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Inter-Fusion of Iris and Sclera Surface Patterns: Biometric Recognition Using the Laplace Transform

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Abstract—In the field of biometric system, iris recognition is the most robust andacts as an active field because of its consistency and easy acquisition of the data.Segmentation of degraded images using Deterministic Linear-time (SDL) algorithm easily detects the sclera part from the degradedVWimages. The existing DL algorithm is based on the neural pattern and as a result the edge point component is not extracted from the iris image.Sclera Segmentation using Multispectral ConjunctivalVasculature (SSMCV) method in an ocular biometric system examines the potential utilization of the sclera patterns. But MCV failed to have an improved ocular biometric system while processing the eye imagesby combining the iris with sclera surface patterns. In order to extract the edge point component, Inter-fusion of Iris and Sclera surface using Laplace Transform (IISLT) is proposed in this paper. In this paper, initially IISLT collects the iris images from the image acquisition system.Then, during the processing stage, IISLT corrects the rotary motion of iris images and mark removal is performed using the Tuning algorithm. Next to the preprocessing step, Least Mean Square Filtering operation is carried out inIISLTfor extracting the edge point component from the biometric iris image. Least Mean Square(LMS) filtering method is developed in IISLT for effective filtering of iris and sclera surface patterns for different range of convergent factor. The convergent factor in inter-fusion guarantees the stability. Finally the filtered iris image with IISLT, perform the Laplace transformation for the searching process (i.e.,) iris recognition step.Experiment results show that the proposed tuning algorithm is effective and comparatively favorable than the state-of-art methods. To prove the efficiency of the method, IISLT carried out the experimental work using MATLAB on the parametric factors such as accurate rate of iris recognition, filtering efficiency of preprocessed image, and False Reject Rate.

Keywords: Least Mean Square Filtering, Mark Removal, Iris Recognition, Laplace Transform, Sclera Surface Patterns, Tuning Algorithm

I. INTRODUCTION

Biometrics is the science of obtaining the identity of human with the help of physical or behavioral traits that includes hand, face, iris, finger portion, signatures and so on. In today's society where the consciousness is increasing more in the aspects of security, the real-world applications involving the authentication of human beings or identification of human require a highly significant mechanism for recognizing individual humans.

The most demanding performance level cannot be obtained through the use and application of a single biometric feature such as signature, fingerprint, face, iris, ear, palm and so on. At the same time, with the introduction of fusing multiple biometrics provides indexing of large databases, increases the performance. Moreover, multiple biometrics is also at the same time more robust against attacks than compared to the single form biometrics. A typical illustration of biometric identification system is illustrated in Fig. 1.that comprises of a user. Initially the process starts with the pre-processing, followed by it weights are assigned and accordingly the features are extracted. Finally, feature matching is performed according to the objective being achieved.

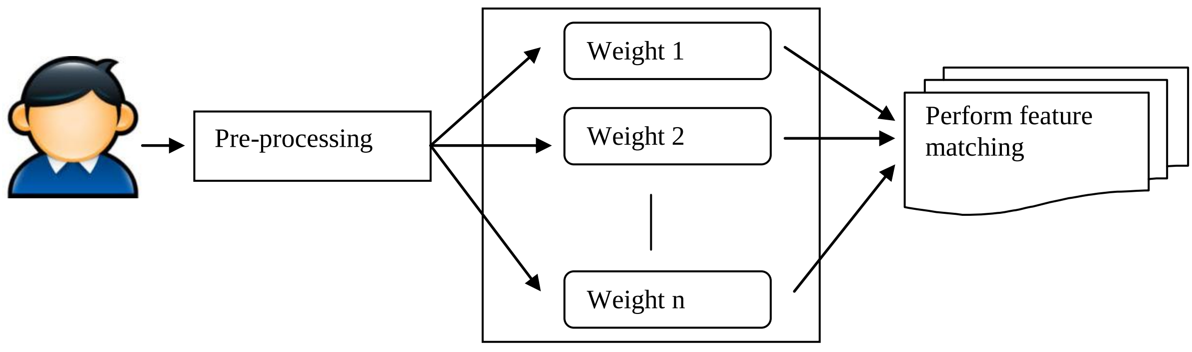

Fig. 1. Illustration of Biometric identification system

This work addresses the broad area of issues related to multi-biometrics for human identification. With the inception of the automation process for the identification of iris, the application of ocular region as an indication of biometric in the mid '90s in addition to the advantages of the application of periocular region resulted in the introduction of the same. The probability of employing retinal blood vessels for the specific identification of human being has also been investigated with higher ranges of opulence.

In Multispectral Conjunctival Vasculature [2], the author attempted to establish the utility of another ocular trait – the sclera. The application of the sclera as a biometric feature was specifically significant in the purview of iris recognition. The author investigated the use of the sclera texture and vasculature patterns as a potential biometric. Here the iris patterns were better obtained using near infrared spectrum (NIR) and the vasculature patterns were better obtained using the RGB spectrum. As a result, the author adopted multispectral images of the eye, comprising of both NIR and RGB channels to ensure that features were imaged. But the MCV system failed to have an improved ocular biometric system while processing the eye images by combining the iris with sclera surface patterns.

