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Circular Hough Transformation Approach for Iris Detection

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***Abstract:** Iris recognition is an automated method of biometric identification that utilizations mathematical pattern-recognition techniques on video images of either of the irises of an individual's eyes, whose complex random patterns are unique, stable, and can be seen from some distance. Retinal scanning is a different, ocular-based biometric innovation that uses the unique patterns on a person's retina blood vessels and is regularly confused with iris recognition. Digital templates encoded from these patterns by mathematical and statistical algorithms allow the identification of an individual or somebody pretending to be that individual. Databases of enrolled templates are searched by matcher engines at speeds measured in the millions of templates every second per (single-core) CPU, and with remarkably low false match rates. To detect the iris from the image efficient feature extraction technique is required. In the base paper, the popular Transformation methods [Discrete cosine transform] DCT, [Discrete wavelet transform] DWT, and [Singular vector decomposition] SVD are used for analyzing and Feature Extraction. The proposed improvement will be based on applying GLCM algorithm 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 technique Circular Hough Transformation and improved GLCM are used. The simulation is being performed in MATLAB and it has been analyzed that performance is increased in terms of certain parameters.*

***Keywords:** Iris, GLCM, Circular Hough Transformation*

I. 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 [1]. 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 [2]. The information that is replicated can be utilized as a part of any path by the clients. So the information should be

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recognized as unique or replicated. Likewise the source from where the data came is essential for the further preparing. The identification of what sort of information is available in the images is being done in a considerable measure of fields [3]. With a specific end goal to make advance face recognition system more robust and simple to design, face alignment are performed to legitimize the scales and orientations of these patches. Other than serving as the pre-processing for face recognition, face detection could be utilized for region-of-interest detection, retargeting, video and image classification, and so forth [4].Iris recognition is an automated method of biometric identification that utilizations mathematical pattern-recognition techniques on video images of either of the irises of an individual's eyes, whose complex random patterns are unique, stable, and can be seen from some distance. Retinal scanning is a different, ocular-based biometric innovation that uses the unique patterns on a person's retina blood vessels and is regularly confused with iris recognition. Iris recognition utilizes video camera innovation with unobtrusive close infrared illumination to acquire images of the detail-rich, intricate structures of the iris which are visible externally [5]. Digital templates encoded from these patterns by mathematical and statistical algorithms allow the identification of an individual or somebody pretending to be that individual. Databases of enrolled templates are searched by matcher engines at speeds measured in the millions of templates every second per (single-core) CPU, and with remarkably low false match rates.The task of the classifier component appropriate of a full system is to utilize the feature vector gave by the feature extractor to dole out the object to a category. Since immaculate classification performance is frequently impossible, a more general task is to determine the probability for each of the possible categories [6]. The abstraction gave by the feature-vector representation of the input data enables the development of a largely domain-independent theory of classification. The degree of difficulty of the classification problem depends on the variability in the feature values for objects in the same category relative to the difference between feature values for objects in different categories. The variability of feature values for objects in the same category might be because of complexity, and might be because of noise [7].Reasonably, the simplest measure of classifier performance is the classification error rate-the percentage of new patterns that are assigned to the wrong category. Accordingly, it is normal to look for minimum-error-rate classification. Be that as it may, it might be vastly improved to recommend actions that will minimize the aggregate expected cost, which is known as the risk. Decision tree is considered to be a decision support tool that uses a tree-like structure or model of decisions and all its possible consequences. It is one way to show an algorithm. These trees are essentially utilized as a part of operations research, generally in decision analysis, to identify a strategy well on the way to achieve a goal [8]. In the field of pattern recognition, the k-nearest neighbor algorithm (k-NN) is a method for classifying objects based on closest training examples in the feature space. K-NN is a kind of illustration based learning, or lazy learning where the function is just approximated locally and all the computation is conceded until classification. Naive Bayes classifier is a simple, probabilistic and statistical classifier which is based on Bayes theorem (from Bayesian insights) with strong (naive) independence assumptions and maximum posteriori hypothesis. A Support Vector Machine (SVM) performs classification by building a N-dimensional hyperplane that optimally separates the data into two categories.

