Design and Implementation of Multi-Modal Feature Extraction for Bio-Authentication

Kamatchy B, P. Dhanalakshmi

Abstract*: Design and implementation of Feature extraction of study of biometric images is being evaluated here. The major challenge in image processing technology is that predicting the uniqueness of the input. Such a system encloses a variable performance when compared with the traditional method. Palm vein recognition is a unique biometric authentication method based on the reliable authentic patterns of veins in the palms of people's hands. Palm vein recognition systems, compare the database of various images and does the feature extraction technique. As an added technique to increase the authentication accuracy now a day's multiple biometrics with Multi-modal feature extraction is mandatory. Here iris based authentication is also extracted to evaluate the improved authentication process in any kind of secured communication.

Index Terms*: Multi modal feature study, iris recognition palm vein recognition, global authentication, and biometrics .

I. INTRODUCTION

The world is now connected with the common cloud of internet. Due to the increasing growth in life style and improved level of economic status so many applications are evaluated to grab our information even without our knowledge. People started getting all the things in online by simply providing their authentication information such as bank account details pin numbers passwords photos finger prints and even digital signature is in use very widely.

One side the evaluation of such a huge level of fast mode of communication is interested but still the sharing of our important information to the unsecure platforms create large level of small losses. Authentication is become mandatory not only through face or finger print since that can be now a days created fake by many peoples and so many news rolling over there.

Aadhar is one of the greatest evaluations in our country in which we provide tri-metric approach which we can also call as first level of multi-modal biometric system. In Aadhar card the face of the individual, finger print and eye ball are scanned and authentication vectors are created.

Aadhar become mandatory for many authentication platforms in which providing the unique details of Aadhar gives us the access to various government schemes and provides numerous benefits. The leakage of information through Aadhar is also increased. So it is mandatory to create more unique vectors through extracting unique features and creating a new feature vector model.

A. Influence of Smart phones

Now a days smart phone usage keeps on increasing with the emerging growth of low cost mobile technology and the influence of internet of things. We have started conveying information in the form of image, data, voice and video to transmit the information very fast and precise. Formations of information transferring platform smart phones are also started grabbing the information which we are storing in the form of data or text. That information somewhere creates traffic in internet platforms.

One side the increased technology, the options and usage experience attract the people's eye which increase the usage time of the mobile phones too. Most of the mobile phones are having biometric authentication systems present inbuilt in it. To increase the secure condition of the information provided by us so many research activities are carried out to improve the authentication accuracy.

II. METHODOLOGY

A. Multi-Modal Feature Study

As the name implies multi-modal feature extraction study is used to create multiple unique features through various algorithms which are proven concepts in the theory. Feature extraction techniques are available a lot in software in use. Combining more than one feature extraction technique to form a hybrid technique is called multi-modal feature extraction.

B. Palm Vein Scanning System

Generally Palm vein scanning systems, are those for finger vein ID, the technology used to apply the infra-red rays to the palm part of the hand and the way hemoglobin in the veins reacts to the applied infra-red rays.[6] The blood's hemoglobin is oxygenated in the lungs and the arteries then carry the oxygenated blood to deliver oxygen to tissues throughout the body. The veins carry deoxygenated blood back to the heart.

Normally a palm scanner is used to capture the raw image or raw appearance of the hand in which the veins are flowing. The raw data is nothing but the reflected rays of the vein when applying the infra-red rays into it. The infra-red rays are applied to the certain frame of the area. The remaining parts are black in color hence the vein portion alone be highlighted and reflected back [6].