The work in [15] investigated the comparative analysis using three different approaches called as the classical sum rule, weighted sum rule and fuzzy logic. These three methods were used for multimodal recognition of integrated iris and fingerprints. The overall scores obtained from various characteristics of biometric of iris and fingerprint was then fused using the min-max rule to improve the quality of images being obtained.

The art of image fusion refers to the combination of relevant information from two or more images with the resultant image being a single image. The image being fused must at the same time provide an easier view for the human to observe the scene than when compared to any one of the source images. With this the performance can be improved by the human in attaining his task. FusedInage Quality Measures [3] was introduced as a novel mechanism to determine the effectiveness of humans in order to measure the targets in fused images. The human detection performance was also measured with the help of experiments conducted through human perception. But certain issues related to illuminants and color components remain unaddressed.

Over a decade, wavelets have been used in signal and image processing that considers time-frequency representation that makes appropriate for image processing. The case scenario that consists of single dimension, the application of wavelets results in optimal representations for piecewise smooth functions. But in case of two dimension, the wavelet bases are suboptimal for denoting the geometric structures that includes edges and texture, as their support value is not significantly applied to the proportions related to the angular geometric. In [4], the author presented a new hybrid method for image approximation that used the advantages of the actual tensor product wavelet transform for the smooth images. Moreover, an easy path wavelet transform was used for the efficient modulation including both edges and texture. But the hybrid method did not open up the possibility for addressing the scenarios including practical images.

One of the most important monitoring factors in our society includes public opinion. As a result it requires most essential to provide the opinion about the quality of image accordingly. It would be more beneficiary if those surveys are replaced using an automatic tool that minimizes the repetitive task enquiring the opinions. The author in [5] designed a model based on the preferences of the human and accordingly the most appropriate method was evolved to measure the tool.

One of the methods of biometrics for effective human recognition is the automatic facial recognition that acts as an efficient mechanism for the purpose of human authentication and identification of human. Like most of the techniques in biometric, the application of facial recognition ranges from policing to civil fields and access control. One among them is the facial recognition which is highly special because they are widely available and easy to acquire. The author in [6] presented a novel face recognition system that included preprocessing, feature extraction and classification, and methods were obtained for score fusion that included situations in an uncontrolled illumination.

To improve the visual perception the author in [8] presented a novel face representation and recognition approach by integrating the information in terms of image space by using multi-scale and multi-orientation methods, scale and orientation domains were obtained using the Gabor filters. By this method the information from different domain area were explored to provide a good representation of face representation for the specific purpose of recognition. Though redundancy was reduced using the Gabor filters, the computational complexity involved in recognizing the face was higher.

The biometric systems involving the hand geometry that includes the verification based on the hand/finger are considered to be the highest user acceptance for biometric traits. This is heavily observed from their widespread developments in the field of commercial applicability around the world. The author in [9] designed a novel mechanism for hand matching that achieved higher performance even in the presence of large hand pose variations. The author used a 3-D digitizer to dynamically obtain the intensity and users' hand range images. The approach also involved the orientation of hand in three dimension followed by pose normalization. Multimodal palmprint including 2-D and 3-D was also presented for features obtained from hand geometry features and were used for matching. But the time involved was high.

Scenarios including multiple sensors applied layered sensing ranging from surveillance to processing of images. Here the area or interest is deployed under different illumination including a number of sensors to provide efficient awareness about the situation than it was possible using a single sensor or single feature. The sensors at the same time also function at different modalities, at different heights or under varied platforms.

The author in [7] presented integrated segment and regions of interest in layered images that included a combination of multiphase active contour technique and a joint segmentation-registration method to obtain optimization but at the cost of time. The author in [14] applied multi-threshold factor to minimize the false regions with the help of kmeans and watershed segmentation method. Finally, the disadvantages of these methods mainly depend on the results obtained through k-means. If the clustering technique was not implemented in a proper manner, the results obtained were also incorrect.

In this paper, an inter-fusion method for the efficient extraction of edge point component using iris and sclera surface patterns is presented, in which each of the components separately filters the iris and sclera surface patterns with different range of the convergent factors. To guarantee the stability as much as possible, the Laplace transformation is applied by successive iterative steps. Followed by this, to extract the edge points in the biometric iris image, filtering operation is performed using the least measure filtering. This filtering operation is performed using least means square technique that reveals the number of pixel points in the iris image starting from the row and column zero.

The correspondence between pixel points is calculated by a radius of the pupil that is heavily subject to filter the unwanted images. Therefore, an inner boundary and outer boundary computation of iris and sclera is introduced that combines the iris and sclera surface using the Eigen vector. To benefit as much as possible and to obtain the accurate result, Laplace transform is applied to reduce the dimension and improve the accuracy rate. The experiments show that the proposed method outperforms other state-of-the-art methods for biometric human identification and recognition.

