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NOVEL TECHNIQUE FOR IRIS DETECTION IN IMAGE PROCESSING

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Abstract

An automated method utilized for biometric identification which includes various mathematical pattern-recognition methods in it is known as the iris recognition method. The videos of the irises of various individual's eyes are studied in this technique. The complex random patterns present within this approach are single, constant moreover can as well viewed from a particular distance. In the base paper, Circular-Hough Transformation is applied with canny edge detection. The GLCM algorithm is applied which will extract the contrast, energy, entropy and heterogeneity of the detected iris has been calculated. To increase the accuracy of iris detection and reduce execution time, improvement in existing GLCM algorithm, feature extraction technique is being proposed. The proposed improvement will be based on applying structural tensor algorithm and improved GLCM for contrast detection.

Keywords: *GLCM Algorithm, Structure Tenser Algorithm, Textural features.*

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1. INTRODUCTION

Image processing is known as the enhancement of raw images assembled from everyday lives that are gathered from any sort of sources like satellites, cameras, web, and so forth such information can be helpful either for logical results or for the criminal examinations. As seen from daily lives, images today are being utilized for sending and accepting data. The images are received from web, satellites, cameras, and numerous other developed innovations. The images that are accessible with some data in them are thought to be as raw images. These images have in them much helpful data, which can be utilized for examination purposes. There is a ton of deception and duplicating of unique information and utilizing for individual issues furthermore to destroy others protection. The classification or structural description of the images is the prior objective of the image recognition mechanism [1]. There is feature detection with property estimation within image classification mechanism. Further, segmentation and relational structure extraction are involved within image description mechanism. However, the cost of this process is very high to minimize which; various techniques have been developed [2]. A complex issue within the image processing mechanism is automatic face detection. In order to solve the issues arising within this method, numerous methods have been presented with time. On the basis of each strategy the successful results need to be achieved which might then result in changing the degrees of results as well as the levels of complexities of these systems. The public acceptance is gained to the iris biometric. Body structure, inherent weakness, and levels of health and transition are uncovered by the iris, as it changes happen in the one's body as the way they live the life. The eyes are the window of the spirit as said in the past and they are the foremost part of our body which is very necessary of view the beauty of the nature [3]. Therefore, it is key window to one's health. Distinguish between the two iris part is difficult to distinguish as similar in the fingerprint and faces. The breaking down of the weak structures of the iris of the eye is known as Iridology that is the branch of the science. Iridology is used for the investigation of the iris for a medical purpose. Fibers and pigmentation are present in the iris that reflect our physical and psychosomatic makeup. while the condition of the organ or body system in the poor condition, the moving of the spirit operation starting that body part go in vain. Different degree of the layer of fiber are extracted when this procedure is follow as the shade of the iris of the eyes is done by this and leave behind the dark marks called as lesions [4]. Biometric Identification technique is the key objective of the iris as it is one of unique identifier of Human and provides the stability throughout the life of the person. Unique patterns are identified with the help of ocular-based biometric technique within the retinal scanning method. The patterns of retina blood vessels of each person are unique and thus can be used for studying the identity of an individual. The video camera technique is used along with unobtrusive close infrared illumination method [5]. The determination of probability of each of the possible categories, the performance of classification is impossible to be judged [6]. A mostly domain-autonomous theory of cataloging is presented with the help of abstraction which is given by the feature-vector illustration to the input data.

2. IRIS RECOGNITION

In the recent years the occurrence of the iris biometric increases comprehensively. The Processing, encoding Iris texture, and designing iris-based recognition systems are the issues that attract the attention of the many researchers. The public acceptance is gained by the iris biometric. The breaking down of the weak structures of the iris of the eye is known as the Iridology that is the branch of the science.