II. LITERATURE REVIEW

Feng Su et.al, (2015) proposed a novel shading enhancement method to boost the shading saliency of the basic locales and to improve the consistency of segmentation results by maximizing chroma while preserving hue [9]. This research proposed an efficient and simple shading enhancement method that can be connected to boost the accuracy and improve the consistency of shading segmentation. As evidenced by experimental results across different shading spaces, images pre-prepared with the chroma based shading enhancement method have much higher shading saliency levels than images without the enhancement or enhancement utilizing existing methods. Therefore, the proposed chroma based shading enhancement method can be utilized as a pre-processing tool to obtain reliable shading segmentation results.

Hsien-Chih Hu, et.al, (2016) proposed a modified algorithm of the original LBP proposal together with other as of late proposed LBP extensions [10]. In this paper, LBP feature extraction edge face detection, strengthen image characteristics, in the light of with human face discrimination influence different angles test recognition efficiency. Experimental results demonstrated the effectiveness and robustness of the described texture descriptors for images that are subjected to geometric or radiometric changes. Combined with FS, TSS image search method to search for a face texture blocks by the experimental results compared in different environments and light changes, It doesn't influence the output of the image can be identification correct image blur effortlessly recognize errors.

Manisha Parlewar, et.al, (2016) proposed a novel quantized gradient based local feature descriptor, named Local Quantized Gradient Direction (LQGD) descriptor and the subsequent Partitioned Gradient Histogram, for facial image representation [11]. The

8 bit LQGD descriptor accommodates eight levels quantized gradient magnitude and direction information from the horizontal and vertical gradients at local facial image pixels utilizing 3x3 neighborhoods. The subsequent novel partitioned histogram based feature detection utilizing the proposed descriptor offers separation in feature space resulting in recognition performance improvement. Spatial and transform domain feature level fusion is utilized for further performance improvement. The proposed technique beats the other published contemporary techniques.

Iliana V. Voynichka, et.al, (2016) proposed an investigation into how certain factors influence facial recognition by investigating what are the most statistically significant pixel-features in an image that differentiate a given individual face from whatever is left of the individual faces in a given data set [12]. Specifically, we propose an algorithm to infer a mask of the pixels with the highest statistical significance levels to identify a given face based on this mask. Our investigation demonstrates that making a mask utilizing the two-sample t-test, chooses the pixels that are most representative of a given individual face physiognomy when compared to face images of whatever is left of the individuals in a given database.

Jianxu Chen, et.al, (2015) proposed another approach for detecting and matching iris crypts automatically [13]. This detection method can catch iris crypts of various sizes. Thismatching scheme is intended to handle potential topological changes in the detection of similar crypt in different images. This approach beats the known visible-feature based iris recognition method on three different datasets. In particular, our approach achieves more than 22% higher rank one hit rate in identification, and more than 51% lower equal error rate in verification. In addition, the advantage of our approach on multi-enrollment is experimentally demonstrated.

Peter Chondro, et.al, (2016) proposed an algorithm that particularly enhances maxillary sinuses utilizing a novel contrast enhancement technique based on the adaptive morphological texture analysis for occipitomental see radiographs [14]. As indicated by the experimental results, the proposed method can increase the diagnosis accuracy by 83.45% compared with the figured tomography methodology as the gold standard. The proposed ToMA was thoroughly tested and compared with two other representative enhancement schemes. The results revealed the proposed ToMA can improve the contrast of SXR better than prior methods while having the lowest computational complexity. To some extent, ToMA can be implemented in a parallel programming scheme to increase the software efficiency with conceivable application on the generally utilized picture archiving and communication system (PACS).

III. Research Methodology

The iris detection is the technique which is applied to detect the iris part from the 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. The canny edge detector is applied with the circular Hough transformation for the iris detection. . The circular-hough transformation is the distance based technique which will mark the boundary and calculate the distance from the outer boundary to inner 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 glcm is applied which detect contrast, homogeneity, energy and entropy of the image. The algorithm is done by applying formula mentioned in the algorithm phase which increase contrast level of the detect image.

