Iris image enhancement for feature recognition and extraction

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ABSTRACT

Poor digital iris images prove to be a challenge when iris features have to be recognised and extracted for use in iris classification. To ensure the accuracy of a typical iris recognition system, acquired iris images have to undergo a process called pre-processing by employing enhancement algorithms. The purpose of this work is: (a) to be able to extricate the best suited enhancement technique that will display the articulated iris features and patterns for efficient extraction; and (b) to use the best enhanced images as a directive towards the development of an algorithm that will simulate the change of the different patterns and features by measuring the boundaries between them. This work explores image enhancement in the spatial domain by using three enhancement techniques namely: (i) local histogram equalisation, (ii) global histogram equalisation and (iii) partial contrast, to improve the quality of iris images from three different iris databases.

INTRODUCTION

The iris begins its formation on the third month of gestation and completes its whole structural formation by the eighth month. As a biometric, it is regarded to be the most reliable physiological trait for non-repudiable authentication of persons today. It has 266 unique spots and its structure remains stable over time and across environments. A typical iris recognition system has the following structure as depicted in **Figure 1** (Proença & Alexandre, 2007).

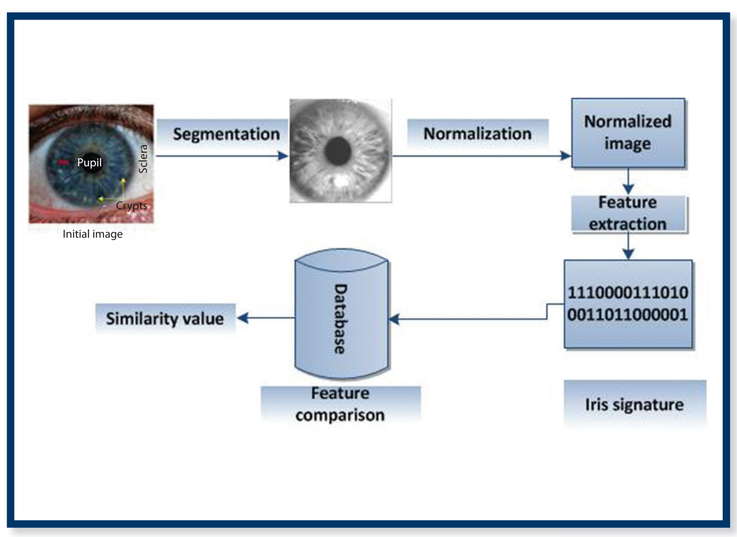

Figure 1: Iris recognition system architecture

The challenge in the use of iris images for purposes of user authentication comes when acquired iris images are of low quality. This refers to blurry, low resolution images with poor illumination. Pre-processing is a crucial stage in the performance of an iris recognition system (Sazonova & Schuckers, 2011). It entails the enhancement of low quality images that can pose a threat and compromise the accuracy of the entire system that either aims to correctly identify and/or match an individual to an existing database. Hence, the main objective of enhancing an image is to ensure that the images supplied for use in specific applications such as feature extraction are more suitable for performing such tasks and yielding better accuracy (Gonzalez & Woods, 2002).

METHODOLOGY

The block diagram in **Figure 2** demonstrates the processes followed to achieve the results.

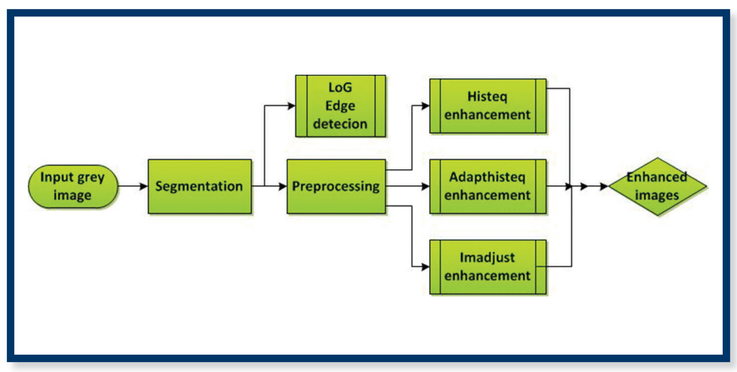

Figure 2: Methodology flow chart

Pre-processing is a crucial stage in the performance of an iris recognition system. It entails the enhancement of low quality images that can pose a threat and compromise the accuracy of the entire system. The main objective of enhancing an image is to ensure that the images supplied for use in specific applications such as feature extraction are more suitable for performing such tasks.

