Identification of Owls by the method of Iris Pattern Matching and Recognitions

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Abstract- The Iris pattern of any animal and birds (including human being) is statistically unique and suitable for biometric measurements. The identity of the animal or birds concerned can be determined and verified comparing the tem- plates obtained with the present algorithm with that template stored in database which is formed on the basis of previous studies. In the present study, the method of circular Hough transform is used for segmentation of the Owl Iris. Pattern matching is achieved by calculating Hamming Distance where its degree is proportional to the closeness of matching. The closer matching between the stored and calculated pattern is found to lead towards better recognition of Irises and thereby the animal itself.

Keywords – Iris recognition, Pattern matching, Biometric identification

I. INTRODUCTION

Owls are unable to move their eyes within their sockets to a great extent, which means they must turn their entire head to see in a different direction. Because Owls have forward-facing eyes, they have well-developed Owls are a group of birds known for their distinct calls, nocturnal habits and silent flight. Owls are familiar to many people because they are often depicted in various ways in popular culture. They rank on par with bats and spiders as the most celebrated of Halloween creatures. Owls also appear as wise and noble characters in many children's stories, including Winnie the Pooh, Mrs Frisby and the Rats of NIMH and Harry Potter Biometric Impressions or attributes have been found to be unique for every individual as well as animals and birds. Irises in the eye can serve as one of the biometric parameters which have been used for identification and authentication of the humans or animals. The features of the owl Iris (like any other animal or bird) can be measured with the help of various algorithms and the Iris patterns thus found to be statistically unique. On the contrary, the images of the Owl irises can be acquired with the help of static camera to be located at various places within the forests and the iris images can be analyzed for the matching and recognition of the same which are already stored in the database of the iris images collected from the same area. The entire process may be considered as one of the most reliable forms of biometric technology. A number of studies already been reported since long on iris recognition. The visible texture of human Iris in a real time video image has been encoded into a compact sequence of multiscale quadrature. Two dimensional Ga-bor wavelet coefficient. An automated method for iris recognition was proposed by Wildes and the study is based on a pyramid laplacian in order to perform two dimensional band pass decomposition for representing iris images. Studies on calculation of the zero crossing of the wavelet transforms were made over concentric circles of the Iris and satisfactory results are obtained. Although these studies are made for the detection of the irises, no work on Owl iris recognition using combination of various algorithm is found in available published or on time literature. The Owl is a prominent bird in ecological system and hence its identification is a point of interest for the wild life conservationist. In the present Study, the method of recognition of Owl iris is based on Circular Hough Transformation for the purpose of the image segmentation. The extracted region has been normalized into a rectangular block with constant dimensions to account for imaging inconsistencies and then one dimensional Gabor Filter is used to extract the phase data and quantize into four levels to encode the unique pattern of the Iris into a bit wise biometric template.

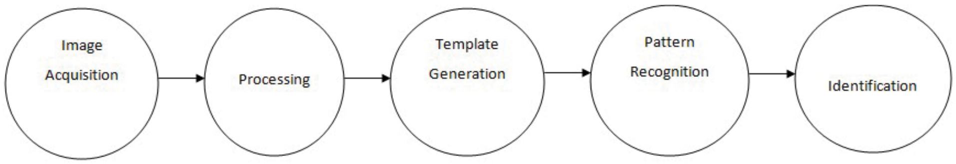

Figure 1. Block diagram of Owl Iris Recognition System

II. PROPOSED ALGORITHM

A. Image Acquisition –

First of all different images of Owl eye of any particular Owl are taken from different angles from various stationary fixed points cameras in a particular area of any forest. Among these the best eye image is selected for iris segmentation for further processing which would lead to iris recognition in a meaningful way.

B. Preprocessing –

An iris image contains some irrelevant parts such as eyelids sclera and pupil. Also, the size of an iris may vary depending on camera-to-eye distance, illumination level and amount of reflections. Therefore, the original image needs to be normalized. The process of normalization has been stated in subsection below.