The paper is organized as follows. The different biometric models for human identification and recognition are discussed in Section I. In Section II, the proposed methodology inner-fusion of iris with sclera surface patterns are elaborated using an algorithm and a framework. Section III provides the details of experiments conducted. Section IV discusses in detail. Section V concentrates on the related work. Finally concludes with Section VI.

II. BIOMETRIC RECOGNITION: INTER-FUSION OF IRIS WITH SCLERA SURFACE PATTERNS

The proposed Inter-fusion of Iris and Sclera surface using Laplace Transform (IISLT) extracts the edge point component.It adopts the preprocessing step in order to remove the rotary motion of the iris. Next the filtering operation aims to extract the edge points in the biometric iris image using the least measure filtering. Finally, Laplace transform is carried out for the accurate recognition of the iris. The overall structure of IISLT is illustrated in Fig. 2.

Fig. 2. demonstrates the step by step process involved in IISLT. The initial step starts with the preprocessing that obtains the iris images from the image acquisition system. During the preprocessing stage, tuning algorithm is constructed for removing the rotary motion in the iris images. The marks in IISLT are also removed from the biometric iris images for efficient filtering ofthe iris images. As the rotary motion and marks in the user's iris reduces the accuracy rate, tuning algorithm is developed to remove that rotary motion and marks.

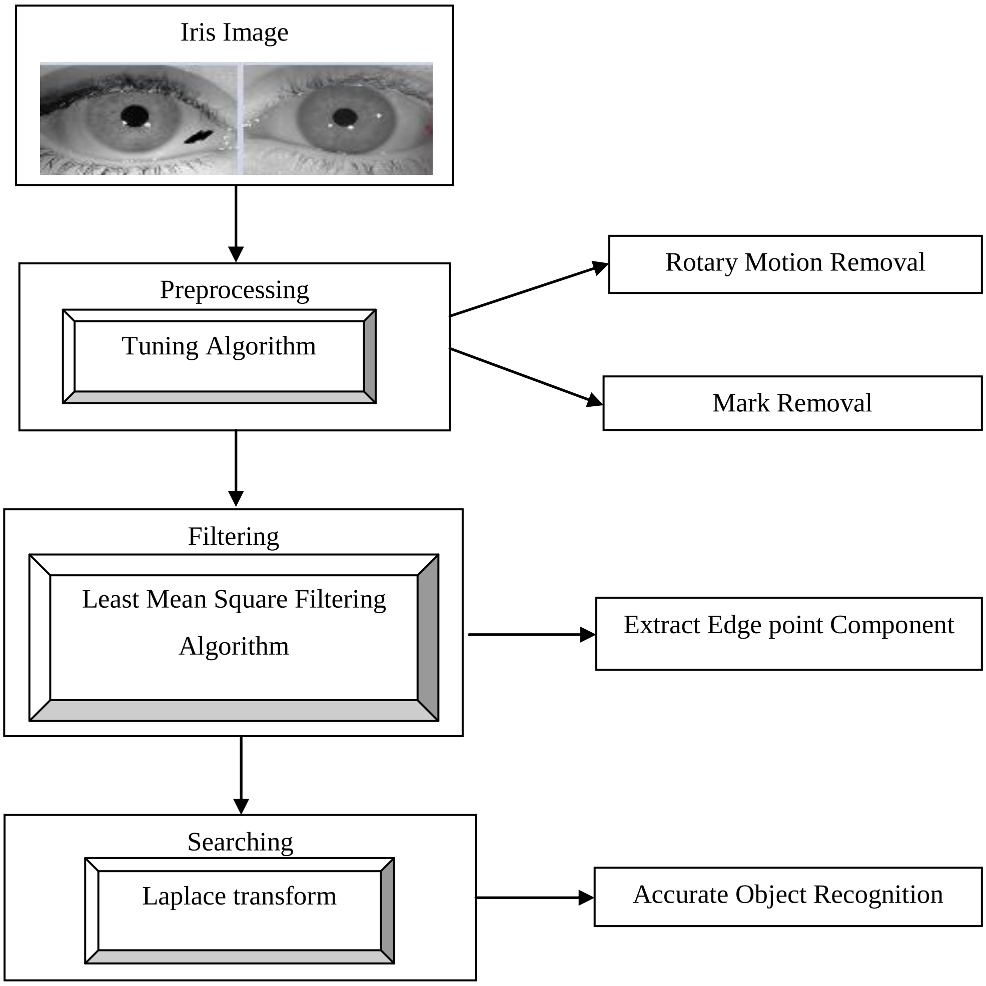

Fig. 2 Overall Structure of the IISLT

Then, IISLT filtering is carried out with the least mean square filtering method. The least mean square filtering method isinspected in order to obtain a range for the convergent factor for reducing the processing time.The convergent in IISLT depends on the Eigen value which spread from the input preprocessed iris image. Eigen value in the least mean square consists of all the linear operators for the standard filtering of unwanted iris images. The Laplace transformation on different quality of images is design for an inter-fusion ocular biometric system by combining the iris with sclera surface patterns.