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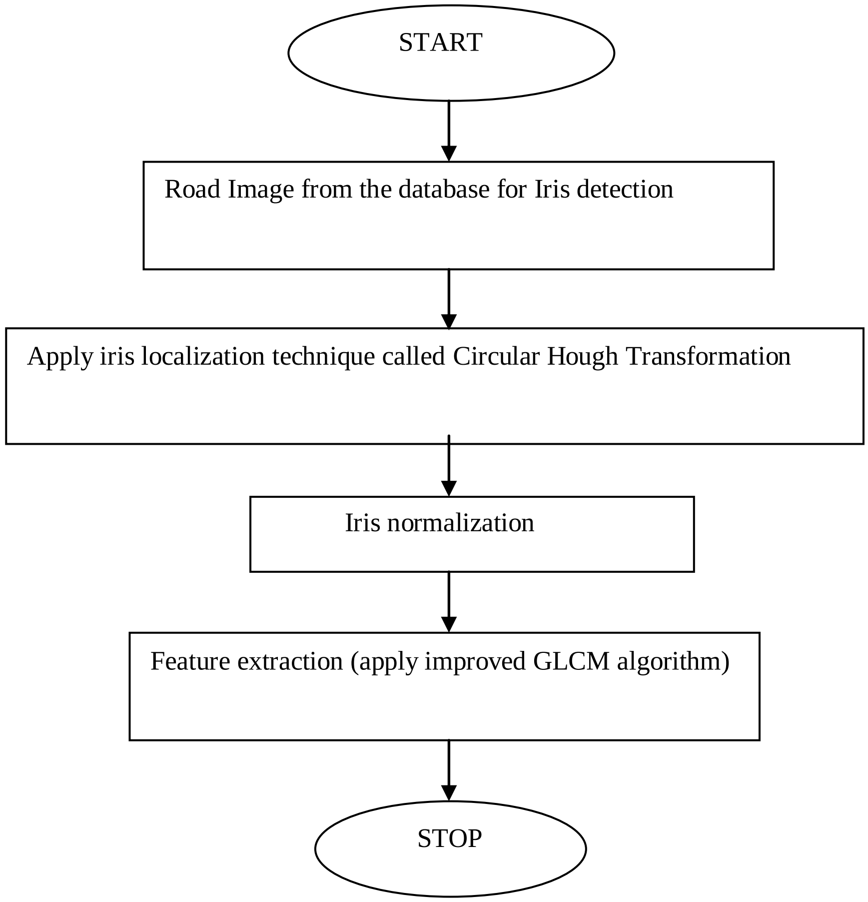

Fig 1: Steps of Iris Detection

IV. Experimental Results

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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 2: Detection of iris portion

As shown in figure 2, as GLCM algorithm is been applied which will extract the textural features of the input image.

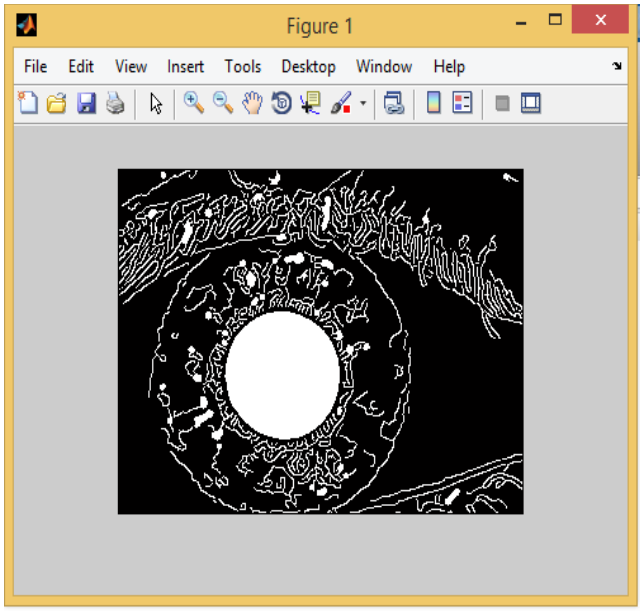

Fig 3: Iris Localization

As shown in figure 3, the technique of Circular Hough Transformation is applied which will localize the iris from the image. The C.H.T algorithm will mark the boundaries of the iris for the localization.

