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Enhancing Liveness Detection Methods in Iris Codes for Iris Recognition

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Abstract : *Iris Recognition methodology is an authentication mechanism that combines the various methodology. It is used to increase the accuracy of the iris detection method. Iris recognition has inherent weaknesses that can potentially compromise the security of a system. Parodying attacks is one of them and enhanced iris recognition is more vulnerable to parody attack than normal iris recognition method. Parodying is giving duplicate input to the biometric sensor. Parody detection is used to check whether the given input is original or duplicate. The objective is to overcome parodying attacks in iris recognition method. The proposed methodology extracts a set of features from iris using mean, median, variance and local ternary pattern (LTP) techniques respectively and the extracted biometric features are fused and fed to a convolution neural network that employs deep learning to detect parodied features from original features. The proposed method gives better results than the existing liveness detection methods in iris recognition.*

Keywords: *Iris recognition, Anti-parodying, feature extraction, feature fusion, Local Ternary Pattern, Convolution Neural Network.*

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I. Introduction

In our Enhancing liveness detection method by improving the iris code for iris recognition. In now a days the particular single biometric methods will be failed to find the perfect identification and verification for a unique individual with a perfect result and accuracy. These enhanced liveness detection method will designed for these purpose mentioned below. These parody attack is a 1st way in the attacking mechanism, when the stolen, imitated biometric trait is keep to the sensor to make unauthenticated access for the biometric methods. These parody attack will be called as “straight attack”, it will be make out directly on the biometric sensor detection. The feasibility of a parody threat is greater than other category of threat against biometric scheme. Since it does not necessitate any information of the organization. The improved single diametric methods will be easily broken by an imposter also by parody only on single biometrics. The anti-parody is a method for the detection of parody attack on the biometric methods. They make sure whether the users input on the biometric sensor is original or duplicate by using the image processing methodology. In these iris parody some methods are added iris images, photographic iris layer, plastic iris and iris pattern printed on the flexi contact lenses. Then the further process about the iris liveness detection will be mentioned below. The remaining paper will be organized as follows in below: In Section 2, the literature survey on anti-parody system in a biometric methodology are described. In section 3 proposed work will be discussed. In the section 4 conclusion is presented.

II. Related Work

J. Daugman et al. [1-3] normal terms of iris recognition, traditional approaches of feature extraction and corresponding iris recognition methodology can be classified into five major categories roughly: phase-based approaches. Diego et al. [4] proposed Local Binary Pattern. LBP for parody detection LBP encodes the intensity variations between a pixel and its neighboring pixels. For each pixel, the surrounding pixels and sampled. The result of LBP is a binary code. Oleg el al. [5] proposed Liveness detection techniques in the area of eye movement biometrics. Two attack scenarios were considered, in which the imposter does and does not have direct access to the biometric database. Liveness detection was performed at the feature- and match score-levels for several existing eye movement biometric techniques. Mohit et al. [6] proposed to parody an iris recognition system by synthesizing a semi-transparent contact lens. The Response of Gaussian derivative filters with multiple scales and orientations at each pixel location is clustered using K-means to certain regions with different textures.

Yang Hu et al. [7] proposed to exploits the bits in different position of code by using the spatial relationship. This research attentions on a deeper insight into this binarization method to produce iris codes. The results of spatial relationship is improved binary code. Ying chen et al. [8] proposed the process of feature extraction and representation based on scale invariant feature transformation and which are orientation probability distribution function based strategy to delete some redundant feature keypoints. Outperform some of the existing methods interms of correct recognition rate, equal error rate, and computation complexity.

Y. Alvarez-Betan courtet al. [9] use Harris-Laplace, Hessian-Laplace, and Fast Hessian to improve a robust key points based feature extraction method for iris recognition under variable image quality conditions. Outperform recognition on highly or less textured iris images.

III. Proposed Work

Iris Recognition method is an authentication mechanism that combines the various methodology. It is used to increase the accuracy of the iris detection methodology. Parodying attacks is one of them and enhanced iris recognition is more vulnerable to parody attack than normal iris recognition method. Parodying is giving duplicate input to the biometric sensor. Parody detection is used to check whether the given input is original or duplicate.

3. 1. Module Description

The Modules In The Proposed Methodology Are Listed Below:

A. Image Acquisition module.
B. Image segmentation.
C. Image normalization.
D. Feature Extraction module.
E. Classification module.

