Retinal vascular Segmentation, classification and Verification using particle swarm optimization for biometric application

M. Ezhilarsan[1], G. Thavaseelan[2]
PG Scholar[1], Assistant Professor[2]

St. Peter's University, TN, India

Abstract— Biometric authentication plays an important role in this paper. Biometrics is measurable biological (anatomical and physiological) and behavioral characteristics that can be used for automated reorganization Among the features measured for physiological are face reorganization, finger prints, hand and finger geometry, iris, retinal, signature, vein pattern and voice reorganization. Behavioral characteristics are keystroke dynamics, voice, gait, and signature dynamics. Biometric technology are becoming for highly secure identification and personal verification. Biometric technology is now being used in almost every area. As the level of security and safety infringement and transaction scam increases, to prevent fraudulent acts and stealing of possessions and ensure safety and security thus decrease crime rates. A new supervised method for segmentation retinal vascular in retinal photographs is implemented in the project. The methods are (i) Kirsch's Templates (ii) particle swarm optimization. The purpose of this method is to automate the retinal image biometrics. Using the retinal image biometrics the persons can be identified.

Keywords—Segmentation, Kirsch's Templates, particles swarm optimization, Biometrics matching

I.INTRODUCTION

A biometric system is essentially a pattern recognition system. Today security has become important concern for the society. Societies need this security so maintain track of their daily operation and their information. To implement this security many choices are available in marketplace one of which is biometrics this document includes featured research in relation to biometrics. Bio means related to biology. Metrics indicated – The science of measurements. Fundamental operations in biometrics are Capture, Extraction, Comparison and Match or Non Match. During Capture process, raw biometric is captured by a sensing device such as a fingerprint scanner or video camera. The second phase of processing is to extract the distinguishing characteristics from the raw biometric sample and convert into a processed biometric identifier record. Next phase does the process of enrollment. Here the processed sample is stored or registered in a storage medium for future comparison during an authentication.

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In many commercial applications, there is a need to store the processed biometric sample only. The original biometric sample cannot be reconstructed from this identifier. Biometrics recognition types are voice print recognition first record the voice print of the person whose voice is to be recognized. The sample voice print examined for many features so that it coordinates with that sample voice print with machine. Biometrics was been founded during prehistoric time. Chinese used fingerprinting in the 14th Century for recognition. In the 17th century fingerprinting was used to seal authorized documents. Biometrics was been discovered by Francis in 1892. It actually came to be used as it had many innovations and innocence is become popular. Phases of biometrics are Input, Process and Output. Biometrics stands for the measurement of nuclear arms, Life measurements, measuring size of DNA stands and the study of whether home hold plant life will someday grow into a tree. These peculiarities are summarized by a computer and used to make one-to-one verification and one-to-many comparison based on one-off features. Biometrics was first used in during the first DPS Session, the first James Bond Movie, Prehistoric times, During the Nixon Administration.

Biometric recognition requires to compare a registered or enrolled biometric sample against a newly captured biometric sample followed by a Verification or Identification process. Biometrics recognition types are voice print recognition first record the voice print of the person whose voice is to be recognized. The sample voice print is examined for many features so that it coordinates with that sample voice print with machine. The feature that mainly counts on voice print is vocal activities and the characteristics of the vocal cord. Finger print brings the print or image of the configuration of fingers and then scans them. In this kind of recognition iris which is placed behind the cornea. Iris recognition has almost 266 patterns of iris. This type of recognition uses several categories of features of face to recognize the users face.

Hand geometry uses the shape of the user's hand. Hand scanners are used to recognize the user's hand. Retina Scan the blood vessels which are located in our eyes In this kind of recognition the user is made to enter on keyboard and the time variation between their entering keystroke is calculated and them the user is recognized.

Facial Recognition is one of the modern developments and this contains Facial Metrics and Eigen Faces. In this kind of recognition the user is recognized from the way he signs and the strokes the compression throughout the signature is being observed Biometrics is being generally used for security intention and there are many new improvements coming up in marketplace for biometrics. So the Biometric technology is becoming for highly secure identification a person verification. Biometric technology is now being used in almost all area

Human face image evaluation, recognition have grow into some of the most significant research subjects in the field of computer vision and design organization. The potential applications involve subjects such as face recognition, face recognition and recognition, and facial appearance evaluation. Among these research subjects, one primary but very significant drawback to be solved is regular eye recognition. The eye is the most significant feature in a human face, as removal of the eyes is often simpler as balanced to other facial features. Eye recognition is also used in person recognition by iris matching. Only those image segments that comprise possible eye pairs will be fed into a consequent face verification system. Localization of eyes is also an essential step for many face design techniques. For comparing two faces, the faces must be aligned.