A. Preprocessing in IISLT

The first step involved in the design of IISLT is the preprocessing. The iris image is preprocessed with the straight up and paralleldown directions on different sizes. The size of the biometric iris image is varied using the illumination variations. IISLT hold normalized iris images which have low and high contrast imageswhereas the pupil of the iris images is constantly darker than the surrounding regions. The iris point is localized exactly in IISLT using the circle fitting method.The circle fitting method is computed as

$\Delta x = \lambda + x$ axis points (1)

$\Delta y = \lambda + y$ axis points (2)

'λ' represents the fitting correction operator and it is summed up with the axis coordinate point to correct the rotary motion of the iris balls in the biometric iris image. The mole detection is carried out in the sclera and iris regions to remove all the marks in the biometric iris image. The iris biometric image before preprocessing step and iris after preprocessing step is illustrated in Fig. 3.

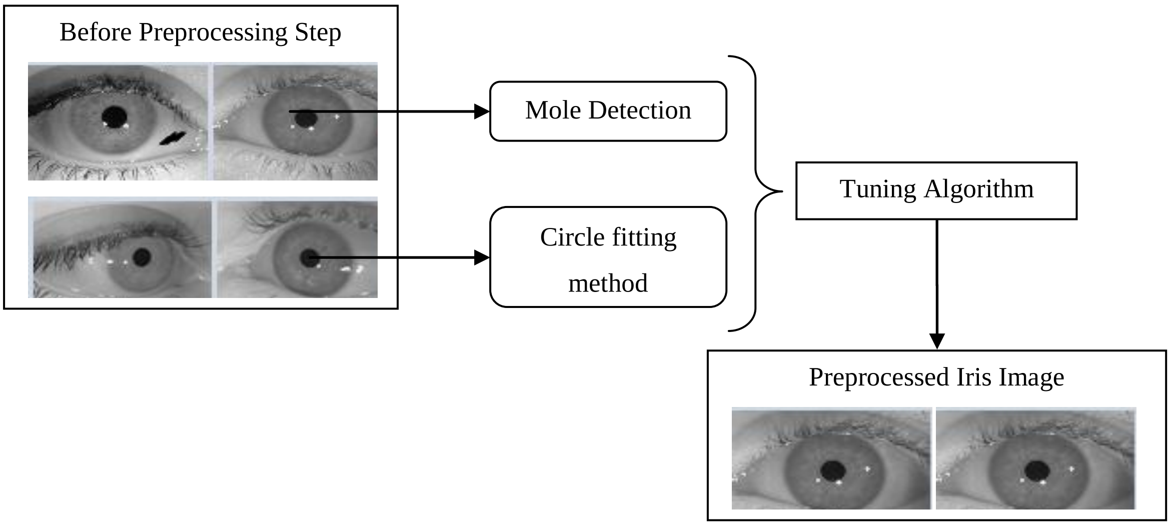

Fig. 3. Procedure of Preprocessing

The IISLT preprocess (i.e.,) pupil edge and the sclera edgein an input iris image are approximated using the circle fitting method.With the differing size of the iris,the iris images are normalized into the same fixed size in the preprocessing step for carrying out the easy processing during the filtering stage.The tuning algorithm is explained as below

Step 1: Left Corner of the image is always considered as the origin point of coordinates to establish the position.

//Rotary Motion Elimination

Step 2: Construct the Circle Fitting method to analyze the rotary motion

Step 3: Rotary motion in IISLT detected, using the 'x' and 'y' axis intersection points

Step 4: Calculate the circle fitting point with Δx and Δy results

Step 5: Adjust the iris position depending on (1) and (2) results

//Mark Removal

Step 6: Construct the Mole detection method on Iris and Sclera spaces

Step 7: Remove the Identified marks in iris Image

Tuning Algorithm combines the rotary motion removal steps and the marks removal steps for obtaining the less intensity result. The preprocessed iris image is taken as the input for the filtering in the IISLT.

B. Least Mean Square Filtering Method

Once the iris image is preprocessed, the second step involved in the design of IISLT is that the preprocessed iris image IP(x,y) after the rotary motion and mark removal is taken for filtering operation. The filtering operation with least means square reveals the number of pixel points in the iris image starting from the row and column zero.

$N(x)$ = No. of row pixel points starting from zero (3)

$N(y)$ = No. of column pixel points starting from zero (4)

In IISLT, $N(x)$ represent the number of row pixel in the preprocessed iris image and $N(y)$ represent the number of column pixel in the preprocessed iris image. The maximum points,$N(x)$ and $N(y)$ is averaged and the center point is computed.

$R = N(x) + N(y) / 2$ (5)

The radius 'R' of the pupil in the preprocessed iris image is computed to filter the unwanted images. The LMS filtering is represented in Fig. 4.