A. Image acquisition module

The png images of face, iris and fingerprint are obtained from user for extracting features. This sub method comprises of suitable capture devices or sensors. A sensor is required to collect signals from a biometric trait and convert the captured signals into a biometric sample such as iris image.

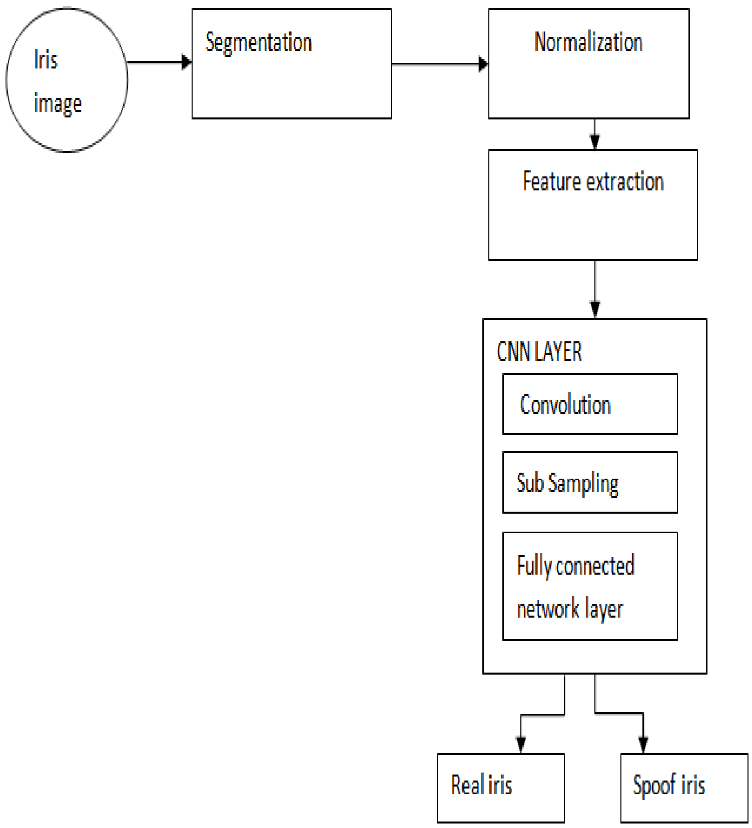

Figure 1: Proposed System Architecture

B.image segmentation module

B.1. Canny edge detection

The algorithm were works in five separate stages:

1. Improving: Noise in the iris image will be removed by blurring.
2. Searching incline: The edges should be noticeable where the fine incline of the iris image has high scale magnitudes. Calculate the derivatives (Dx(x, y) and Dy(x, y)) of the iris image in the x and y directions i.e., use central differencing methodology.
3. Non-hike suppression: edges will be marked by find the local maxima. The "non-hiking suppression".

The three pixels in a 3 × 3 around pixel (x, y) are tested:

• If Dx(x, y) = 0◦, then the pixels (x + 1, y), (x, y), and (x − 1, y) are tested.
• If Dy(x, y) = 90◦, then the pixels (x, y + 1), (x, y), and (x, y − 1) are tested.
• If Dx (x, y) = 45◦, then the pixels (x + 1, y + 1), (x, y), and (x − 1, y − 1) are tested.
• If Dy(x, y) = 135◦, then the pixels (x + 1, y − 1), (x, y), and (x − 1, y + 1) are tested.

4. Dual thresholding: Fine potential edges are known by dual thresholding.
5. Edge rooted by hysteresis: The Canny machinist is finest even for noisy iris images as the method connecting the gap between fine and weak edges of the image by linking the weak edges in the output only if they are connected to fine strong edges.

B.2. Circular Hough Transform (Cht)

Circular hough transform is used to transform a set of edge points in the image space into a set of gathered votes in a parameter space. For each fine edge point, polls are gathered in an accumulator array for all parameter mishmashes. The array element has that contain highest number of polls it will be indicated.

Step1: For every edge pixel (p) find the candidate center point using

$$x_t = x_p - r * \cos(\theta)$$
$$y_t = y_p - r * \sin(\theta)$$

Where x_p and y_p is the location of edge point p

$$r \in [r_{min}\ r_{max}]$$

x_t and y_t is the determined circle center.

