ILLUSTRATE AND ANALYSIS OF IRIS IMAGE USING CLUSTERING AND WAVELET TRANSFORM

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Abstract : Many biometric procedures based on different features and algorithms are currently under development. However, it is known that, thanks to all these techniques, iris recognition is one of the most promising for high security applications. In this article, a new scheme is proposed for the segmentation and recognition of the iris in a biometric system based on the iris. In the new scheme, we use the circular modified diffuse segmenter model (MCFS) to segment the inner boundary of the pupil and iris. Subsequently, a feature extraction scheme based on a binary encoder called LCE is proposed to extract the significant features to perform the iris recognition process. Once the LCE operator performs the pattern extraction scheme, iris recognition is performed using a fuzzy logic classifier. We use three sets of data from the widely used iris databases (CASIA, MMU and UBIRIS) to analyze the increase in error rates when the iris is segmented incorrectly. We have selected 780 images from the CASIA, MMU and UBIRIS databases that the segmentation algorithm used can accurately segment. From the results of the trial, the proposed MCFS + LCE method is outperformed compared to existing methods. An image is a rectangular grid of pixels. It has a defined height and a defined and high width counted in pixels. Use of WDR STW EZW wavelet techniques, etc. Each pixel of the color image is square or circular and has a fixed size on a given screen. However, several photos may use pixels of different sizes. Each pixel has a color. The color image is a 32-bit integer. The first eight bits determine the pixel's blush.

***IndexTerms* - Modified circular fuzzy segmentor, Fuzzy logic classifier, Local circular operator, SPIHT, EZW, WDR, CASIA, MMU, UBIRIS.**

INTRODUCTION

A term "biometric" refers to the identification and authentication of an individual identity based on characteristics or characteristics unique to individuals. Biometric systems consist of physiological characteristics and behavioral characteristics. The physiological characteristics are a group of biometric elements that include the physiological and biological characteristics dominated by a biometric system. Specifically it contains DNA, hand, face, ear lobe and iris. The behavioral characteristics are a group of biometric elements related to the non-physiological or non-biological characteristics dominated by a biometric system. It consists of four categories: signature recognition, voice, gear and key sequence To meet the security requirements of today's network company, personal identifiers are increasingly important. Conventional methods used for personal identifiers can be token-based methods or knowledge-based methods. Token-based methods use identification keys or cards for authentication, while knowledge-based methods use a code or password preset by the user. However, conventional methods are not reliable if, for example, the token is lost or the password is forgotten, then; The needs of reliable new methods developed for personal identification become an increasingly important area of research. The iris is one of the most reliable methods to identify individuals because it is fixed and does not change over time. of life. Furthermore, it is impossible to discover that two people have the same characteristics as the iris even for twins. The iris is a circular anatomical structure that is located between the cornea and the lens of the eye, as shown in Figure 1-1. The task of the iris is to control the light that enters through the pupil; This is done through the sphincter and dilator muscles, which regulate pupil size. The average diameter of the iris is between 11.6 mm and 12.0 mm and the pupil size is between 10% and 80% of the iris diameter. The human iris consists of two layers; the epithelial layer made up of cells of intense pigmentation and the stromal layer that contains the blood vessels. It is responsible for reducing the size of the pupil. This layer is located in the upper part of the epithelial layer. Use of WDR STW EZW wavelet techniques, etc. Each pixel of the color image is square or circular and has a fixed size on a given screen. However, several photos may use pixels of different sizes. Each pixel has a color. The color image is a 32-bit integer. The first eight bits determine the pixel's blush.

