AN EFFICIENT IRIS RECOGNITION SYSTEM

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ABSTRACT
The human iris, an annular part between the pupil and the white sclera is emerging as a highly reliable biometric trait for personal identification. Although the area of the iris is small it has enormous pattern variability which makes it unique for every person and hence leads to high reliability. Modern cameras that are used for acquiring iris are less intrusive compared to earlier iris scanning devices and public awareness of system reliability and difficulty to circumvent is developing. An iris has a mesh like texture to it, with numerous overlays and patterns. Basically, iris recognition system comprises of four main modules: Image Acquisition, Preprocessing, Feature Extraction and Pattern Matching. Firstly an image containing the users eye is captured by the system. Then the image is preprocessed. Thirdly, features representing the iris patterns are extracted. Finally, decision is made by means of matching.

1. INTRODUCTION

With communications among people constantly increasing nowadays, how to recognize people’s identity has become an essential problem. The traditional methods such as keys, certificates, passwords, etc, can hardly meet the requirements of identity recognition in the modern society. Biometrics, which means biological features based identity recognition, has provided a convenient and reliable solution to this problem. Iris based identity recognition is one of the most important parts of biometrics due to its various advantages, such as preciseness and no need of direct contact with the testees. According to some comparative research, the error rate of iris recognition is the lowest one among all the biometrics approaches till date. Iris recognition technology was designed to be less intrusive than retina scans, which often require infrared rays or bright light to get an accurate reading. Scientists also say a person’s retina can change with age, while an iris remains intact. And no two blueprints are mathematically alike, even between identical twins and triplets. During the course of examining large number of files, anatomists and ophthalmologists have noted that the detained pattern of an iris, even the left and the right iris of a single person, seem to be highly distinctive.

2. IMPLEMENTATION

2.1 Image Acquisition

Image acquisition is most important step in iris recognition because all further steps depends upon this step. For image acquisition we used CCD camera. To acquire more clear images through a CCD camera and minimize the effect of the reflected lights caused by the surrounding illumination, we arrange two halogen lamps as the surrounding lights, as the figure illustrates. The size of the image acquired under this circumstance is 320 x 240.

2.2 Image Manipulation

In this stage image is transformed in to RGB to gray level and from eight bit to double precision to help in the manipulation of image is subsequent step.

2.3 Iris localization

In this step, we should determine an iris part of the image by localizing the position of the image derived from inside the limbus (outer boundary) and outside the pupil (inner boundary), and finally convert the iris part into a suitable representation. Because there is some obvious difference in the intensity around each boundary, an edge detection method is easily applied to acquire the edge information. It is used to find complex object boundaries by marking potential edge points corresponding to places in an image where rapid change in brightness occurs. After edge points have been marked, they can be merged to lines. Edge detection operators are based on idea that edge information in an image is found by looking at the relationship of a pixel with its neighbors. In other words,
edge is defined by discontinuity in gray values. An edge separates two distinct objects.

Figure.2 Iris isolated image

2.4 Feature Extraction

The process used for the feature extraction is to extract the relevant pixel values from the iris image using the Fast Fourier Transform (FFT). Before seeing something about FFT, let us see what Fourier Transform is:

In many signal-processing applications, the important features of signals are mostly interpreted in the frequency domain. The main analytic tool for the frequency domain properties of discrete time signals and the frequency domain behavior of discrete time system is the Fourier Transform. We extract these features by extracting a buffer of 256 pixel values. Once this buffer is extracted, we find the FFT (Fast Fourier Transform) of the extracted buffer. The modules value of FFT is stored as an array in the database and this is used for matching a test image with one’s available in database. Also the phase is calculated and is stored in other array.

2.5 Mapping

The pattern matching process may be decomposed into four parts:

1. Bringing the newly acquired iris pattern into spatial alignment with a candidate database entry.
2. Choosing a representation of the aligned iris pattern that makes their distinctive pattern apparent.
3. Evaluating the goodness of a match between the newly acquired and database representation.
4. Deciding if the newly acquired data and the database entry were derived from the same iris based on the goodness of the match.

The comparison between a new “test” iris code and database of existing codes is performed in the following manner:

The exclusive-OR function is taken for each difference between the two codes. Bit #1 from the reference iris code code record, bit #2 from the presented iris code record is compared to bit #2 from the reference iris code record, and so on. If two bits are alike, the system assigns a value of zero to that pair comparison. If the two bits are different, the system assigns a value of one to that pair comparison. After all pairs are compared, the total number of bit-pair divides the number of disagreeing bit-pairs. This value is termed as “Hamming Distance”. A Hamming Distance of 0.10 means that two iris code records differed by 10%.

At Hamming Distance (0.342), the probability of a False Reject is approximately the same as the probability of a False Accept. When two iris code differ more than 34.2% of their bits, they are considered to be different, if fewer than 34.2% of their bits difference they are considered to be from identical irises.

Euclidian Distance $= \sqrt{\sum (A_i - B_i)^2}$

Where, $A_i =$ Absolute FFT element of test image.
$B_i =$ Absolute FFT elements of image from database.

The minimum Euclidian distance corresponds to the image in the database, which matches most closely, with the image. A very high threshold level for Euclidian distance is set so as to accept the image in database as the correctly matched image with high authencity. The Euclidian distance above which the image is declared as rejected is said to be 0.005, whereas the typical Euclidian distance for other images are of the order of $10^3$ and $10^4$.

3. RESULT

A number of experiments were performed to show the effectiveness of the developed algorithm, using Pentium IV 2.8 GHz processor. A total of 20 different eyes (i.e. different iris classes) were tested and for each iris seven images were used. This makes up a total of 140 experiments. The correct recognition rate of this system is 95.28%.

![Figure.3 Number of training images Vs failure rate](image)

4. CONCLUSION

We have successfully developed a new iris recognition system capable of comprising two digital images. This identification system is simple requiring few component and effective enough to be integrated within security system. The errors that
occurred can be easily overcome by the use of stable equipment. Judging by the clear distinctiveness of the iris patterns we can expect iris recognition systems to become the leading technology in identity verification.

5. REFERENCES