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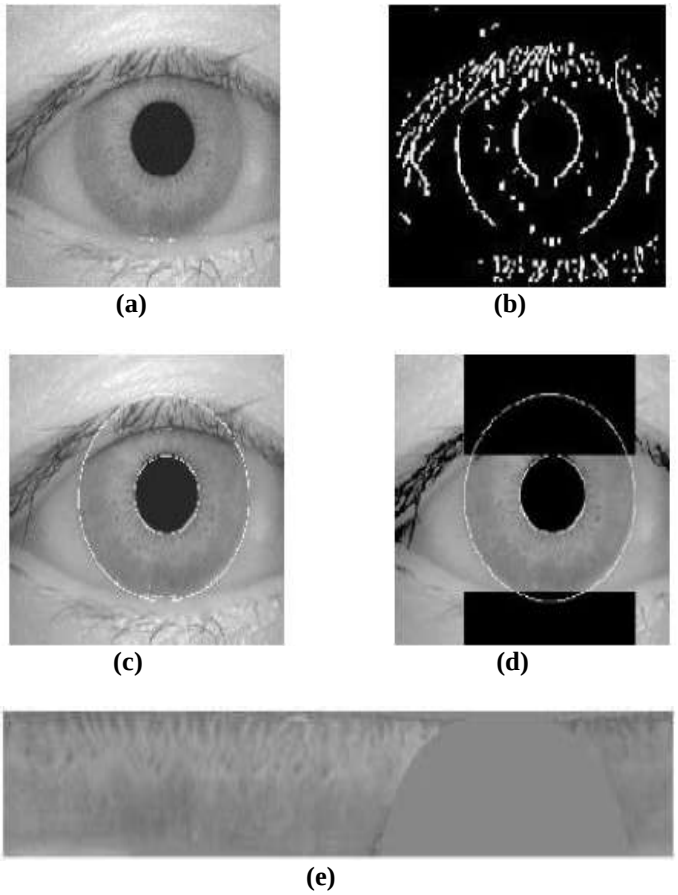

Fig 1: The result for iris recognition on an eye image. (a) Eye Image (b) Edge Detection (c) Inner and outer boundaries of iris region (d) Eyelid and eyelashes removal (e) Iris Normalization

Biometric Identification technique is the key objective of the iris as it is one of unique identifier of Human and provides the stability throughout the life of the person. For image processing technique, edge detection is the essential module [11].

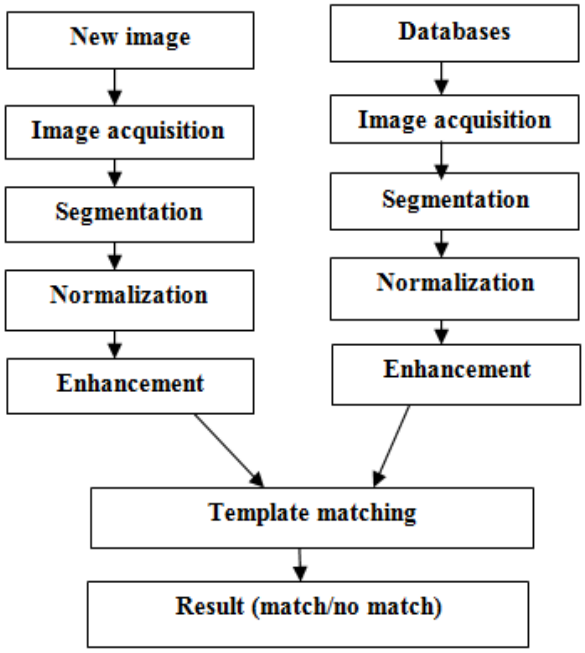

Fig 2: Processing steps

Biometric iris detection system must provide a reliable and private recognition scheme to either verify or decide the identity of a person [12]. Iris is located between the pupil and the sclera and the main role of this is to manage the quantity of the light that incoming throughout the pupil. The extremely randomized look of the iris make its use as a biometric healthy recognized. Its appropriateness as an exceptionally accurate biometric derives from:

i. It becomes difficult to fraud and use the identity of other person.

ii. It protect from the external environment as it is intrinsic isolation.

iii. The physical structure of the data is rich in nature.

iv. According to its genetic property, no two eyes are identical in nature. The pigmentation of the iris is the feature that is needy on genetics. These processes determine the color and the gross anatomy. The detailed morphology is determined by the details of development as they are unique in nature.

v. A natural test against artifice is provided by the stability over time, physiological response to light and the unfeasibility of surgically modify it without undesirable risk to vision. Here the general, the iris recognition system is composed of the follow five steps. According to this flow chart, preprocessing includes image enhancement.

2.1 Image Acquisition

There are several points that need to taken into consideration. This is necessary to image of the iris with satisfactory decision and roughness in order to maintain recognition. The high-quality contrast in the internal iris pattern is important with no resorting to the point of clarification as it annoy the operator so that comfort brightness is provided by the operator for the adequate

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intensity of source [14]. CASIA database has been utilized for further implementation. The main objective of the CASIA database is to diminish the requirement of user cooperation.

