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Iris Recognition System for Secure Authentication

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Abstract
Image Processing is a biometric based personal Identification technique in which Impersonation is most dangerous security threat. Different biometric systems are developed on face, voice and Hand geometry recognition with an effective method for automatic recognition of a person's identity with a high efficiency. The aim of this paper is to provide a platform independent access to Iris recognition using different technologies present today. In this System IRIS recognition of an individual using Hough transform technique to determine radius of iris and pupil and comparing it by using mathematical equivalent ratios which can be implemented in java and compare it with stored image in database to authenticate an individuals.
Keywords:Biometric, Equivalent ratio, Hough Transform, Image Processing, IRIS recognition

1. Introduction

Biometric Systems provide an automatic recognition based on different unique features or characteristics. Various biometric systems are developed on fingerprints, facial features, voice, Hand geometry, Handwriting, the retina and the one presented in this paper, the IRIS. Iris has over 100 million users from more than 170 countries and counting. The number of people in India who have had their iris patterns enrolled by Iris Code is about more than 103 million [1]. The Unique Identification Authority of India is enrolling about one million persons each day and they plan to have the entire Population enrolled within upcoming years [1]. Today, IRIS recognition is important factor because in face recognition, difficulties arise from the fact that the face is a changeable social organ. Face displaying a wide variety of expressions, Image varies with viewing angle, pose, illumination, accoutrements, and age. It has been proved that, for mug shot images taken one year apart, even the best current algorithms can have error rates of 43–50 percent [2].The fast growth in the use of an applications and the great concern of security require automatic personal identification. Traditional automatic personal identification schemes can be divided into two categories: knowledge-based and token-based such as password [3],[4].However, these approaches have some limitations. In the token-based approach, the "token" can be easily stolen or lost. In the knowledge-based approach, the "knowledge" can be guessed, shared or forgotten. The iris recognition is the most reliable among all biometric methods because the probability of finding two people with identical iris pattern is almost zero [5]. Image processing technique can be used to extract the unique iris pattern from image of eye, and encode it into a biometric template, which can be stored in a database. The biometric templates contain mathematical representation of the unique information stored in iris and allow comparison to be made between templates. When we wish to identify an iris then eye

is first photographed, and a template created for iris region. This template is compared with the other image stored in database until either matching template is identified or not identified. Hence this biometric feature can be used for securing the data which need to be kept secret always.

2. Literature Survey

Iris Recognition is the process of recognizing a person on basis of iris image. It is known fact that recognition is an image dependent feature that enables us to recognize person identity. During the year ahead, retinal scans and fingerprints are more reliable means of identification. Unlike other forms of recognition techniques, such as passwords or keys, a person's iris cannot be stolen, forgotten or lost. Few years ago the French ophthalmologist Alphonse Bertillon seems to be the first who proposed the concept of purpose of iris for individual identification [5]. In 1981, the iris can be used in biometrics is suggested by San Francisco ophthalmologist Aran Safir and flom. After few years they collaborating with the computer scientist John Daugman of Cambridge University, London. The John Daugman is the first who developed the algorithm on iris recognition and also the first person who patent algorithm and publish the paper on iris recognition. With tremendous improvement over the year this algorithm is the basic algorithm for all iris recognition algorithms. With rapidly growing technologies today we have various high resolution hardware device which are capable to reduce the overhead in image processing. In early years of this century, the iris recognition systems are deployed at airport systems to authenticate person without wasting time on passport authentication.

3. Proposed Approach

On the basis of previous work on iris recognition it led us to do a few possible improvements in iris recognition technique. For justification of these we implemented new concept for iris recognition in Java.The basic flow used is as follows,

- Getting a source or an image from external device.
- Grayscale conversion of an image.
- Finding an iris and pupil area.
- Comparison of radius of an image with stored image in database to get the result.
- Finally, Store the result into database.