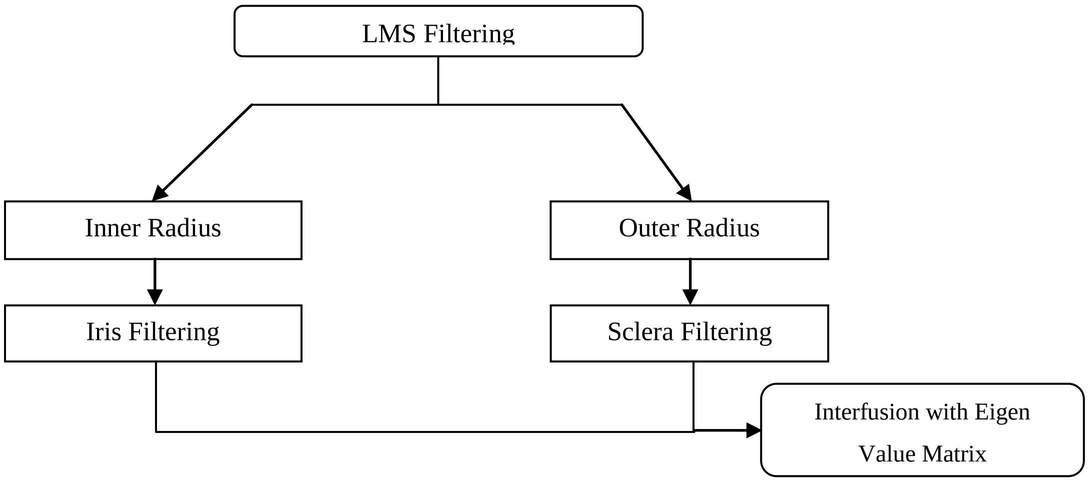

Fig. 4.LMS Filtering Method

As illustrated in the Fig. 4. theinner radius is used to filter out the iris of the eye image and the outer radius is used to filter out the sclera surface of the eye image.The ideal straight up and parallel down direction perform afiltering on the sclera surface for the optimum coefficient vector solution. The filtering vector is formularized as,

$$\left.\begin{array}{r} \text{Initialize } (x, y) = 0 \\ F = W\,(OR + IR) \\ W\,(\text{Eye Image}) = \text{Iris}(x, y) + \text{Sclera}\,(x, y) \end{array}\right\} \quad (6)$$

The steps in least mean square is denoted in (6). 'F' represents the filtering of the Eye Image 'W'. The 'IR' represents the inner boundary computation (i.e.,) iris and 'OR' represents the outer boundary computation (i.e.,) spectral surface. The inter-fusion of iris and spectral surface pattern is performed in (6). The filtering reduces the images which do not coincide with the computed result whereas the coverage achieves multiple directions. Eigen value matrix is the least square matrix carried out for the linear operation of filtering in IISLT, and summarized as,

$f'(x, y) = \ln(\text{Eigen matrix})\ \text{matrix}\ (x, y) = \lambda f(x, y)$ (7)

Eigen vector combines the iris and sclera surface with (x,y)coordinates. The convergent in IISLT depends on the Eigen value matrix which spread from the input preprocessed iris image. Eigen value in the least mean square consists of all the linear operators for the standard filtering of unwanted iris images. LMS filtering with Eigen value extract the edge point through (7) in the biometric iris image.

C. Laplace Transform on Inter-fusion of Iris and Sclera Surface

Once the filtering is performed with the least mean square filtering, the Eigen vector combines the iris and sclera surface sing Laplace transform for consecutive process. The Laplace transform inIISLT takes the filtered images to attain the accurate result rate while recognizing the biometric iris images.The Laplace transform provides an easy way to evaluate different filtered inter-fusion iris and sclera surface images. Let us assume that$f'(x, y)$ is continuous function, then the transformation is described as given below,

$$LT = \int K f'(x, y)\, dt \qquad (8)$$

'LT' denotes the Laplace transform with 'x' and 'y' coordinates where the integral transform assigns a function f' (x, y) and lies between x and y.The Laplace transform on inter-fusion is well suited to recognize the biometric iris image with high accurate rate. In IISLT, Laplace transform with many relationships and operations (i.e.,) different quality images is a useful property over the original f'(x,y).

The f'(x,y) correspond to least mean square filtering method improves the accuracy rate with minimal processing time because of the Eigen vector value usage. Laplace transform reduce the dimension of the iris features into heuristic outcome for satisfying biometric iris recognition results.LM usage in the inter-fusion recognizesall quality of iris images effectively. IISLT basic idea is achieved with respect to all the above implemented steps.

III. EXPERIMENTAL EVALUATION

Inter-fusion of Iris and Sclera Surface using Laplace Transform in biometric recognition is experimented with MATLAB coding. IISLT uses the Quality—Face/Iris Research Ensemble (Q-FIRE) iris images for experimental work. Iris sequences in Q-FIRE are collected at varying distances and quality. The iris biometric dataset collection contains images of iris and face biometric modalities. The iris images taken from the OKI IRISPASS EQ5016A devices and Dalsa 4 M 30 infrared camera devices are taken in IISLT for experimental work.