As both the positions of eyes and the inter pupillary distance between them are reasonably constant for most person, the eyes are often used for face image normalization. Eye localization also further facilitates the recognition of other facial landmarks. In addition, eyes can be used for crucial face appearance evaluation for human computer relations as they often reflects a person's emotions. The commonly used technique logy for passive eye recognition includes the template matching technique [5, 6], eigen space [2, 3, 7] technique, and Hough transform-based technique [1, 4]. In the template matching technique, fragments of an input image are compared to previously stored images, to evaluate the similarity of the colleague using correlation values. The drawback with template matching technique cannot deal with eye changes in scale, appearance, revolution and illumination. Use of multi scale templates was somewhat helpful in solving the previous drawback in template matching. A technique of using deformable templates is proposed by Yuille et al [8]. This offer the advantage of finding some extra aspects of an eye like its shape and size at the same time. But the rate of success of this technique depends on initial position of the template. Pentlands et al. [7] proposed an eigen space technique for eye and face recognition. If the training record is changeable with respect to appearance, orientation, and illumination, then this technique offer better performance than simple template matching. But the performance of template matching techniques is intently related to the training set used and this technique also expects normalized training sets and test images with respect to size and orientation. Another standard eye recognition technique is obtained by using the Hough transform. This technique is based on the shape aspect of an iris and is often used for binary valley or edge maps [9, 10].

The drawback of this method varies on performance of threshold values used for binary conversion of the basins. Apart from these three traditional approaches, newly many other image-based eye recognition techniques have been reported. Feng and Yuen [11] applied strength, line joining direction of centers of the eyes, the solution of convolving an eye variation filter with the face picture, and the variation projection function (VPF) [12] technique to recognize eyes. Zhou and Geng [13] extended the knowledge of VPF to the generalized projection function (GPF) and showed with tentative solutions that the hybrid projection function (HPF), a specific case of GPF is improved with comparing of VPF and integral projection function (IPF) for eye recognition. Kawaguchi and Rizon [9] traced the iris using strength and edge information. They used present patterns, a separability filter, the Hough transform, and pattern matching in their algorithm. Sirohey and Rosenfeld [20] proposed an eye recognition algorithm based on linear and nonlinear filters. Huang and Wechsler's method [14], applied genetic algorithms and built conclusion trees to recognize eyes. For the intention of face recognition, Wu and Zhou [18] retained size and intensity information to find eye-analog sections from a gray dimension image, and used the specific geometrical relationship to filter out the possible eye-analog pairs. Han et al. [16] applied such techniques as morphological closing, conditional dilation and a labeling process to recognize eye-analog sections. Hsu et al. [17] used colour information for eye recognition.

Although much effort has been spent and some progress has been made, the drawback of regular eye recognition is still far from being fully solved owing to its complexity. Features containing facial appearance face revolution in plane and depth, blocking and lighting conditions, all definitely affect the performance of eye recognition algorithms. The technique proposed in this paper involves skin recognition to eliminate background components followed by eye recognition. Remote recognizing is a natural expansion of the human being need to discover and understand its environment. Through developments in technology, men have been able to encompass the way we see the world to a perception never before possible. Using flying and space borne stages, complex imaging systems that exceed the drawbacks of the human eye are used to observe the Earth. Through these systems, we can now see in spectral segments that were previously invisible to the unaided eye.

The facility to remove data about our world and present it in ways that our visual perception can understand and is the ultimate goal of imaging science in remote sensing. In all applications--from environmentally supervising to brainpower information gathering the need to achieve more accurate information in a timely and efficient manner continues to develop exponentially. It is precisely because of this instant development that a broad range of technologies is offered in this statement. Particle group Optimization is methodology to drawbacks whose solutions can be characterized as a point in an n-dimensional resolution space. A number of *particles* are arbitrarily set into motion through this space. Each repetition, they perceive the health of themselves and their neighbors and

imitate successful neighbors (whose present situation represents a better solution to the drawback than theirs) by moving towards them. Several techniques for grouping particles into challenging, semi-independent *multitutes* can be used, or all the particles can belong to a single global *multitute*. This extremely simple technique has been unexpectedly effective across a variety of drawback domains.

