm development. The implementation of the modified greedy is firstly starts at the internal spline energy, which is written as:

$$E_{\text{int}} = (\alpha(s)|v_s(s)|^2 + \beta(s)|v_{ss}(s)|^2) / 2 \quad (1)$$

Moreover, the internal spline energy is modified by introducing the smoothing function *fn(I)*, in order to beautify the curves and make the appearance of the iris features image more accurate and even slick at the edge, which is written as:

$$E_{\text{int}} = (\alpha(s)|v_s(s)|^2 + \beta(s)|v_{ss}(s)|^2) / 2 + f_n(I) \quad (2)$$

Where

$$f_n(I) = 1 / (2N + 1)\,[\, y(i+N) + y(i+N-1) + \ldots + y(i-N)] \quad (3)$$

Additionally, for comparison between iris images that has been tagged is matched based on iris template tag id. The matching process technique used for iris recognition is Hamming Distance (HD) since HD is the standard matching algorithm for iris. In fact, to match between the real iris templates with the one in the database is based on the iris template tag id so that the

searching for the accurate user would be faster and higher accuracy performance can be obtained.

Section 2 explains the methodology on theory and finding the niche of the framework. The expected result and discussion is explained in Section 3.

2. METHODOLOGY

This research is started with preliminary studies, which literature reviews are conducted to obtain the theory and research gap regarding on developing platform trends based on non-circular segmentation.

Furthermore, the flow of the conceptual framework represented in diagram as illustrated as in Figure 3. The proposed framework is categorized into two main processes, which are a) enrollment and b) verification or identification.

In the enrollment process, the iris image is acquired from the iris camera or sensor which involve hardware and software specification. Then, the iris image is transformed into smaller size through the segmentation and normalization. During the segmentation, the iris image is detected based on the inner and outer boundaries based on the original size and shape. In fact, the iris is localized in the region of interest in getting the successful region of iris. The normalization phase is to transform the almost round shape of the iris into a rectangular shape so that the optimum storage space can be achieved. Before the iris is stored, the iris is extracted and the upper layer is tagged with the user's identity.

On the other hand, the matching process consists of verification and identification method. The verification is a one-to-one matching that compares one iris template to another iris template for only one user. For identification, the method is one-to-many matching which an iris template of a user is compared with several iris templates from many users including the user's iris templates. The identification matching takes longer time to compare and involve huge computational process to determine the real, not real or unknown user.

The proposed framework for non-circular segmentation using modified greedy algorithm is shown as Figure 3.

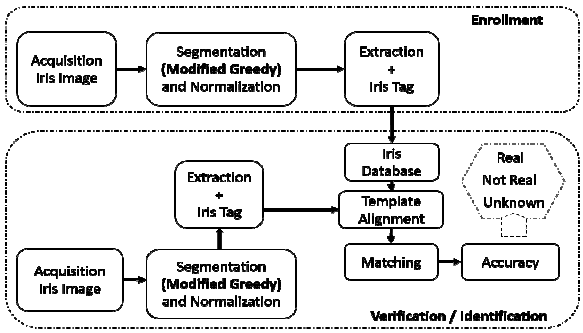

Figure 3 Proposed conceptual framework

3. EXPECTED RESULTS AND DISCUSSIONS

The conceptual framework of non-circular segmentation using modified greedy algorithm is implemented on MATLAB platform. The new proposed conceptual framework is transformed into software based in MATLAB platform that links to iris sensor and iris database as shown in Figure 4.

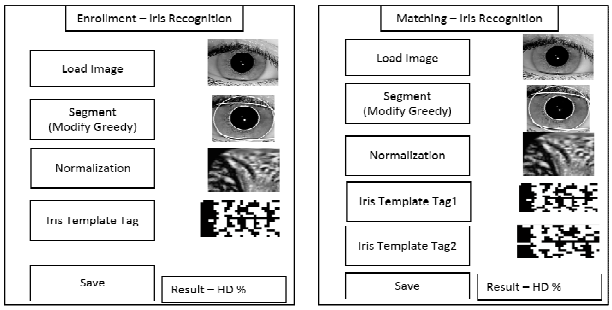

Figure 4 Proposed interface for enrollment and matching

4. CONCLUSIONS

As a conclusion, this paper proposed another framework for non-circular segmentation in iris recognition. In future the development of system will be based on the conceptual framework. The development system helps in determine the real user in higher accuracy performance.

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