To produce non-uniformity in the Q-FIRE dataset, data acquisition equipment (i.e.,) Dalsa and Canon cameras was controlled to achieve high, medium, and low quality iris images. Each device holds175 subjects, which includes height and weight, subjects of different age groups, ethnicity and gender observed for different sessions. The experiment is conducted in Q-FIRE dataset on the factors such as accurate rate of iris recognition, rotary motion correction rate, filtering efficiency of preprocessed image, processing time, false reject rate.

The accuracy rate of iris recognition system in IISTL model is identified using the two parameters namely, authentic distribution and impostor distribution. Here the authentic distribution of iris recognition system in IISTL model measures the match values of the two iris images of the same eye whereas the impostor distribution measures the match of the two different iris images. Rotary motion correction rate in IISTL model refers to the rate of removal of rotary motion present in the iris images during the preprocessing stage.

The mark removal error rate in IISTL model identifies the error rate obtained during the removal of marks in the iris images. The filtering efficiency of the preprocessed image is defined as the summation of 'IR' that represents the inner boundary computation of the iris and 'OR' that represents the outer boundary computation of the spectral surface. Processing time refers to the time taken to perform the overall operations of iris recognition. The false rejection rate for IISTL model is the evaluation of the likelihood that the IISTL model incorrectly rejects an access attempt by an authorized user which is evaluated as given below.

FRR = Number of false rejections / Number of attempts made

IV. RESULT ANALYSIS OF IISLT

The IISLT model is analyzed against Segmentation of degraded images using Deterministic Linear-time (SDL) method and Sclera Segmentation method using Multispectral Conjunctival Vasculature (SSMCV). Each technique has its own respective accuracy level and filtering efficiency. The existing and proposed result is analyzed through table values and graph points. TABLE I tabulates the accuracy rate with respect to the number of images used. We make a comparison of our model IISTL, SDL method and SSMCV method.

Table I Tabulation of accuracy rate

No. of images used	Accuracy Rate		
	SDL Method	SSMCV Method	IISTL Model
10	52	55	60
20	57	60	67
30	62	66	73
40	65	70	75
50	70	72	78
60	72	75	80
70	75	78	83
80	78	80	85

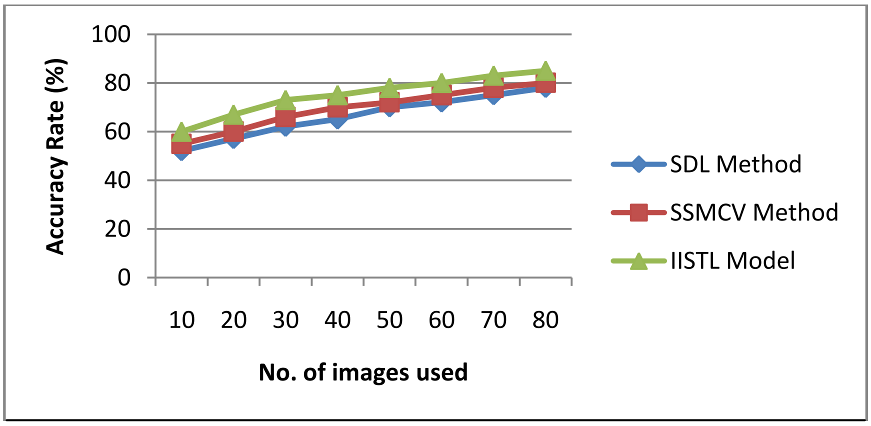

Fig. 5. No. of images used Vs Accuracy Rate

Fig. 5. illustrates the accuracy rate measured using our model IISTL. Comparisons of accuracy rate are made with two other methods, Segmentation of degraded images using Deterministic Linear-time (SDL) algorithm [1] and Sclera Segmentation method using Multispectral Conjunctival Vasculature (SSMCV) [2]. From the fig. 5. it is illustrative that the accuracy rate is higher using IISTL model. This is because of the application of tuning algorithm, removes the rotary motion and marks present in the iris images by increasing the accuracy rate. Also with the introduction of Laplace transform on inter-fusion, the biometric iris image is recognized with high accurate rate. Comparatively, the accuracy rate in IISTL model is improved by 10-15% when compared to the SDL method and 13-18% higher than the SSMCV method.

The rotary motion correction rate of our IISTL model is presented in TABLE II. It is easy to find that the rotary motion correction rate is improved using IISTL model than the state-of-art methods.