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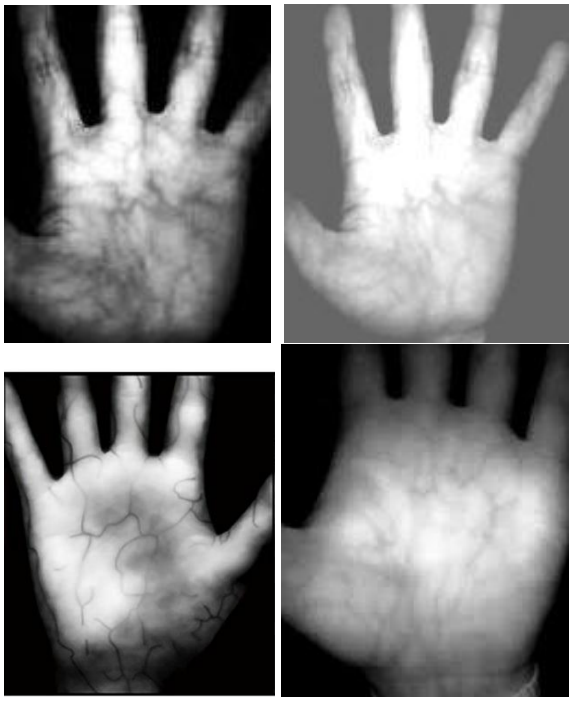


Fig1 Palm Vein Input Samples

The infra-red rays are applied to the certain frame of the area. The remaining parts are black in color hence the vein portion alone be highlighted and reflected back [6]. Normally the flow of veins is unique for each and every person hence it can be easily used to authenticate the person when comparing with the pre-stored values in the database.

Benefits of palm vein recognition systems:

- The Palm vein based multiple biometrics technique is very much benefited to find out the uniqueness present in the human.
- It acts as a Permanent unique ID for each and every person.

C. IRIS Scanning System

IRIS patterns are another important biometric thing now-a-days in which the uniqueness present in the iris of each person cannot be predicted by the simple systems. The iris is nothing but the pattern present inside the eye ball. While getting the information from eye ball using various source sensors like eyeball sensors the cost of installing the sensor would be increased and added extra complexity too. The usage of camera become very frequent now a days hence by using normal camera and HD camera so many biometric processes are undergoing.

The biological characters of iris are considered for biometric verification. Normally the iris is brown, blue and gray in color sometimes greenish in color with complex patterns that are visible only when closely absorbing the eye. The application of Iris recognition in health care authentication, cloud simulation, secret accessing, banking and biometric access systems in various places.

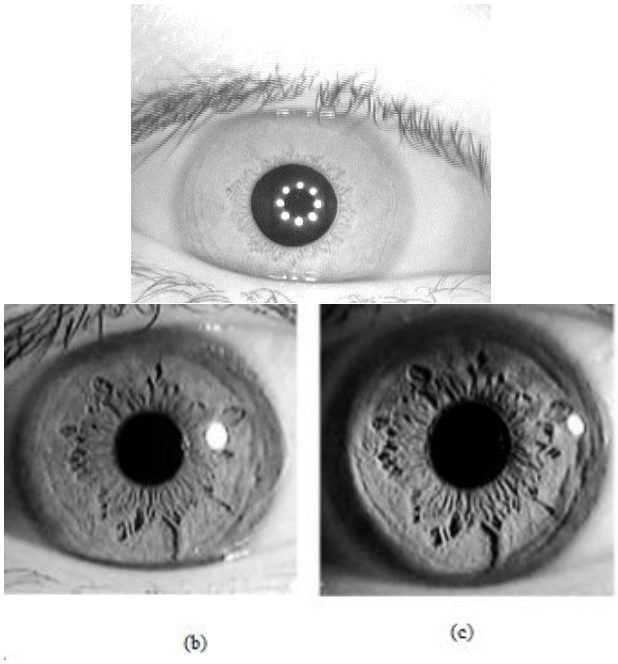


Fig 2 (a) Input IRIS image sample (b),(c) Samples of IRIS atterns

III. SYSTEM DESIGN

A. MATLAB Image Processing

MATLAB is a high end visual tool and technical computing platform in which various numerical computing are feasible in a fast way. It contains various applications and inbuilt user commands which are incorporated with various scientific computing methods. The handling of matrix based applications are processed well in MATLAB Image processing toolbox.

B. Image Processing Toolbox

Image processing toolbox incorporates various useful acquisition steps involved to get maximum information from the captured image, the unique features from the image, resizing the image, enhancing the image, removing the noise from the image etc. Image Processing toolbox is also useful for getting the live data in real time.

Image processing process the color image and gray scale image, the input here are the palm vein and iris are initially preprocessed with the help of image processing toolbox. Image enhancement, filtering is done to remove the unwanted features of the input image.