II.METHODOLOGY

In this process the retina image is first processed by preprocessing filter and all the unwanted pixels are filtered and removed from the image. Then the image is sent for further processing to the particle swarm optimization (PSO), Statistical analysis and kirsch's template. During this stage the kirsch's template focuses on the corners of the images and develops a better image for presentation where the PSO analyze all the available nerves and selects the best nerve for the further analysis. Finally the statistical analysis selects the mean and variance of the pixel which is good and sends it to the final stage of the biometric matching. The biometrics matching of images can be done by following expression

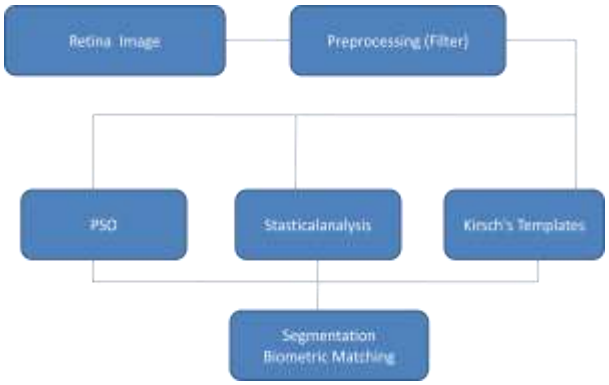

FIGURE 1:BLOCK DIGRAM

III.IMPLEMENTATION

Segmentation is to divide an image into meaningful structures is called segmentation, is often an essential proceed in image analysis, object representation, visualization and many image processing take place in. Segmentation algorithms are generally based on 2 basis properties (i) discontinuity (ii) similarity. Partition based on abrupt changes in intensity is called discontinuity. Partition based on intensity similarity is called similarity. Homogeneity of regions is used as the main segmentation. Gray level, color, texture, shape model objects can be identified. Watershed, Image enhancement, contour, top and bottom transmission, complementary this all segmentation don in this paper as show in output in the result. The segmentation of the output is retinal image going to next stage of pre-processing filter.

In this stage it flit all the unwanted pixels and removed the noise also in the hyper spectral image retina this filter is a liner filter. After filter processing the retinal image is move to Kirsch Templates for edge detector.

The Kirsch Templates is a Kirsch compass kernel is a non-linear edge detector it should find the maximum edge strength in a few predetermined directions. Kirsch templates size is 3x3 matrix is used for the extraction the blood vessels from retinal image Edge detection is a process of identify a pixel values. The Kirsch Templates directions are North, Northwest, West, Southwest, South, Southeast, East and Northeast. In these 8 directions it rotates 45 degree increments through the direction for maximum magnitude.

$$h_{n,m} = \max_{z=1,\ldots,8} \sum_{i=-1}^{1} \sum_{j=-1}^{1} g_{ij}^{(z)} \cdot f_{n+i,m+j} \quad (1)$$

$$h1=\begin{bmatrix}5 & -3 & -3\\ 5 & 0 & -3\\ 5 & -3 & -3\end{bmatrix} \qquad h2=\begin{bmatrix}-3 & -3 & -5\\ -3 & 0 & 5\\ -3 & -3 & -5\end{bmatrix}$$

$$h3=\begin{bmatrix}-3 & -3 & -3\\ 5 & 0 & -3\\ 5 & 5 & -3\end{bmatrix} \qquad h4=\begin{bmatrix}-3 & 5 & 5\\ -3 & 0 & 5\\ -3 & -3 & -3\end{bmatrix}$$

$$h5=\begin{bmatrix}-3 & -3 & -3\\ -3 & 0 & -3\\ 5 & 5 & 5\end{bmatrix} \qquad h6=\begin{bmatrix}5 & 5 & 5\\ -3 & 0 & -3\\ -3 & -3 & -3\end{bmatrix}$$

$$h7=\begin{bmatrix}-3 & -3 & -3\\ -3 & 0 & 5\\ -3 & 5 & 5\end{bmatrix} \qquad h8=\begin{bmatrix}5 & 5 & -3\\ 5 & 0 & -3\\ -3 & -3 & -3\end{bmatrix}$$

Figure 2: Kirsch's convolution kernels

Kirsch template is well work for images giving clear distinction between the background and foreground. The retinal blood vessels can be considered as required foreground information from hyper spectral image images, Kirsch algorithm can effectively applied in my paper and that image go for next stage of particle swarm optimization

The particle swarm Optimization is a mechanism is used to find the max or min value of a function to process. This mechanism is used for a maximize efficiency, production, are some other measure. The particle swarm Optimization can be refer to either minims or maxims. The maximization of a function f is equivalent to minimization to the opposite function. The value n denotes the number of dimensions in the search space, and the number of parameters involved in the optimization problem. The function f is objective function, which maps the search space of the function space. Since a function has only one output, this function takes space only one-dimensional. This single fitness value determines the optimal set of parameters for the desired task.