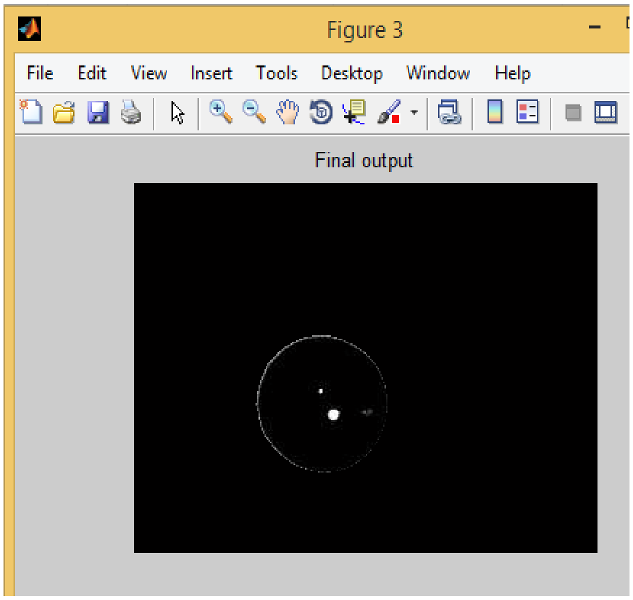

Fig 4: Output of Circular Hough Transformation

As shown in figure 4, the algorithm of C.H.T is applied which mark the boundaries of the iris. The technique calculate the distance and mark the final iris part from the image.

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TABLE I
ACCURACY COMPARISON

Images no.	D.C.T Technique	G.L.C.M Technique
1	80.4647	89.12737
2	84.07378	92.32163
3	83.65483	91.50088
4	79.24177	89.90560
5	81.15233	92.26376

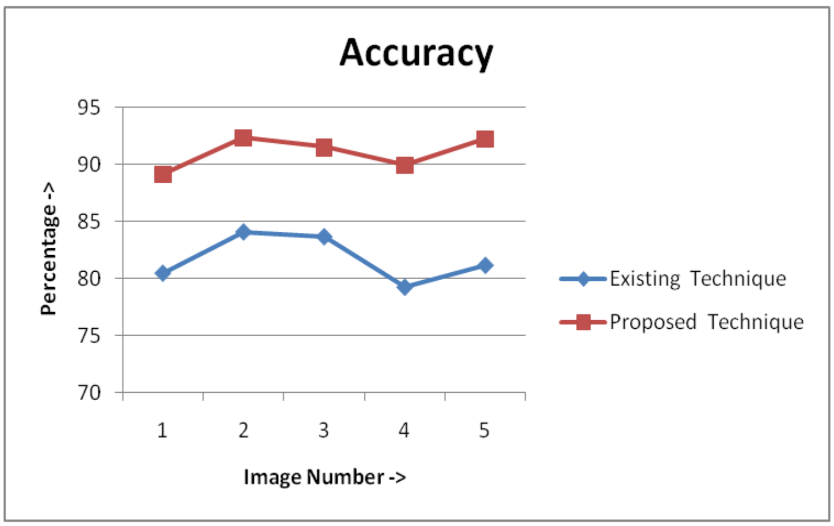

Fig 5: Accuracy Analysis

As shown in figure 5, the accuracy of the existing and proposed algorithm is compared for the performance analysis. It is analyzed that accuracy of proposed algorithm is high as compared to existing algorithm

TABLE II
PRECISION COMPARISON

Images no.	D.C.T Technique	G.L.C.M Technique
1	82.46746	92.12737
2	86.07378	95.32163

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3	85.65483	94.50088
4	81.24177	92.90560
5	83.15233	95.26376