The flow can be easily understood by the fig.1 as follows,

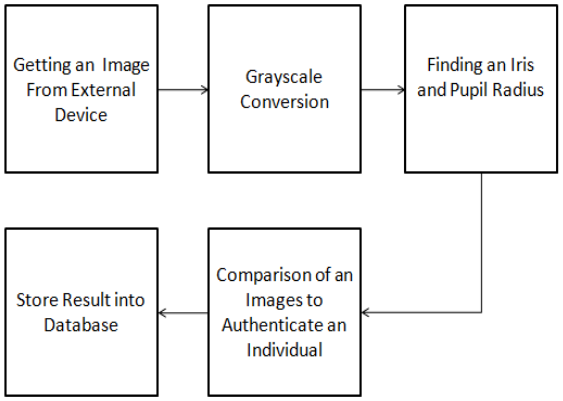

Figure1: IRIS Recognition Process

3.1 Getting image from external source

In image processing getting an image from external device is the major challenge. If we don't have image then we cannot be able to perform further process on image. It is the first stage in image processing module. In image processing terms it is also known as image acquisition. While performing image acquisition we have to focus on its environment or the hardware device by which we are going to captured image. It is important, because if an image is taken from any other hardware device having resolution higher compared to other device then at this stage it makes lot of difference in pixels or resolution that is the reason why we have to do lot of work to compare images, then by performing image acquisition we get the image which is used for further processing. After getting image we convert image into grayscale format to make further process easier, at last stage the image will be in same format as shown in fig.2.

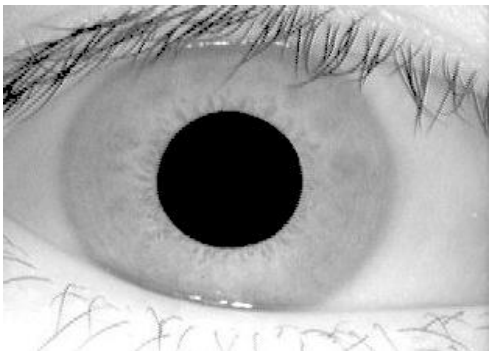

Figure 2: Image to be processed

3.2 Iris and Pupil Radius Detection

The object determination is an important factor in image processing because there are many different techniques are available to detect radius or any other shapes from an image, but many methods are not that accurate to determine shapes because they need images according to different environments. If the image is not of suitable environment then we are not able to determine the shape of image easily and we have to do different changes to parameters to get radius. Therefore it is an important to detect radius with highest accuracy. The Hough transform is a technique which can be used to detect a particular shape within an image. There are two different types of Hough transform are there, classical Hough transform and generalized Hough transform.The classical Hough transform is most commonly used for the detection of regular curves such as lines, circles, ellipses. A generalized Hough transform can be used where a simple analytic description of a feature is not possible. The advantage of the Hough transform technique is that it isrelatively unaffected by image noise. The Hough transform in case to detect circle is calculated by formula as given below,

$$(a - c1)^2 + (b - c2)^2 = r^2 \quad (1)$$

Where, in (1) c1 and c2 are the coordinates of the center of the circle and r is the radius. Also (a, b) are arbitrary points on plan or edge points which detects circle by following the pixels.

The process of identifying circular objects in Hough space is as follows,

- First we createan accumulator space for each pixel which is made up of cells, here in (1) c1 and c2 are cells and set each cell to 0.
- For each edge point (a, b) in image Increment all cells according to the (1) because that could be the center of a circle and these cells are represented by c1.
- For each value of cell c1 find all possible values of cell c2 which satisfy the equation.
- After getting cells values we search for the local maxima cells, these it means this cells have their value greater compared to other cells. These are the cells having the highest probability of being center of circle.

As shown in fig.3, the pupil area is surrounded by the circle with the center point which is determined by using Hough transform technique as explained above, by changing the parameters we can also determine the radius of iris circle.