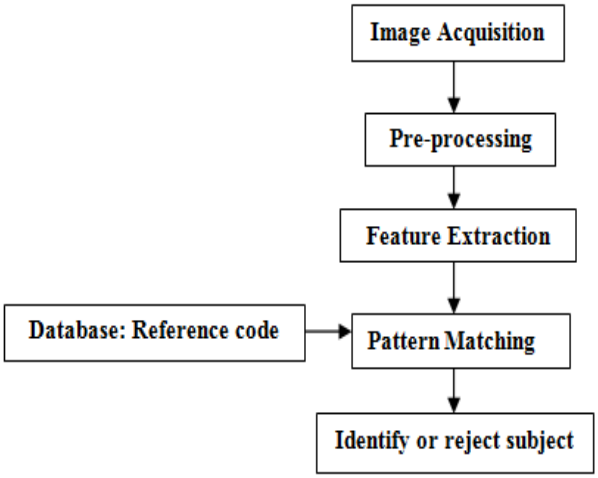

Fig 3: General steps of Iris Recognition

2.2 Pre-Processing

Algorithm for Detection and Segmentation

Iris Detection: while the images have obstruction, visual noise and singular levels of illumination, still in this condition iris can be detected. It eliminates the lighting reflections, eyelids and eyelashes obstruction [15]. It also accepts the images with tapering eyelids or eyes that are gaze away with the help of wavelet algorithm. The improvement results in the maximum quality of iris features template from moving iris image and is known as automatic interlacing detection and correction.

Correct Iris Segmentation: Under given conditions this process is achieved. VeriEye uses active shape models in the perfect circle fail as it accurately model the contour of the eye as the iris borders are not model by these perfect circles. There is difference between the internal and external boundaries in the centre of the iris. The iris internal boundary and its middle are marked in red and the color of the external boundary and its middle in the iris is marked as green. [16]

Locating Iris: The first handing out step consists in locating the internal and external boundaries of the iris and second step to normalized the iris and third step to enhance the original image.

2.3 Pattern Matching

The pattern matching the binary code scheme has been utilized widely. It is the scheme in which it is necessary to characterize the obtain vector in the binary code as the difference between two binary code-words is easier to identify as compared to between two number vectors. The manipulation and compression between the Boolean vectors are always easier. Some of its characteristics are firstly observer in order to code the feature vector. All the obtained vectors have the greatest value that is greater than 0 and a smallest value that is less than 0 in the binary coding scheme.

2.4 Identification and Verification

The two main goal of each safety system is the Identification and verification of every individual as it is required for the present environment in order to minimize the fraud cases. The user data is checked by the system in the verification stage in order to identify that entered data is right or not such as username id or password [17]. In this recognition stage, the system is try to find out who are the subject is without any input in sequence. Therefore, one-to one search is known as verification and one-to-many comparison is called as identification.

3. IRIS RECOGNITION FOR BIOMETRIC IDENTIFICATION PROCESS

For biometric identification process, an automated system is presented which is known as iris recognition method. Here, the mathematical patter-recognition methods are imposed on the video images where the irises can be identified for an individual person's eye. With the help of this method, the irises of individuals can be identified and can be converted as unique, stable and can be identified from some distance. Unique patterns are identified with the help of ocular-based biometric technique within the retinal scanning method. The identity of the individual or someone pretending to the individual can be identified with the help of digital templates which are encoded from these patterns with the help of mathematical and statistical algorithms. With the help of matcher engines, the databases of the templates that are stored within the systems are analyzed to help in identifying the patterns which are generated from the images or videos studied [18]. In recent years, there is a growth in the iris biometric applications. Due to increase in issues in pre-processing, the iris texture encoding and designing of the iris-based recognition methods are growing in demand. Eyes are a very important part in the human's body as they are known as the window to the spirit of a human. It is very easy to distinguish the irises of two individuals. With such level of uniqueness of irises, it is not possible that two irises meet with each other [19]. Thus, in order to provide such biometric identification systems, the iris detection biometric systems are presented which help in providing secure environments in certain applications.

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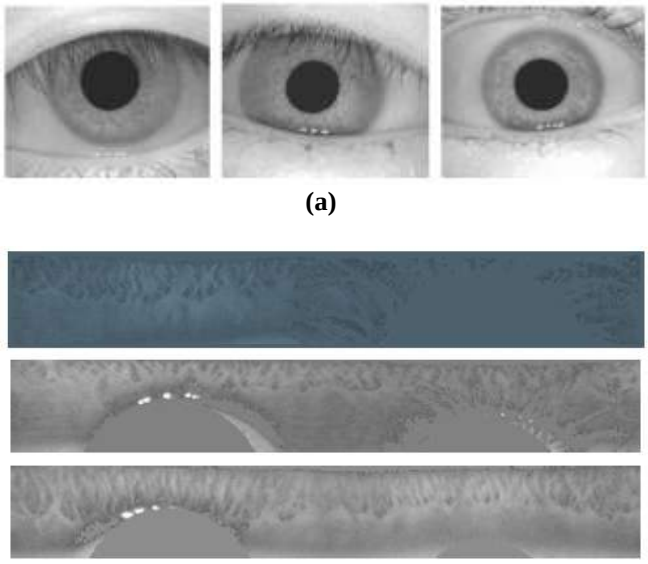