Table II Tabulation of rotary motion correction rate

No. of images used	Rotary motion correction rate (%)		
	SDL Method	SSMCV Method	IISTL Model
10	38	40	42
20	41	43	45
30	44	47	50
40	46	48	55
50	50	51	58
60	51	55	62
70	53	58	65
80	56	60	68

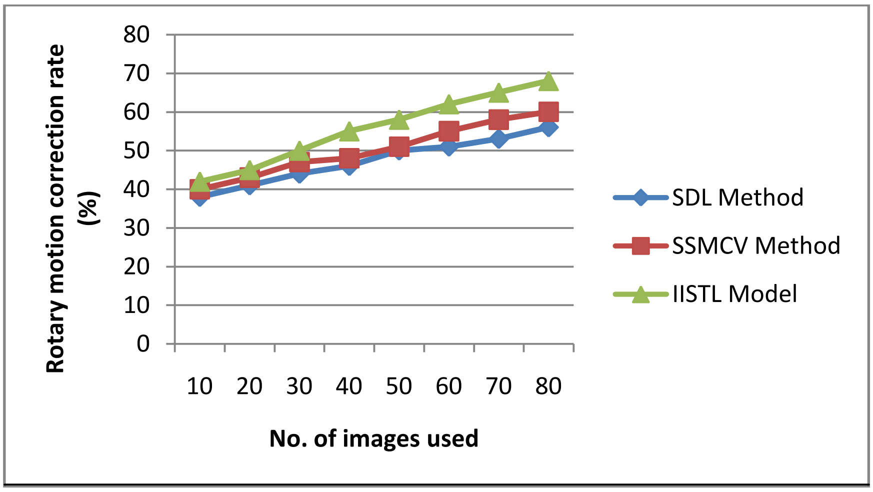

Fig. 6. No. of images used Vs Rotary motion accuracy rate

Fig. 6. describes the rotary motion accuracy rate based on the number of images used. The number of images used is exactly preprocessed using the tuning algorithm and improve the rotary motion accuracy rate by 8-18 % when compared to the SDL [1] method. As the number of images is increased, the rotary motion accuracy rate is also improved gradually. The iris image is preprocessed using the straight up and parallel down directions for different size images being used with the size of the biometric iris image varied using the illumination variations and as a result the rotary motion accuracy rate is improved by 5 – 18 % in IISTL model when compared to the SSMCV [2] method.

TABLE III describes the filtering efficiency on images learning based on the number of iris images given as input. As the image count improves, the filtering efficiency rate is also improved.

Table III Tabulation of filtering efficiency

Images learning	Filtering efficiency (%)		
	SDL Method	SSMCV Method	IISTL Model
10	35	40	43
20	38	43	48
30	42	47	52
40	45	52	55
50	50	60	63
60	52	65	70
70	60	60	72
80	62	72	75

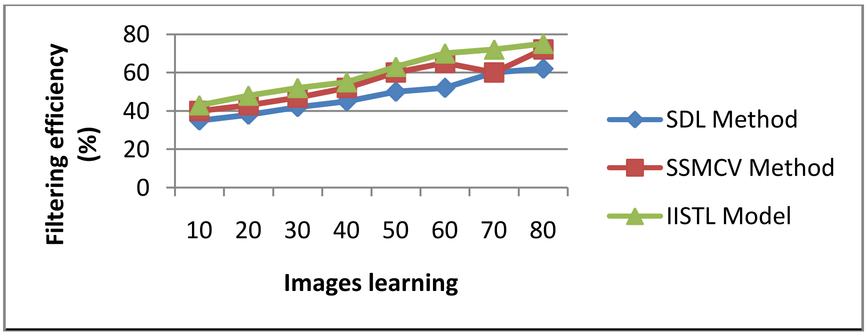

Fig. 7. Images learning VsFiltering efficiency

Fig. 7. describes the filtering efficiency with respect to the images learning for the SDL method, SSMCV method and IISTL model. IISTL model filters the unwanted images using Least Mean Square (LMS) for effective filtering of iris and sclera surface patterns on different range of the convergent factor, improves the filtering efficiency rate by 16- 25% when compared to the SLD [1] method. The filtering efficiency is improved by the preprocessing applied using the tuning algorithm.The radius 'R' of the pupil in the preprocessed iris image is evaluated that filters the unwanted images with 4-16 % higher filtering efficiency in IISTL model when compared to the SSMCV [2] method.

Table IV Tabulation of processing time

Images learning	Processing time (ms)		
	SDL Method	SSMCV Method	IISTL Model
10	30	28	25
20	32	30	28
30	34	33	30
40	36	35	32
50	40	39	34
60	42	40	36
70	44	41	38
80	45	42	40

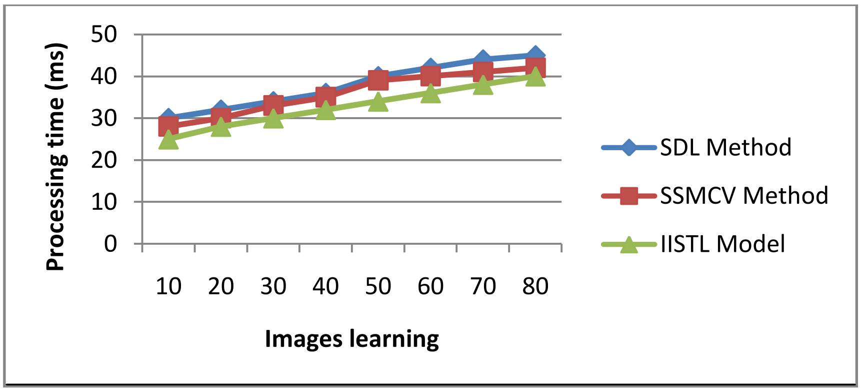

Fig. 8. Images learning Vs Processing time

TABLE IV and Fig. 8. presented the measure of processing time based on the number of images given as input. IISTL model uses the least mean square filtering method to build the system with 12 -20 % improved when compared to the SDL [1] method. With the application of Eigen value matrix calculates the inner and outer radius and as a result the processing time is improved by adapted rate is improved by 5 – 14 % when compared to the SSMCV [2] method.