IV. DESIGN IMPLEMENTATION

A. Design Diagram

This module consists of preprocessing the input palm print image and iris image. The palm vein images are captured using the IR sensed camera to get the accurate vein flow.

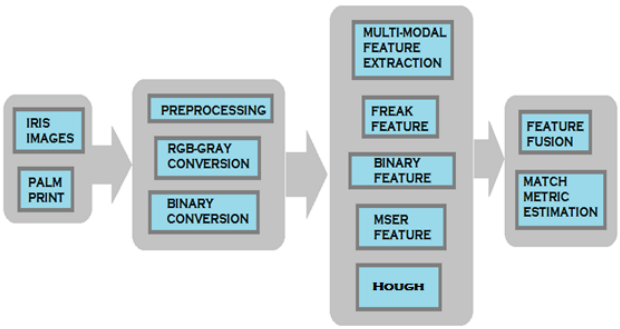


Fig 3 Design Diagram of Multi-Modal Feature Extraction Scheme

B. Design Descriptions

The images are even though looks gray and the initial size of the images are 3 dimensional, hence the requirement to convert the matrix into 2 dimensional matrix the RGB to gray conversion have to be done. The gray scale image is further converted into binary which is applicable for binary feature extraction. Resizing the image becomes mandatory since all the images are not unique in the database.

C. Multi-Modal Feature Extraction Techniques

Multi-modal feature extraction is implemented here. the following techniques are involved in the multi modal feature study.

D. FREAK Feature Extraction

FREAK descriptor is also described as Fast retina key point extraction is most robust and accurate form of descriptor used to compare the retinal intensities changes of the input image and find out the best intensity pixel and their orientation etc. The function FREAK command in MATLAB derives the descriptors from pixels surrounding an interest point. The initial interest points will be selected by us through software codes. The pixels represent and match features specified by a single-point location. Each single-point specifies the center location of a neighborhood. The method you use for descriptor extraction depends on the class of the iris image and palm vein image. The FREAK descriptor is evaluated by the formula below.

Formula

$$D_C(i,j) = \begin{cases} 1 & \text{if } N(RF_i) - N(RF_j) >= 0, \ \forall i \neq j \\ 0 & \text{otherwise} \end{cases}$$

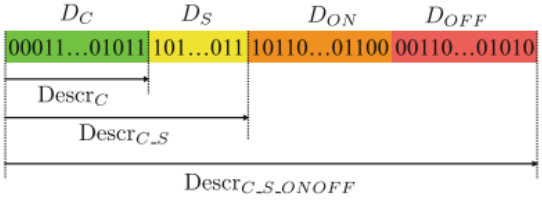


Fig 4. Illumination of Descriptor Construction

E. MSER Feature Extraction

MSER is called as Maximally Stable Extremal Regions In computer vision, Maximally Stable Extremal Regions (MSER) are used as a method of blob detection in images. This technique was proposed by Matas et al. to find correspondences between image elements from two images with different viewpoints. This method of extracting a comprehensive number of corresponding image elements contributes to the wide-baseline matching, and it has led to better stereo matching and object recognition algorithms

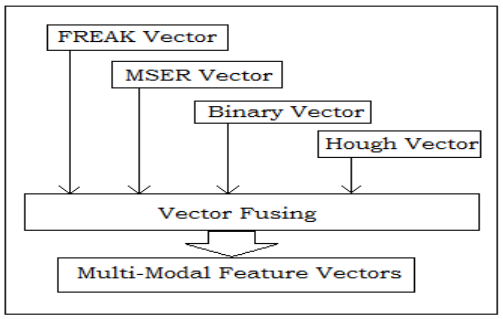
F. Binary Feature Extraction

This object provides the ability to pass data between the extract Features and match Features functions. It can also be used to manipulate and plot the data returned by extract Features.BinaryFeatures(featureVectors) constructs binaryFeatures object from the M-by-N input matrix, feature Vectors. This matrix contains M feature vectors stored in N uint8 containers.

G. Hough Transform & Feature Study

Hough transform is used to extract the lines present in the iris pattern to evaluate the extracted feature points to be correlated into the line which is detected by the hough transform. Various lines prediction feature vectors avail the usage of Hough transform while handling iris image and Palm vein image in the form of gray scale is easier.