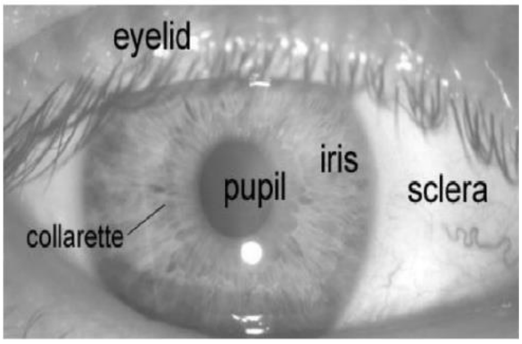


Figure 1-1: A front view of the Human Iris

Iris recognition is a method used to identify people based on unique characteristics within the iris. Furthermore, the iris usually has a gray, blue, brown or green color. The recognition of the iris is considered a form of biometric verification. The first concept of iris recognition was proposed in 1987 by Flom and Safir. They proposed highly controlled and non-functional lighting conditions to change so that pupil size in all images remain the same for proper Iris segmentation. They summarized system based iris recognition subsystems, that is, image acquisition, pre-processing phase, Iris segmentation phase, iris analysis, extraction phase features, which benefit along with appropriate techniques for image processing and pattern recognition. This theoretical work on the Iris recognition system was considered as a basis for all practical approaches to the Iris recognition system. A typical iris recognition system includes six main phases. The first phase, the image acquisition takes place by capturing series of images of the iris with cameras, in order to ensure the acquisition of the best images to increase flexibility and provide a sound recognition. The second stage, image preprocessing, means controlling the size, color and light of the image to be ready for the segmentation phase. The third stage, the segmentation that includes the detection of the limit of the iris and pupil and the temporal layer containing the blood vessels. It is responsible for reducing the size of the pupil. This layer is located in the upper part of the epithelial layer. Iris recognition is a method that is used to identify people based on their unique characteristics within the iris. Furthermore, the iris usually has a gray, blue, brown or green color. The recognition of the iris is considered a form of biometric verification. The first concept of iris recognition was proposed in 1987 by Flom and Safir. They proposed highly controlled and non-functional conditions to change illumination so that pupil size in all images remains the same for adequate Iris segmentation. They summarized system based iris recognition subsystems, that is, image acquisition, pre-processing phase, Iris segmentation phase, iris analysis, extraction phase features, which benefit along with appropriate techniques for image processing and pattern recognition. This theoretical work on the Iris recognition system was considered as a basis for all practical approaches to the Iris recognition system. A typical iris recognition system includes six main phases. The first phase, the image acquisition takes place by capturing series of images of the iris with cameras, in order to ensure the acquisition of the best images to increase flexibility and provide a sound recognition. The second stage, image preprocessing, means controlling the size, color and light of the image to be ready for the segmentation phase. The third stage, the segmentation that includes the detection of the limit of the iris and the pupil, and also detects the eyelids and eyelashes. In the fourth phase, normalization means converting the region of the iris in a similar way to a rectangle. The fifth stage, the extraction of the characteristics, extracts the characteristics of the normalized image of the iris and codifies them to obtain a suitable design for recognition. The last phase of the iris recognition system, classification, means to compare the features created when viewing the iris with the views stored in the database. Figure 1-2 shows the above-mentioned stages.

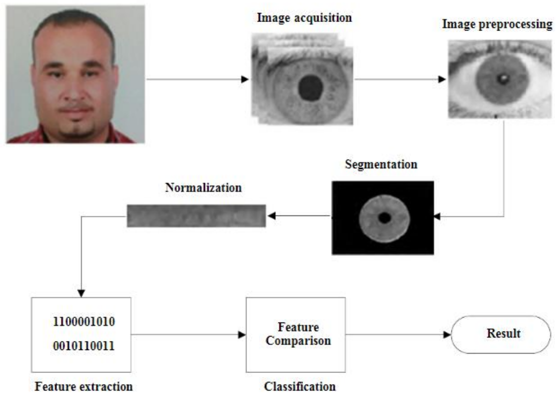


Figure : Typical stages of iris recognition system

Motivation

The iris recognition system has become one of the best authentication systems nowadays thanks to its beneficial uses for many artificial vision applications, such as security systems and visual surveillance. There are many examples that demonstrate the importance of the iris recognition system. For example, fighting crime, increasing terrorist threats and security measures at airports. The iris is considered adequate for the identity of an individual because it has many advantages, as it is therefore an internal organ of the eye; It is a highly protected place, the iris is a visible organ, therefore; remote images. It is possible that Iris is formed in the human in the seventh month of gestation before Christmas, then; considered a fixed feature throughout human life and, last but not least, research has shown that even twins have different iris models, therefore; It is considered better than other biometric applications to define the identity of the individual. The main objective of this thesis is to implement a system able to recognize the models of human iris to be used in biometric identification. Emphasis will be placed on implementing three methods that can perform iris recognition and compare the results obtained with these methods.