Table V Tabulation of false rejection rate

No. of images used	False Rejection Rate (%)		
	SDL Method	SSMCV Method	IISTL Model
10	25	20	15
20	28	23	18
30	32	25	20
40	35	28	22
50	40	32	25
60	45	34	28
70	50	40	30
80	55	42	32

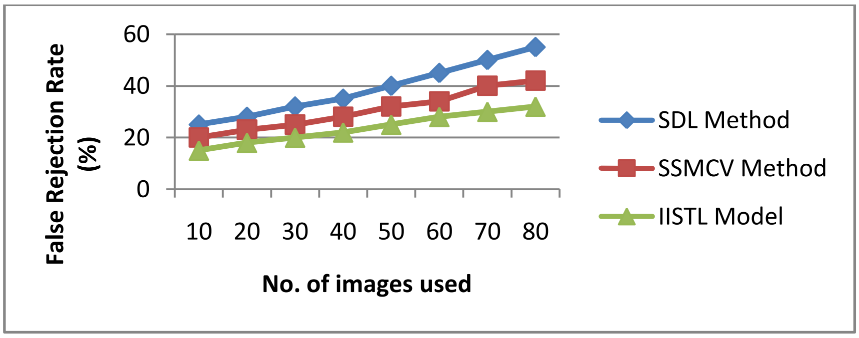

Fig. 9. No. of images used Vs False Rejection Rate

TABLE V and Fig. 9. illustrate the false rejection rate based on the number of images used. The Laplace transform in IISLT takes the filtered images to attain the accurate result rate while recognizing the biometric iris images and as a result the false rejection rate is improved from 55 -70 % in IISTL model when compared to the SDL [1] method. The Laplace transform on inter-fusion is well suited to recognize the biometric iris image with high accurate rate and as a result the false rejection rate is improved from 25-33% when compared to the SSMCV [2] method.

Finally, inter-fusion of iris and sclera fusion patterns using tuning algorithm and Laplace transform corrects the rotary motion of iris images and mark removal to improve the accuracy rate and to minimize the false rejection rate. Further with the application of Laplace transform searching process is improved by minimizing the processing time. As a result, IISTL, improves the accuracy rate of iris recognition and improves the filtering efficiency of the preprocessed image.

V. RELATED WORKS

The estimation of Albedo from an input facial image is highly significant for different tasks related to computer vision that include 3-D morphable-model fitting, recovery of shape, recognition of face and so on. Though different methods are available, they do not provide good estimation results. Certain methods do not consider the inclusion of cast shadows and highly need a model based on the statistical properties to obtain facial albedo. This paper [10] described a method for estimation of albedo estimation that uses both the intensity of the image and in depth information of the face that includes cast shadows and general unknown light. As a result, the intensity error is minimized but under the general assumption that the surface of the face has constant albed.

One of the important methods included in the pattern recognition system is the biometric model that identifies the user by evaluating the unique characteristics of a user. In [11], the author presented an efficient multimodal biometric recognition method using finger knuckle print and palm print to obtain a multimodal biometrics. With the help of the extensive features, the local information of the palm print was extracted and were fused at different matching score level. During the recognition phase, the features that were registered and the queries provided were matched with the database using the most familiar neighborhood ratio method called as the Nearest Neighborhood.

The features that were derived were then fused using the rule called as the weighted sum in order to obtain fused matching score. In [12], a biometric access control system was designed with the features extracted using finger print were obtained. In order to enhance the process, Gabor filter was then applied to improve the quality of images being obtained. But the aspect of security was compromised. Face and signature [13] were used as the bimodal biometric system to increase the accuracy rate using score level fusion approach. The accuracy rate was improved by 10%. To increase the accuracy rate advanced pattern recognition techniques remained an open issue.

VI. CONCLUSION

We have presented an Inter-fusion of Iris and Sclera Surface using Laplace Transform with preprocessing, filtering operation and searching for different iris images. First, we proposed a preprocessing method based upon the rotary motion of iris images and mark removal using the Tuning algorithm. We also proposed Least Mean Square Filtering operation, which basically consists of number of pixel points in the iris image starting from the row and column zero where the maximum point is averaged and center point is evaluated. Then inter-fusion is performed using the Eigen value matrix where the inner radius filters the iris image and the outer radius filters the sclera surface of the eye image. Moreover, to obtain the accurate result, Laplace transform is applied on inter-fusion of iris and sclera surface that improves the accuracy rate and with minimal processing time. Compared with the other state-of-the-art methods, the proposed system demonstrated successful accurate rate of iris recognition accuracy with minimum false rejection rate using different set of images.

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