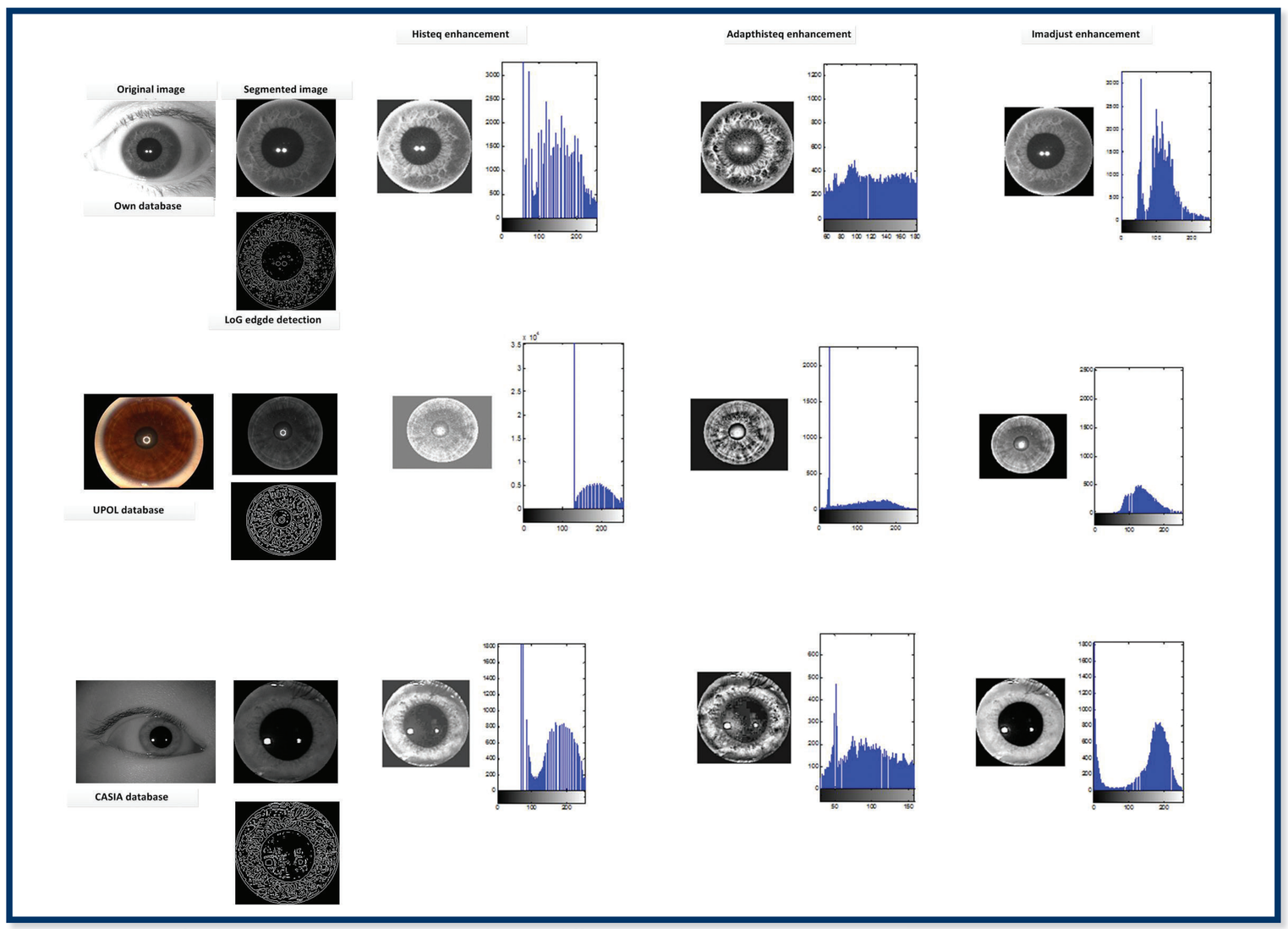

Figure 3: Results of enhancement algorithms tested using different iris databases

ANALYSIS OF RESULTS

LaPlacian of Gaussian (LoG): detects edges in an image by looking for zero crossings after filtering. It highlights regions of rapid intensity change in the image.

Histograms provide an efficient and practical way to assess the overall contrast and average brightness of grey level values within the range [0 255]. Dark images contain a concentration of bars on the lower parts of the grey level range. For bright images, the concentration of bars is on the higher or opposite end of the range. Low contrast images cluster the bars within narrow range of grey levels. Images with a high contrast display a bimodal histogram that clearly distinguishes between the two main grey level ranges, 0 and 255.

Histeq: improves the contrast of a monochrome image using global histogram equalisation. It also aims to enhance the small details within an image.

Adapthisteq: performs contrast limited adaptive histogram equalisation (CLAHE). Unlike the above technique, the histogram equalisation of a monochrome image is a local one. This means that it operates on small data regions rather than the entire image.

Imadjust: performs contrast adjustment by mapping the darkest pixel value to 0 in the input image and the brightest pixel value to 255, thereby redistributing the intermediate values linearly for images of an unsigned 8-bit integer class.

CONCLUSION

The enhancement techniques explored here also comprise the employment of other algorithms and commands so as to better present and demonstrate the obtained results. Edge detection and enhancing images for use in an iris recognition system allow for efficient recognition and extraction of iris patterns.

REFERENCES

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