Problem Description

The main problem studied in this thesis is the recognition of the iris. Therefore, our main challenge in this thesis is to propose a methodology, design and implementation of the iris recognition system to obtain high precision in the recognition of the human iris using three different approaches. There are many studies that focus on the recognition of the iris using images taken from the eyes of individuals. However, many of the negative results occur due to errors in the image acquisition method, image size, quality, shadows, image background, eye color, as well as contact lenses in the eyes, etc. All these features can lead to an incorrect classification and therefore negative results are obtained.

Topic Outline

This paper presents basic information on biometric technology and biometric applications used in some fields of life. Then there is a general definition of the iris and its position in the eye. Furthermore, some details on the iris recognition system and a historical perspective on this system are provided. In the second chapter, the bibliographic reviews on the recognition of the iris and the results obtained in each study are reviewed and presented. In the third chapter, the main steps of the methodology in this thesis are explained; First, a general description of the databases used in this thesis is provided, so a detailed explanation of the most important phases of iris recognition is provided. These phases are; Finally, a general description of the basic algorithms used to extract the characteristics of the iris, pre-processing, segmentation and normalization is presented. These algorithms are HOG, GLCM and LBP. Furthermore, two SVM and KNN classifiers used to classify the characteristics obtained from the iris are explained in detail. In the fourth chapter the most important results obtained from the experiments and the phases that accompanied the implementation of these experiments are discussed. The last chapter provides a general observation of the results obtained and the important important point observed in this thesis.

Eye Image Dataset

Many eye image datasets can be publically accessed for iris recognition research. In the present study, the proposed method three datasets like CASIA, MMS and UBIRIS.

UBIRIS: The UBIRIS iris image databases consist of three subsets, namely UBIRIS v1.0 Session 1, Session 2 and UBIRIS v2.0 Train, with about 2377 images in total. Initially, under natural lighting and heterogeneous imaging conditions UBRIS database were incarcerated, which contains 10 photographs of each eye. The UBRIS database has two separate versions.

UBIRIS.v1 - In two separate sessions, this edition of the database contains 1877 images gathered from 241 eyes during September 2004. It reproduces less constrained imaging conditions. It is open and free obtainable.

UBIRIS.v2 - The second edition of the UBIRIS database has over 11000 images (and continuously growing) and more practical noise factors. Images were really incarcerated at-a-distance and on-the-move.

MMU: MMU1 iris database contributes a total number of 450 iris images, which were taken using LG IrisAccess®2200. This camera is semi-automated and it operates at the range of 7-25 cm. On the other hand, MMU2 iris database consists of 995 iris images. The iris images are collected using Panasonic BM-ET100US Authentic am and its operating range is even farther with a distance of 47-53 cm away from the user. These iris images are contributed by 100 volunteers with different age and nationality. They come from Asia, Middle East, Africa and Europe. Each of them contributes five iris images for each eye. There are five left eye iris images which are excluded from the database due to cataract disease. Due to some privacy issue, anyone who interests on this database should email a particular name, institution and country to the administrators.

SIMULATION AND RESULTS

Below shown observation table and graphs are very much sufficient to analyze the concept of image compression by different wavelets.

Basically four wavelets are used to compress these images. These wavelets are as follows:

WDR Algorithm (Wavelet difference reduction) SPIHT Algorithm (Set Partitioning in Hierarchical Trees)

EZW Algorithm (Embedded Zero tree Wavelet) STW Algorithm (Spatial time domain wavelet).To compress the images by using different wavelets, matlab tool is used. The MATLAB high-performance language for technical computing integrates computation, visualization, and programming in an easy-to-use environment where problems and solutions are expressed in familiar mathematical notation. Mat lab is a software package that does mathematics and computations, analyze data, develop algorithms, do simulation and modelling, and produce graphical displays and graphical user interfaces. Four images for the compression purposes are as following:

The simulation results of image compression by applying the embedded zero tree Wavelet (EZW), Set Partitioning In Hierarchical Trees (SPIHT), Wavelet Difference Reduction (WDR), Spatial-orientated Tree Wavelet (STW), Partitioning and Adaptively Scanned Wavelet Difference Reduction (ASWDR) algorithms various comparisons are obtained on the basis of PSNR and MSE and compression ratio (CR) values for the particular bit-per-pixel (BPP) ratio. For this purpose, we use the picture of pers. The original image is shown in Fig. and the compressed black and white images are shown in Figs.