(a)

(b)

Fig 4: (a) Three original eye images (b) Three corresponding Normalized iris images

4. RESEARCH METHODOLOGY

The iris detection is the technique which is applied to detect the iris part from the original eye image. The iris detection consists of following steps:-

1. Input image:- In the first phase, the image is given as input from which the iris need to be detected and apply technique of bilateral filter to remove noise from the input image.

2. Iris Localization:- The Iris localization is the technique which detects the boundary of the iris part from the eye. In the base paper, the canny edge detector technique is applied with the circular Hough transformation for the iris detection. In the proposed, the canny edge detector technique is applied which will mark the boundary of the eyes. The structural tensor technique is applied with canny edge detector the mark the portion of iris. The structural tensor is the distance based algorithm which will calculate the distance from the outer boundary and mark the whole iris from the eye image

3. Normalization and feature extraction:- In the last phase of the process the normalization is applied on the detected iris portion. To detect the textural features of the iris portion technique of GLCM is applied in the base paper which detects contrast, homogeneity, energy and entropy of the image. In the proposed technique improvement in the existing algorithm is done by applying formula mentioned in the algorithm phase which increase contrast level of the detect image.

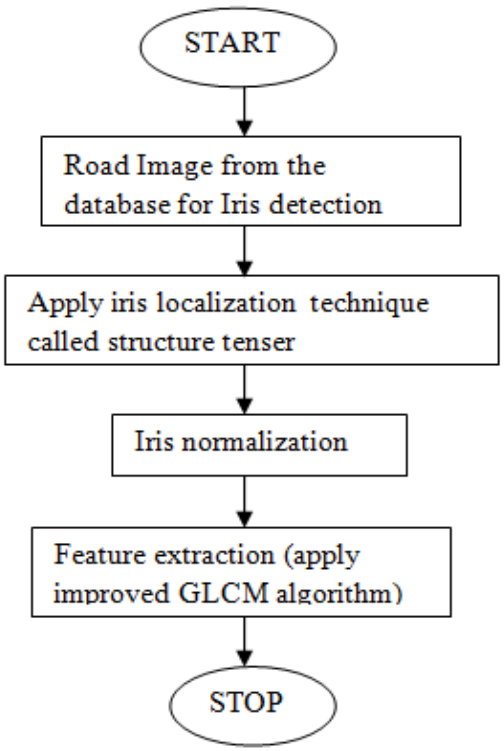

Fig 5: Steps of Iris Detection

5. EXPERIMENTAL RESULTS

The proposed technique has been implemented in MATLAB and results are presented below.

```
glcms =

  Columns 1 through 7

    76038    52    35    71    48    14     2
       47     6     2     1     2     0     0
       33     0     1     1     3     0     0
       74     0     1    13     8     1     0
       51     0     0     8    11     5     0
       15     0     0     2     3     1     0
        0     0     0     1     1     0     0
        4     0     0     0     0     0     0

  Column 8

        2
        0
        1
        0
        1
        0
        0
        1
```

Fig 6: Texture feature analysis with GLCM

As shown in figure 6, the GLCM algorithm is been applied which will extract the textural features of the input image. The GLCM algorithm will make the co-occurrence matrix of the input image from where the energy, entropy, and heterogeneity will be calculated.

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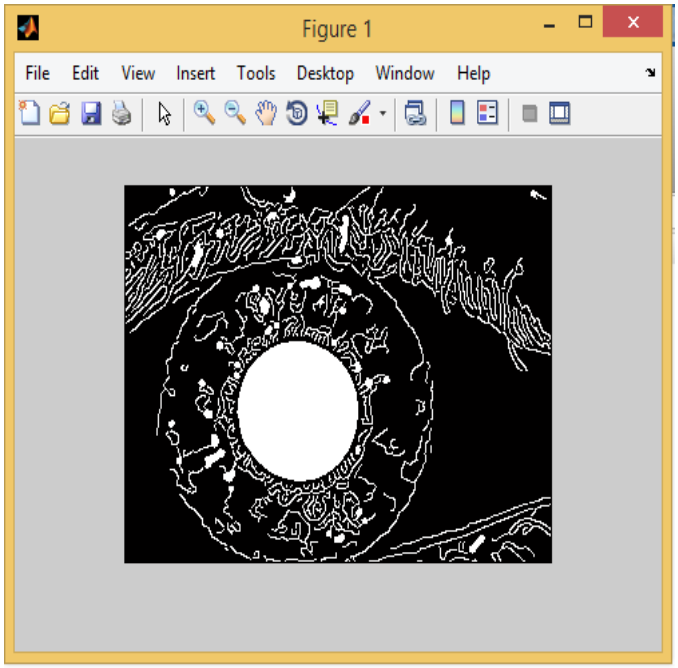