The PSO algorithm works in simultaneously maintaining several candidate solutions for the search space. During the algorithms is checked each iteration of the candidate solution is evaluated the objective function of the optimized, determining the fitness solution of each candidate solution can be thought the particle flying the fitness landscape finding the maximum or minimum of the objective function. In this paper PSO is used for analyze retinal nerves. First we take one retina for verification is that retina good for verification mean go for next state. Retina is bad for verification mean the PSO check which one is best retina for verification and select that retina image for next state is statistical analysis and biometric matching.

Statistical analysis is used for learning the subject is to find principles of numerical reckoning and is practicable methods for measuring quality of subject. Statistical analysis is determination from the probable of possible. in my project statistical analysis is measuring a retinal image pixel by mean and variance of the pixel value and give best pixel value image for verification that image is go for biometric matching. The biometrics matching of images can be done by following expression in this expression we check the image same are not.

idn = sqrt(sum((I2(:) - I(:)).^2)) / sqrt(sum(I(:).^2))

IV. RESULTS:

The results for segmentation and kirsch template processes are as follows. Top transmission(Figure 3), bottom transmission(Figure 4) Image enhancement(Figure 5), complementary images(Figure 6) Watershed image(Figure 7), contour image(Figure 8), kirsch templates image(Figure 9), Particle Swarm Optimization(Figure 10), Differential Particle Swarm Optimization(Figure 11), Fractional D Differential Particle Swarm Optimization (Figure 12) and final stage is image matching. The image matching is done with the help expression (2) give two image to the matching expression both same mean it show image is same if the image is same mean it show mismatch image

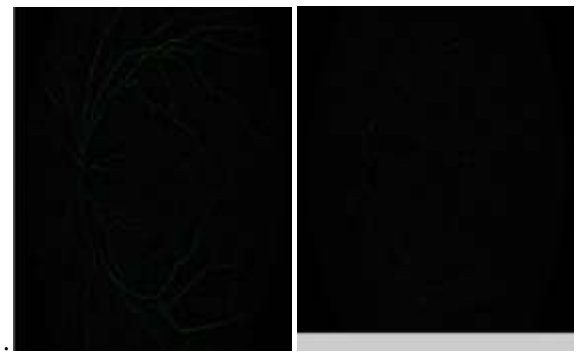

Figure 3 Figure 4

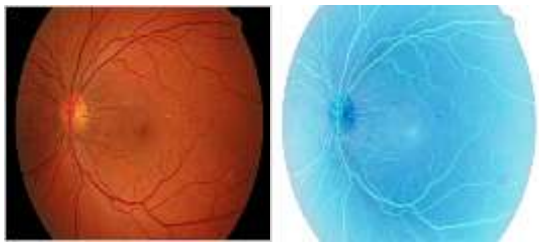

Figure 5 Figure 6

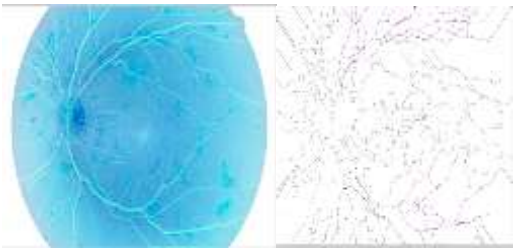

Figure 7 Figure 8

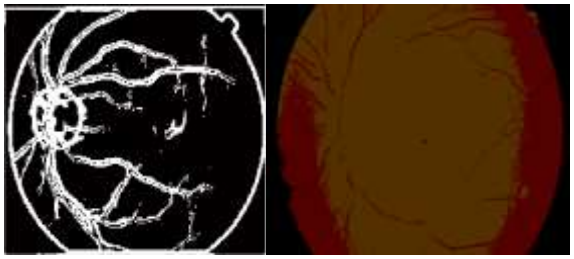

Figure 9 Figure 10

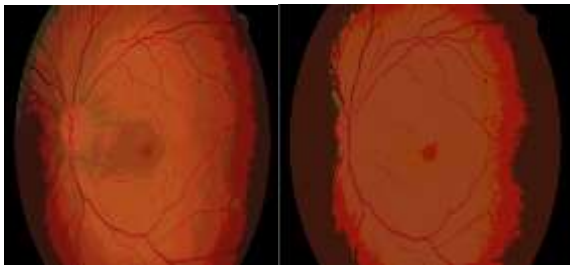

Figure 11 Figure 12

V.CONCLUSION

This project is based on biometric application which I have used for identifying a person by her/his retina. I have employed the kirsch template and particle swarm optimization methods in my project as well total of 60 images were tested in my project for which the desired output was delivered for 45 images.

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