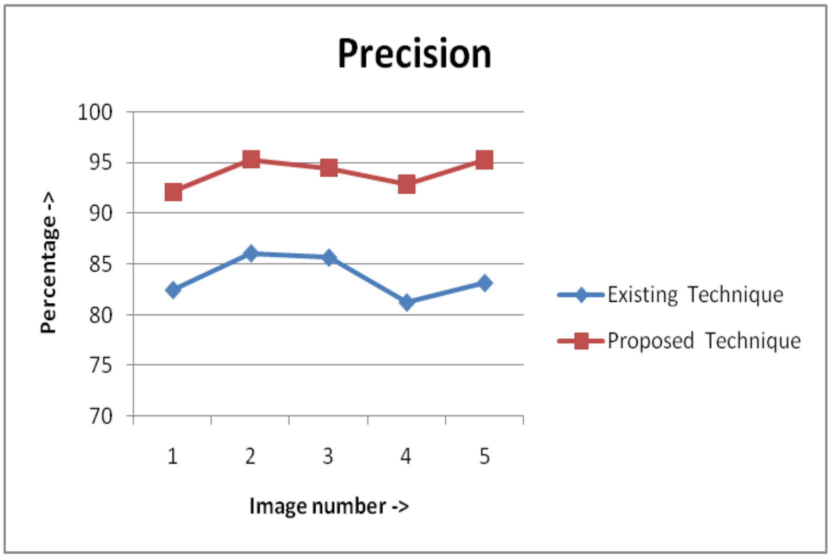

Fig 6: Precision Analysis

As shown in figure 6, the precision value of the existing and proposed algorithm is compared for the performance analysis. It is analyzed that precision value of proposed algorithm is high as compared to existing algorithm

TABLE III
RECALL COMPARISON

Images no.	D.C.T Technique	G.L.C.M Technique
1	81.96746	91.62737
2	85.57378	94.82163
3	85.15483	94.00088
4	80.74177	92.40560
5	82.65233	94.76376

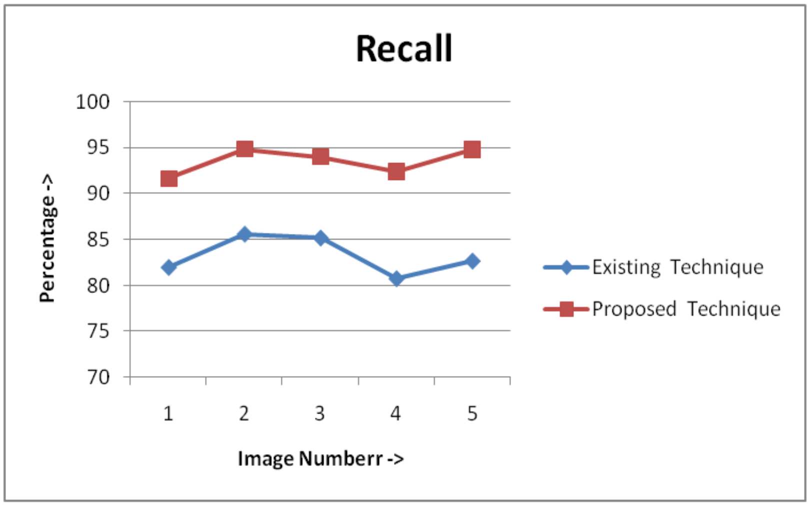

Fig 7: Recall Analysis

As shown in figure 7, the recall of the existing and proposed algorithm is compared for the performance analysis. It is analyzed that recall of proposed algorithm is high as compared to existing algorithm

V. CONCLUSION

In this work, it has been concluded 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. The Circular-Hough transformation was applied with Canny-edge detection for Iris Segmentation. The DWT,DCT and SVD is applied to extract the features of the detected iris which was not efficiently extracted. The Circular-Hough transformation is now used to calculate the distance mark the boundaries of the iris. The GLCM algorithm is applied to Extract features and extract the features efficiently and also improved to increase accuracy of 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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