C. Iris Localization –

In Iris localization step the inner (iris/pupil) boundary and the outer (iris/sclera) boundary in the original image of the Owl eye are detected and are modeled as circles as shown in Figure 2.

Figure 2. Iris Localization in which two circles overlay for iris and pupil boundaries.

D. Iris Normalization –

Next step is to normalize iris images to compensate for iris deformation as shown in Figure. 3. Here the Owl iris region is transformed so that it has fixed dimensions in order to allow comparisons so that two photographs of the same iris under different conditions will have characteristic features similar at the same spatial location. The center value of the pupil is taken as the reference point, and the radial vectors are passed through the region. A normalized pattern is built by backtracking to find the Cartesian coordinates of data points from the radial and angular positions in the normalized pattern. The normalization approach produces a 2D array with horizontal dimensions of angular resolution and vertical dimensions of radial resolution form the circular-shaped collarette area. In order to prevent non-iris region data from corrupting the normalized representation, the data points, which occur along the pupil border or the iris border, are discarded.

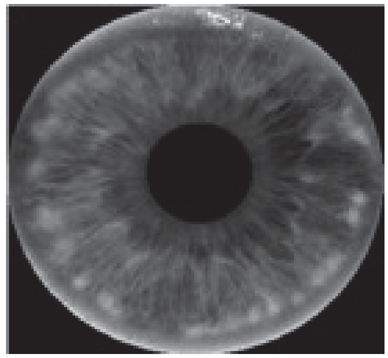

Figure 3. Segmented and normalized image of the Owl eye

The homogenous rubber sheet model of Daugman remaps each point within the iris region to a pair of polar coordinates (r,) where r is on the interval [0,1] and is angle [0,2] which is shown in Figure 4. The remapping of the iris region from (x,y) Cartesian coordinates to the normalized non-concentric polar representation is modeled as [2, 3]

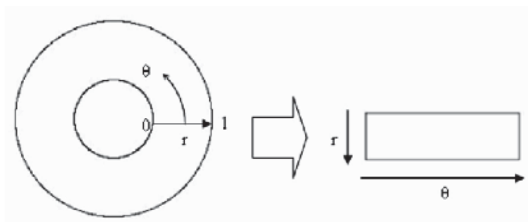

Figure 4. Schematic presentation of the unwrapping of the Iris.

After that we select the ordered coefficient from 1 to N to get N coefficient. the formulae of watermark embedding are as follows

$$I(x(r, \theta), y(r, \theta)) \rightarrow I(r, \theta) \text{ with}$$
$$x(r, \theta) = (1-r)xp(\theta) + rxl(\theta) \qquad (1)$$

Where I(x,y) is the iris region image, (x,y) are the original Cartesian coordinates, (r,) are the corresponding normalized polar coordinates, and xp,yp are the coordinates of the pupil and xi,yi are the coordinates of the iris boundaries along the direction. The rubber sheet model takes into account pupil dilation and size inconsistencies in order to produce a normalized representation with constant dimensions. In this way the iris region is modeled as a flexible rubber sheet anchored at the iris boundary with the pupil center as the reference point.

E. Feature Extraction and encoding –

For easy comparisons of Iris only the significant features of the Iris must be encoded. The feature representation should have enough information to classify various irises and should be less sensitive to noises. The figure 6 shows how the correlate region of the Iris has been extracted.

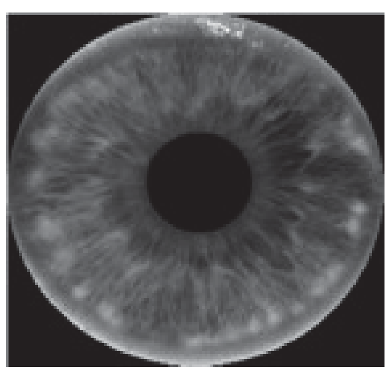

Figure 5. Segmented portion of the Iris

The black regions denotes the area for matching while the white regions of correlate denotes noise. Correlate region of the Iris extracted from the segmented part of Iris is shown below.