Fig. show original black and white image

Original image

1 EZW 2 SPIHT

4WDR 3STW

5ASWR 6SPIHT_3D

Table 1 and 2 show the values of PSNR and MSE for the different algorithms considered in this paper when CR and BP is approximately black and white image consider 1.3 and 0.3 respectively for TABLE 1 and for TABLE1 color image CR and BPP is 2.5 and 0.6 respectively.

Compression CR and BPP Table 1

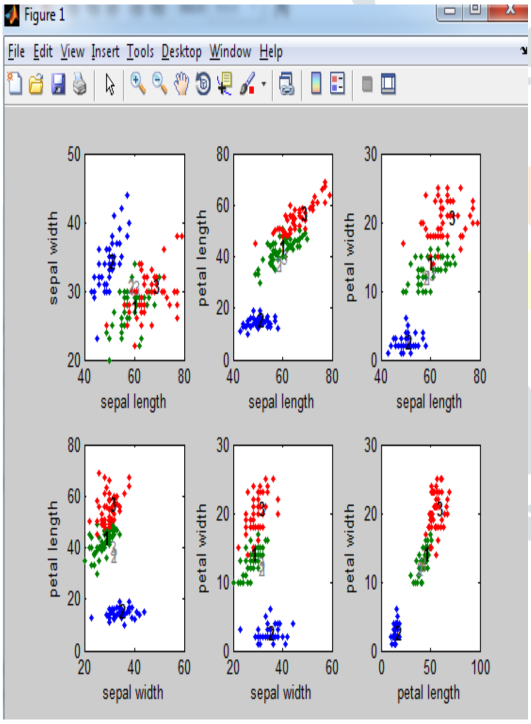
Black and white image	CR=1.3	BPP=0.3
Color image	CR=1.65	BPP=0.45

Compression color image by using proposed method TABLE 2

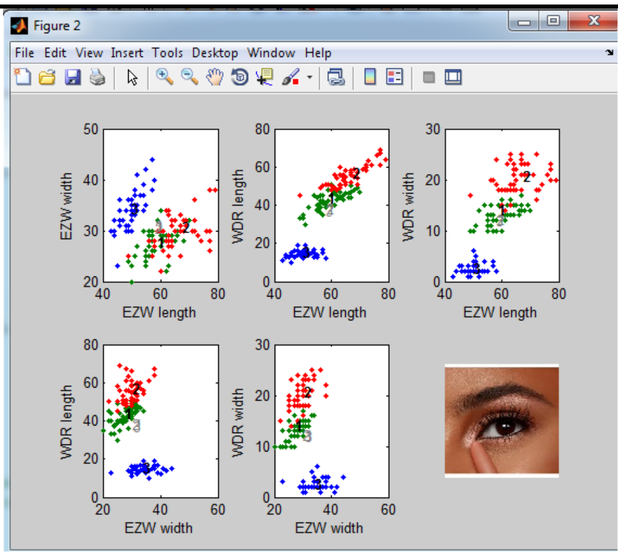
Different Wavelets	MSE(%)	PSNR(db)	CR
EZW	18.1991	35.5303	3.59
SPIHT	11.9975	37.3399	0.88
STW	18.0313	35.5705	3.49
WDR	18.1991	35.5303	3.94
ASWR	19.1991	35.5303	3.88
SPIHT_3D	11.9983	37.3396	4.44

Compression color image by using previous method TABLE 3

Algorithm	MSE(%)	PSNR(db)	CR
EZW	10.1915	38.0484	4.03
SPIHT	6.2820	40.1498	0.96
WDR	10.1915	38.0484	4.47
ASWR	10.1915	38.0484	3.39



In this paper, we have implemented and compared techniques for image compression. These algorithms are Embedded Zerotree Wavelet (EZW), Set Partitioning In Hierarchical Trees (SPIHT), Wavelet Difference Reduction (WDR), Spatial-orientated Tree Wavelet (STW), 3D-Set Partitioning In Hierarchical Trees (3D-SPIHT) and Adaptively Scanned Wavelet Difference Reduction (ASWDR). With the help of these algorithms each image is compressed and then decompressed. For the purpose to compare image quality, we consider MSE and PSNR as quality parameters. MAXLOOP is selected for compression algorithms on the basis of CR and BPP. We select MAXLOOP by keeping two things in mind that we require a low compression ratio and a better result.



