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Iris recognition Using Fast Walsh Hadamard Transform Based feature Space

Shahid Akbar[1], Maqsood Hayat[1], Mohammad Sohail*[2], Haroon Khan[1]
[1]Department of Computer Science, Abdul Wali Khan University, Mardan, KPK, Pakistan
shahidakbarcscs@gmail.com, haroon_rajjar@yahoo.com
*[2]Department of Physics, Abdul Wali Khan University, Mardan, KPK, Pakistan
sohail.dagiwal@gmail.com[2]

ABSTRACT

The significance of Iris detection and recognition in area of bioinformatics and pattern recognition has been increased from last few decades. Looking at the importance of Iris detection and recognition, we propose a robust, stable and reliable computational model. Features are extracted from iris images using two different approaches such as Hilbert transform and Fast wavelet Hadamard Transform (FWHT).Random forest is used as a classification algorithm. 5-folds cross validation test is applied to evaluate the performance of K-nearest neighbor. Among three feature spaces, FWHT feature space has achieved promising results. The success rate of K-nearest neighbor on FWHT feature space is 94.4%. After examining the results, we have observed that our model might be useful and helpful for iris detection in future work.

Keywords: FWHT; Hilbert transform; K-nearest neighbor; 5 folds

I.INTRODUCTION

Iris of the human eye is the spherical region having diameter of 12mm located between black pupil and white sclera. Iris recognition provides the most secure techniques for individual identification and detection because of its stable and unique features. None of the two irises are same, even in case of twins. Iris texture varies from person to person and it also provides more stability than other biometrics like fingerprint, face etc. Physical characteristics of iris remain the same for lifetime [1, 2].Iris based automated systems are currently available in various environment such as airport security, ATMs, physical access security and many more.

Pioneer take a shot at Iris Recognition has been completed by the John Daugman[3-7]. Sundaram et al., found the internal and the external roundabout iris locale utilizing Daugman calculation and Hough change [8]. While, Birgale et al., disintegrated the fragmented Iris picture through discrete wavelet change up to levels 3. Coordinating of iris pictures are performed utilizing Euclidian separation [9].Tuama et al., proposed a calculation for recognizing and sectioning the iris and student limit [10]. So also, Surveet et al., separated the component from standardized iris picture utilizing one dimensional Discrete Sine Transform and neural system utilized for arrangement. The proposed procedure is surveyed on both the CASIA and Bath database [11]. In like manner, Patil et al., acquainted lifting wavelet change approach with concentrate highlights from CASIA iris pictures. Acknowledgment rate is assessed by measuring the Euclidian separation between two iris formats [12]. Cuiet et al., gave a union methodology PCA on the iris pictures. Super-determination is utilized to improve the nature of the union pictures [13]. Huanget et al., utilized free segment Analysis (ICA) to concentrate highlights from iris pictures and focused learning instrument to recognize design [14].In a continuation, Monroet et al., utilized discrete cosine change on both CASIA and Bath iris datasets and got the acknowledgment rate of 100% [15].Whereas, Kekreet et al., created wavelet change from orthogonal segment changes of different sizes. It was researched that DCT accomplished the better results contrasted with other methods[16].

In this paper, we introduced a computational model for iris acknowledgment. Components are extricated utilizing two diverse methodologies, for example, FastWalsh hadamard change (FWHT) and Hilbert change. K-closest neighbor is used as a theory learner. MMU iris database is utilized to assess the acknowledgment rate of the classifier.

The rest of the paper is sorted out as takes after: Feature extraction strategies and order calculation are portrayed in Section2. Area 3 presents Results and dialog .Finally conclusions are attracted the last Section.

I. METHODS AND MATERIAL

A. Dataset description

Keeping in mind the end goal to prepare and test the computational model we utilized MMU iris dataset, which contains 450 pictures that are similarly marked into two unique classes of left and right iris pictures. Every one of the pictures are put away in BMP arrange and having picture determination of 320*240 pixels.

Figure 1. Sample Iris images from MMU

B. Hilbert Transform (HT)

Hilbert transform is a key tool of signal processing and is used as a frequency domain transform. Applying Hilbert Transform frequency of the signals do not changed [18]. In this paper, Hilbert transform is used to extract important features from iris images. The Hilbert transform for a function X (t) is defined as:

$$H[X(t)] = \frac{1}{\pi}\int_{-\infty}^{\infty}\frac{x(\tau)}{t-\tau}\,d\tau \qquad (1)$$

C.* Fast Walsh Hadamard Transform (FWHT*)

In computational mathematics, FWHT is an efficient algorithm to calculate the Walsh hadamard transform (*WHT).FWHT* is computational better than *WHT*[19, 20]. In image processing *FWHT* is used for image compression and filtering. Hadamard transform is a real, symmetric and orthogonal. The Walsh hadamard transform is defined as:

$$H(n) = \begin{bmatrix} H(n-1) & H(n-1) \\ H(n-1) & -H(n-1) \end{bmatrix} \qquad (2)$$

***D.* Proposed Method**

In this work we extracted the features from iris images by applying two different methods such as *FWHT* and Hilbert Transform for investigating the recognition rate, Random forest is utilized as learner.5-folds cross-validation test is employed to assess the performance of the classifier. Other performance measures are applied to determine the discrimination power of the learning algorithm, are mention below.

$$Accuracy = \sum_{i=1}^{k} \left({}^{TPi}/_{N}\right) \qquad (3)$$

$$Sensitivity = \left(\frac{TP}{TP} + FN\right) * 100 \qquad (4)$$

$$Specificity = \left(\frac{TN}{FP} + FN\right) * 100 \qquad (5)$$

II. RESULTS AND DISCUSSION
III.

In arrangement, diverse cross acceptance tests are utilized. For our situation we utilized 5-folds cross approval test to assess the execution of the proposed model. One fold is utilized for testing reason and the rest of the folds are utilized for preparing. The entire procedure is rehashed 5 times lastly the outcomes are joined.

The expectation rates of the proposed model utilizing all the two element space are delineated in Table 1.K-closest neighbor accomplished an exactness of 94.4% with affectability, specificity of 93.2% and 94.5% utilizing FWHT highlight space. On other hand, Hilbert change highlight space got an exactness of 87.9%, affectability of 89% and specificity of 87%.The experimental result uncovers that FWHT focused more vitality in light of just couple of coefficients when contrasted with different changes strategies.

TABLE1. PERFORMANCE RATES OF K-NEAREST NEIGHBOR USING 5-FOLDS (ACC= ACCURACY, SEN: SENSITIVITY, SP: SPECIFICITY)

Propose Methods	Acc %	Sen%	Sp%
FWHT	94.4	93.2	94.5
Hilbert	87.9	89	87

IV. CONCLUSION

In this paper, we proposed an efficient, stable and reliable security system for iris recognition. Two numerical descriptor extraction schemes namely: *FWHT* and Hilbert transform are used to extract features from Iris database. K-nearest neighbor is utilized as classification learner. The performance rate of the learner algorithm is assessed using 5 folds cross validation test. The experimental results show that *FWHT* based feature space has achieved the highest success rate of 94.4% compared to other feature extraction schemes.

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