Fig 7: Iris Localization

As shown in figure 7, the technique of structural tensor is applied which will localize the iris from the image. The structure tensor algorithm will mark the boundaries of the iris for the localization.

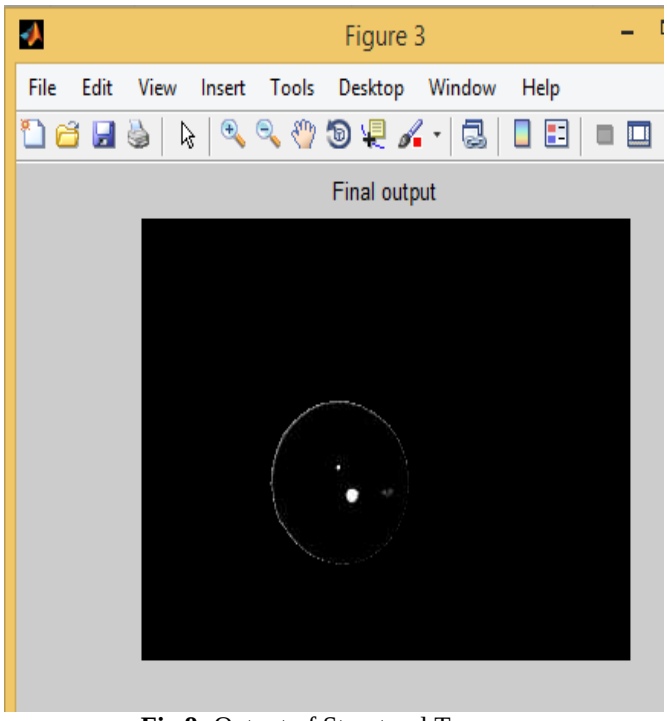

Fig 8: Output of Structural Tensor

As shown in figure 8, the algorithm of structural tensor is applied which will mark the boundaries of the iris. The technique will calculate the distance and mark the whole iris part from the image.

6. PROPOSED ALGORITHM

6.1 The Structure Tenser Algorithm

1. Apply circular filter sequential technique to detect boundary of pupil.
2. Calculate centroid of the detected boundary, i.e.

[i,j] = Central of [x,y]

3. Calculate magnitude of the area under the pupil.
4. Calculate the circular boundary.

6.2 GLCM Algorithm

1. In first step we count all the number of pixels in the matrix in which the records is stored.
2. In next step store the counted pixels in matrix P[I,j].
3. After that check the similarity between pixels in the matrix by apply histogram technique.
4. To calculate contrast factor from the matrix:

$$g = \exp[\frac{mean(I) - minimum(I)}{maximum(I) - mean(I)}]$$

5. The elements of g needs to be normalized by dividing the pixels.

$$g = \begin{bmatrix} 0.8\ if\ g < 0.8 \\ 1.2\ if\ g > 1.2 \\ g\ otherwise \end{bmatrix}$$

MSE: The formula for mean square error is

$$MSE = \frac{1}{n}\sum_{i-1}^{n} (\hat{X}_I - X_I)^2$$

FAR:

$$FAR = \frac{impostor\ scores\ exceeding\ threshold}{all\ impostor\ scores}$$

FRR:

$$FRR = \frac{genuine\ scores\ falling\ below\ threshold}{all\ genuine\ scores}$$

7. CONCLUSION

In this work, it has been completed that iris detection consists of two phases. In the first phase the iris boundary is detected and in the second phase features of the detected iris is extracted. In the base paper, the Circular-Hough transformation is applied with Canny-edge detection for boundary detection of iris. The GLCM algorithm is applied to extract the features of the detected iris. In the proposed work, the Circular-Hough transformation is replaced by Structural tensor algorithm which reduces execution time. The GLCM algorithm is improved to increase accuracy of

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iris detection. The simulation results show variations in the execution time and accuracy of proposed algorithm as compared to existing algorithm.

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