We can select less number of MAXLOOP but due to less number of steps we get smaller compression time. On the basis of calculated performance, comparisons amongst the algorithms are carried out. For a specific value of CR and BPP the results of SPIHT technique is best among all these techniques. It has low MSE and high PSNR values. By the help of these algorithms we sustain good reproduction of the images as well as compression and also we can preserve the image quality. In future, many methodological aspects like scale parameters, choice of the mother wavelet, threshold values etc of the wavelet technique will always require further investigations and can lead for enhanced outcome.

It is only conclusively applicable when it is used to compare results from an equivalent codec (or codec type) and same content. It is most simply outlined via the mean squared error (MSE) which for two m × n images I and K wherever one in every of the images is taken into account a noisy approximation of the other is outlined.

$$MSE = \frac{1}{mn}\sum_{i=0}^{m-1}\sum_{j=0}^{n-1}[I(i,j) - K(i,j)]^2$$

$$PSNR = 10.\log_{10}\left(\frac{MAX_I^2}{MSE}\right)$$

$$PSNR = 20.\log_{10}\left(\frac{MAX_I}{\sqrt{MSE}}\right)$$

Here, *MAX*1 is the maximum possible pixel value of the image. When the pixels are represented using 8 bits per sample, this is 255. More generally, when samples are represented using linear PCM with B bits per sample, *MAX*1 is 2B−1. For color images with three RGB values per pixel, the definition of PSNR is the same except the MSE is the sum over all squared value differences divided by image size and by three. For color images the image is transformed to a different color space and PSNR is reported alongside each channel of that color space.

Compression Ratio (CR) and Bit-Per-Pixel (BPP)

Compression Ratio (CR) provide the measure of achieved compression is given by the and the Bit-Per-Pixel (BPP) ratio. BPP CR and represent Bul. equivalent information. CR indicates that the compressed image is stored using CR% of the initial storage size while BPP is the number of bits used to store one pixel of the image. The initial BPP is 8 for a grey scale image. The initial BPP is 24 for a true color image, because 8 bits are used to encode each of the three colors (RGB color space). Confront of compression methods is to find the best compromise between a low compression ratio and a perceptual result.

PEAK SIGNAL TO NOISE RATIO: The higher the PSNR, the better the quality of the compressed, or reconstructed image.

$$\mathbf{PSNR} = \mathbf{10.log_{10}\frac{R^2}{MSE}}$$

Where,

I(x,y) is the original image.

I'(x,y) is the approximated version (which is actually the decompressed image)

M , N are the dimensions of the images. (M=Width, N=height)

ANALYSIS: As shown in the above drawn comparison chart the PSNR value for the image-II by using wavelet difference reduction (WDR) is larger), so the chance of error is lesser. While, the PSNR value for the image-IV by using spatial time domain wavelet (STW) is lesser, so the chance of error is higher.