H. Multi-Modal Feature Vector



D.Algorithm Flow

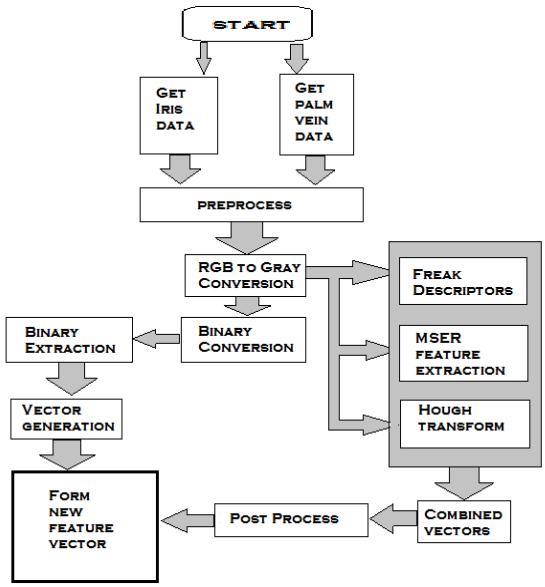


Fig 5 Algorithm Flow of Multi-Modal feature extraction technique

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V. RESULTS AND DISCUSSIONS

The simulation result of multi-modal feature extraction techniques is shown in figure 6

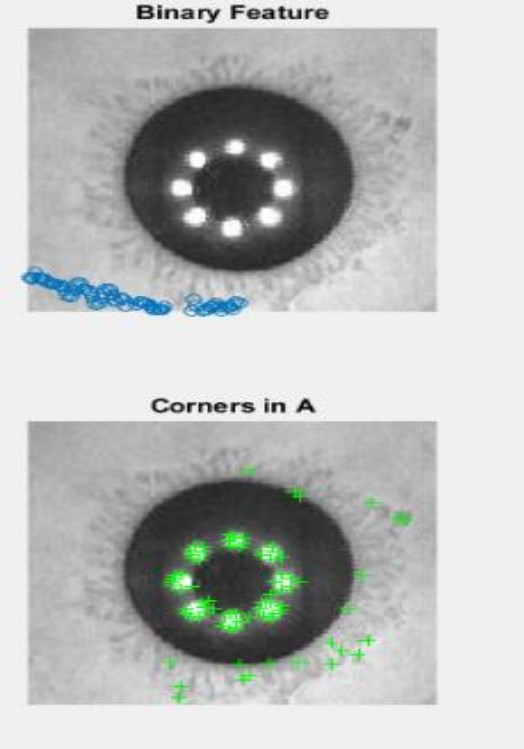

Fig 6 Binary feature Extracted

Fast feature extracted Multi-Modal feature extraction technique is nothing but the organized form of proven techniques put together to form a hybrid method of extracting the features. The iris pattern is normally good in gray scale bounding henceforth the gray imaging technique is applied here. MSER technique is shown in figure 7.

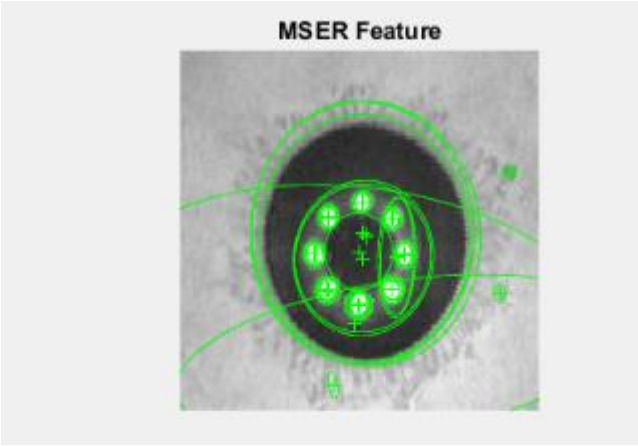

Fig 7 MSER feature extracted of IRIS

Figure 8 depicts the Vector sequence to show how the unique features are ranging in the vector model. The stem plot is shown that so many unique features correlate with the pattern