Step2: For range of radius:

- The center point is computed.
- The Accumulator array is incremented by one for calculated.
  Accum [x_t,x_t, r] = Accum [x_t,x_t, r]+1
- The point with maximum value in the accumulator is denoted as circle center with radius r

C. Iris Normalization Module:

Step1: Localizing iris from an image explains the circular portion from the rest of the image

Step2: The circular ring iris image is transformed to rectangular image.

Step3: The coordinate methodology is altered by unwrapping the iris from polar equivalent to their cartesian coordinate.

$$I(x(\rho,\theta), y(\rho,\theta)) \rightarrow I(\rho,\theta) \text{ With,}$$
$$x_P(\rho,\theta) = x_{\rho 0}(\theta) + r_P * \cos\theta$$
$$y_P(\rho,\theta) = y_{\rho 0}(\theta) + r_P * \sin\theta$$
$$x_i(\rho,\theta) = x_{i0}(\theta) + r_i * \cos\theta$$
$$y_i(\rho,\theta) = y_{i0}(\theta) + r_i * \sin\theta$$

- Where r_p and r_i are respectively the radius of pupil part and the iris part.
- While (x_p (θ), y_i (θ)) and (x_i (θ), y_i (θ)) are the coordinates of the pupil and limb boundaries in the direction θ. The value of θ belongs to [0; 2π], ρ belongs to [0; 1].

D. Feature extraction module

D.1. Mean, median, variance:

Mean: Average or mean value. S = mean(X) is the mean value of the elements in X if X is a vector. For matrices, S is a row vector containing the mean value of each column.

Median: (Median value) For vectors, median(x) is the median value of the elements in x. For matrices, median(X) is a row vector containing the median value of each column.

Variance: For vectors, Y = var(X) returns the variance of the values in X. For matrices, Y is a row vector containing the variance of each column of X.

D.2. Local ternary pattern (ltp):

From the Iris image, the local ternary pattern (LTP) is calculated. In LTP the nearby pixels values are matched with the central pixels by using a lag limit value 'l'. Based on this comparison of the nearby pixels values will be assigned one of the three values +1 or 0 or -1.

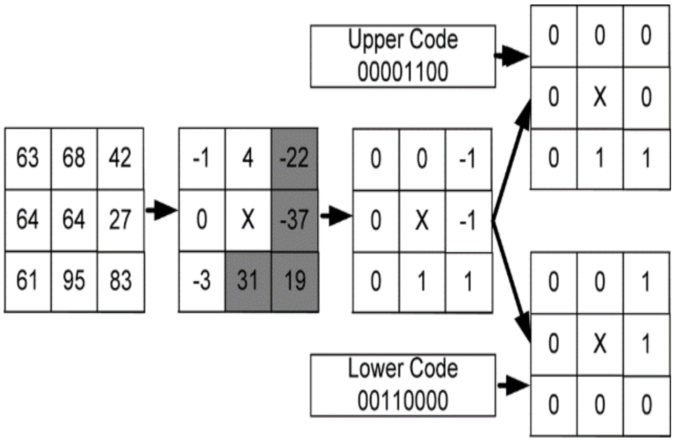

Figure 2: working of Local Ternary Pattern

Calculation of local ternary pattern (LTP)

Steps to calculate local ternary pattern (LTP):

1. Compute the Local Ternary Pattern (LTP) from the iris image.
2. Match them with nearby pixels with central pixel value.
3. Assign the nearby values based on steps 1 and 2.

E.Classification

The Convolution neural network is used for classification. It contains sampling layer and convolution layer. The typical architecture of a convolution neural network is multiple layers composed of where these each layer performs a specific function of transforming its input into a useful representation. The Convolution layer has transforms the basis of the convolution neural network and performs the core operations of training. Convolutional layers consist of a rectangular grid of neuron. It performs the convolution operation over the input volume. The Sub-Sampling Layer is placed after the Convolutional layer. It reduces the spatial dimensions (Width x Height) of the Input Volume for the next Convolutional Layer.

IV. Conclusion

Biometric methodology is used for authentication using biological and physiological traits. Iris Recognition method is an authentication mechanism that combines the various methodology. It is used to increase the accuracy of the iris detection system. Iris recognition has inherent weaknesses that can potentially compromise the security of a methodology. Parodying attacks is one of them and enhanced iris recognition is more vulnerable to parody attack than normal iris recognition method. Parodying is giving duplicate input to the biometric sensor. Parody detection is used to check whether the given input is original or duplicate.

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