COMPARATIVE ANALYSIS OF MEAN SQUARE ERROR FOR WITH RESPECT TO WAVELETS VS IMAGES

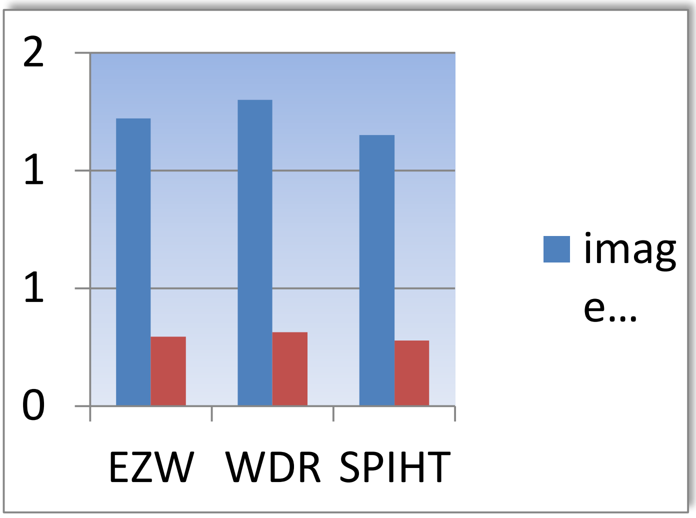


Figure Comparative chart for Mean Square Error

MEAN SQUARE ERRROR:
The lower the value of MSE, the lower is the error.

$$\mathbf{MSE} = \frac{\mathbf{1}}{\mathbf{MN}} \sum_{Y=1}^{M} . \sum_{x=1}^{N} [\mathbf{I}(\mathbf{x}, \mathbf{y}) - \mathbf{I}'(\mathbf{x}, \mathbf{y})]^2$$

Where, R is the maximum fluctuation in the input image data type. For example, if the input image has a double-precision floating-point data type, then R is 1. If it has an 8-bit unsigned integer data type, R is 255, etc.
ANALYSIS: As shown in the above drawn comparison chart the MSE value for the image-II by using wavelet difference reduction (WDR) is lesser , so the chance of error is lesser. While, the MSE value for the image-IV by using spatial time domain wavelet (STW) is larger , so the chance of error is higher.

COMPARATIVE ANALYSIS OF BITS PER PIXEL WITH RESPECT TO WAVELETS VS IMAGES

BITS PER PIXELS: The Bit-Per Pixel ratio BPP, which gives the number of bits required to store one pixel of the image.
Better the value of Bits Per Pixels, so better will be the image quality. For achieving low compression ratio, no. of bits per pixels should be less.

ANALYSIS: As shown in the above drawn comparison chart the BPP value for the image-II by using spatial time domain wavelet (STW) is lesser (0.3022), so the quality of image is bad. While, the BPP value for the image-IV by using wavelet difference reduction (WDR) is larger so the quality of image is good.

- **COMPRESSION RATIO:** The following formula is used to find the value of Compression Ratio:

$$\mathbf{CR} = \frac{\mathbf{ORIGINAL\ DATA}}{\mathbf{COMPRESSED\ DATA}}$$

Or,

$$\mathbf{CR} = \frac{\mathbf{ACTUAL\ BPP}}{\mathbf{REDUCED\ BPP}}$$

ANALYSIS: As shown in the above drawn comparison chart the CR value for the image-I by using spatial time domain wavelet (STW) is lesser, so the image will take less space for storage. While, the CR value for the image-IV by using wavelet difference reduction (WDR) is larger, so the image will take larger space for storage.

CONCULUSION

In this report, the results of four different wavelet-based image compression techniques are compared. The effects of different values like PSNR, MSE, BPP & CR are examined. The results of the different wavelet like EZW, WDR, SPIHT & STW are compared by using four parameters such as PSNR, MSE, BPP & CR values from the reconstructed image. These compression algorithms provide a better performance in picture quality at low bit rates. These techniques are successfully tested in many images. WDR technique provides high PSNR and low MSE values when compared to the EZW, STW & SPIHT technique.

FUTURE SCOPE

The image compression by using wavelet plays a vital role in today's era. Wavelet is basically a child of today's digital era. In this, report we studied about different wavelets EZW, WDR, STW & SPIHT for finding the parameters like PSNR, MSE, BPP & CR. By the inspection, we find that image compression technique plays a vital role for finding highest PSNR & lowest MSE by sacrificing the values of parameters like BPP & CR up to some extent to which it is acceptable. One of the most recent image compression algorithms is the Adaptively Scanned Wavelet Difference Reduction (ASWDR) algorithm. The adjective adaptively scanned refers to the fact that this algorithm modifies the scanning order used by WDR in order to achieve better performance not only in terms of PSNR & MSE while also in terms of BPP & CR. The Arithmetic coding with WDR algorithm will be added in the future.

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