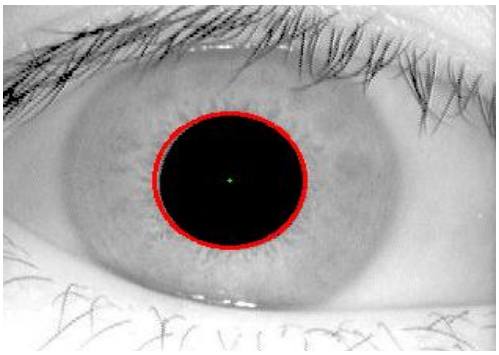

Figure 3: Pupil radius Detection

3.3 Iris and Pupil Matching

Image matching is an important aspect in image processing, including object recognition. It is the phase in which actual comparison of measurements of iris and pupil's stored data with the image to be authenticate using different techniques is calculated to get authentication result. Theapproach that we have implemented is related with the concept of Equivalent Ratios. In current approach we don't have to use different methods to make image ready for comparison we just have to crop or cut image from top and bottom. To make comparison more robust there are some assumptions that we have to follow to use the concept of equivalent ratios. The assumption are as given below,

- The iris image must be taken by high resolution hardware device to avoid mismatch.
- Both images should have same environment that means they should be captured by same hardware device.
- Iris image must be cropped or cut according to the size of iris circle from the top and bottom of image.

Once we get the input image according to above assumptions then by using Hough transform we get radius of iris and pupil from image.

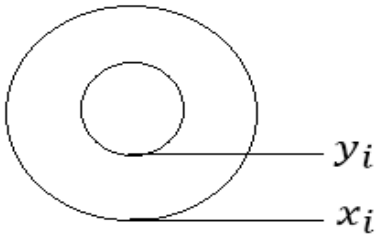

Figure 4: stored iris and pupil radiuses

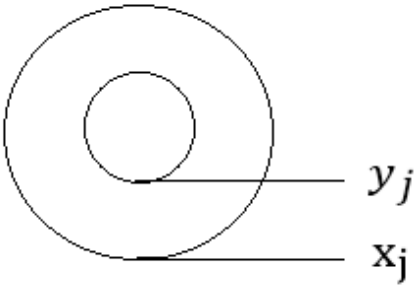

Figure 5: radiuses of iris and pupil to compare

Let us consider x_i, x_j and y_i, y_j be the radiuses of iris and pupil circles as shown in fig.4 and fig.5. Here the fig.4 shows the stored image of iris measurements and fig.5 is the measurements of iris image which is to be compare for authentication purpose. As you can see the size of fig.4 and fig.5 is not same, now as the size is not same we cannot directly compare the measurements of both image. That is the reason why we are comparing them by using the concept of equivalent ratios. Once we get radiuses of circles then we compare images by (2) as given below,

$$\frac{x_i}{y_i} \cong \frac{x_j}{y_j} \qquad (2)$$

Here in (2) x_i, x_j are the radiuses of iris that is the outer circle and y_i, y_j are radiuses of pupil that is the inner circle as shown in fig.4 and fig.5. According to (2) we get ratio of each iris image by using mathematical division then according to concept of equivalent ratios the two ratios are said to be equivalent if the ratios are identical after division. But here situation is different as images are not captured or taken similar every time that is the reason why we are comparing the approximate result of ratios. According to our research it is found that if image is taken from same environment then the diameter of pupil circle is approximately equal every time compared to another image that is the reason why image must be taken in same environment.

4. Conclusion

The importance of iris authentication system with the help of new approach is very high. A totally new business model can be developed with the help of current approach. The current system has been developed with the help of Java programming language and someMathematical operations, it is performing according to our expectations butthere are some limitations such as blur and dynamically taken images

that make it impossible to achieve required view to compare images, therefore we need images having same environment or images those are taken from same biometric device.

The advantage of current system is its platform independency which make it capable to do work on any platform or it can be made portable using advanced technologies present today.

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