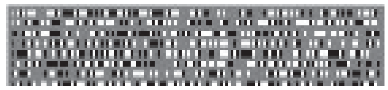

Figure 6. Correlate region of the Iris extracted from the segmented part of Iris.

In the correlate part of the iris some part of it are white while rest of the portion is black .The black regions denotes the area for matching while the white regions of correlate denotes noise which is unwanted for our study given in figure below.

Figure 7. Black areas denotes area required for matching and White Region denotes the noise

An easier way of using the Gabor filter is by breaking up the 2D normalized pattern into a number of 1D wavelets, and then these signals are convolved with 1D Gabor wavelets. Gabor filters are actually used to extract localized frequency information. The frequency response of a Log-Gabor filter is given as:

$$G(f) = \exp\left(\frac{-\left(\log(f/f_0)\right)^2}{2\left(\log(\sigma/f_0)\right)^2}\right)^2 \quad (2)$$

Where f0 represents the center frequency and gives the bandwidth of the filter.

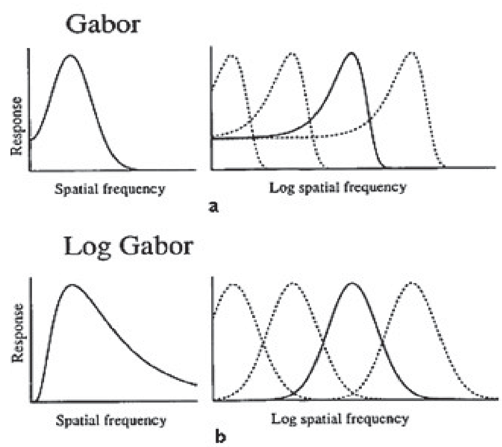

Figure 8. (a) Response of the Gabor filter in normal and logarithmic scale (b) Response of the Log Gabor filter in normal and logarithmic scale

F. Matching –

Comparison of the bit patterns generated is done to check if the two irises belong to the same Owls. Calculation of Hamming Distance (HD) is done for this comparison. HD is a measure of the number of bits disagreeing between two binary patterns]. Since this code comparison uses the iris code data and the noisy mask bits, the modified form of the HD is given by

$$HD = \frac{1}{N}\sum_{j=1}^{N} X_j \oplus Y_j \quad (3)$$

Where Xj and Yj are the two iris codes and N is the number of bits in each template. Since an individual iris region contains features with high degrees of freedom, each iris region will produce a bit-pattern which is independent to that produced by another iris, on the other hand, two iris codes produced from the same iris will be highly correlated. If two bits patterns are completely independent, such as iris templates generated from two different irises, the Hamming distance between the two patterns should be equal to 0.5. This occurs because independence implies the two bit patterns will be totally random, so there is 0.5 chance of setting any bit to 1, and vice versa. Therefore, half of the bit patterns will agree and half will disagree .If two patterns are derived from the same iris, the Hamming distance between them will be close to 0.0, as because they are highly correlated and the bits should agree between the two iris codes.

III. EXPERIMENT AND RESULT

Experiments are performed in two different stages: Iris segmentation and Iris recognition. At first stage the localization of Irises using MATLAB is shown. Average time for localization is 56 Sec and accuracy rate was 91.5% and Iris matching accuracy rate is 94%. Table here shows the comparison for different techniques used for Iris localization and matching accuracy rate.

Table -1 Accuracy Rate for Iris Segmentation and Recognition

Methodology	Accuracy Rate	Average Time(s)	Matching Accuracy Rate
Daugman	**85%**	**83**	**100%**
Wildes	**80%**	**98**	**95%**
Masek	**86%**	**76**	**90.20%**
Proposed	**91.50%**	**56**	**94%**

IV.CONCLUSION

An area in which the algorithm is needed is to be continuously developed and improved had been outlined, and the potentials of utilizing Iris Recognition are examined. Further biometric identification of Owls will be helpful to make a clear note of wild life preservation and also to make the census of Owls. Moreover differentiating of two species and also gender recognition will be possible in further studies. Patterns of different birds and animals iris regions can be classified in a distinguish manner.

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