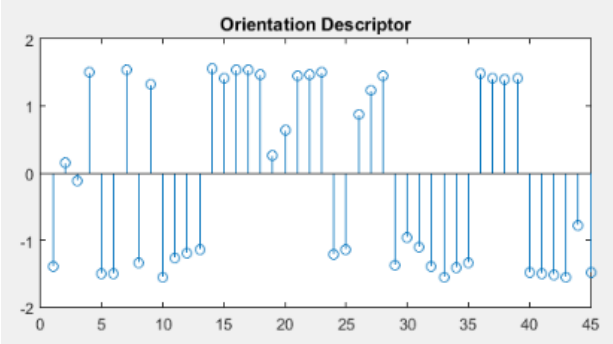

Fig 8 Vector Sequence of Descriptors

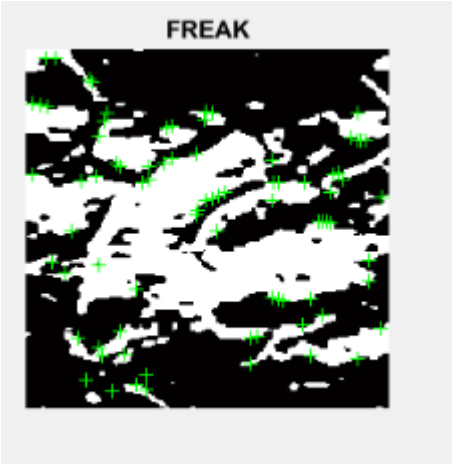

Fig 9 Palm vein FREAK feature extracted output

The figure 10 shows the MSER feature extracted output in which the binary analysis is made. The intensity of the iris vector changes in position and shape.Fig 11 shows the Hough transform of the system, Hough transform is used to predict the varying lines present in the iris pattern.

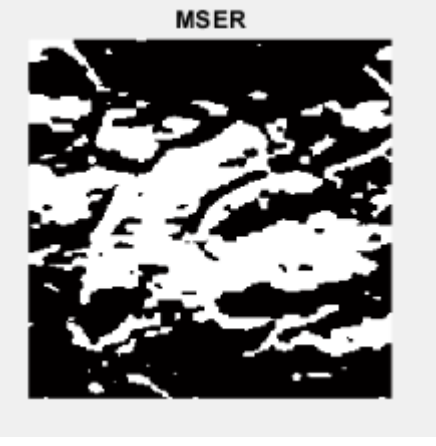

Fig 10 MSER feature extracted Palm vein

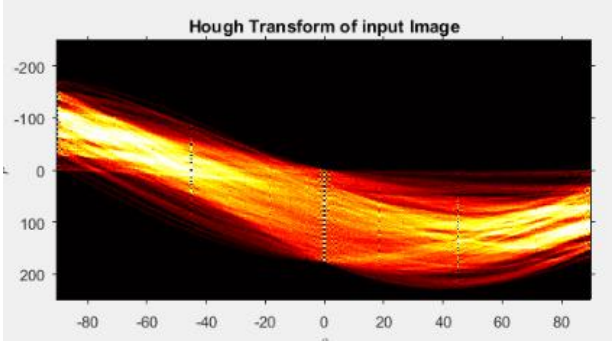

Fig 11 Hough Transform to extract the Lines

VI. CONCLUSION

Thus, the study of various feature extraction methods of image processing platform for extracting the uniqueness present in palm vein and iris is discussed here clearly. Multimodal feature extraction is the technique which is analyzed here and the results of the simulated screenshots evaluates the extraction of various feature points, metric ratios, corner points present in the test samples. The feature vectors imply various parameters such as corners, lines, angles etc. Those feature points are combined together to form a multimodal feature vector. The resultant simulations and graphs enable us to get a clear picture of so many hidden unique points present in the images. Further as a future implementation and extension of this work Palm vein and Iris images are applied in a Platform for bio-authentication and accessing a secret document, sharing the confidential information etc. The future scope of the work can be further extended to predicting and authorizing the iris patterns and acknowledging the individual identity. Mobile application based system using ANDROID is also on the line to add up the system for user friendly

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