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Mathematical Computation Using Triangulation For Both Palm Identification

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Abstract- Biometric is the science of identifying individuals by their unique biological characteristics. This technology has become a growing aspect of our daily life. Although biometrics has been used for decades, recent developments and usages have made the advancement more popular especially in the private sector. Authentication based on biometrics is being applied to control fake access to top-security resource. Recently, with the high raising of information system technologies, databases manipulation or business process systems have begun to use biometrics such as hand geometry, palm, iris, fingerprint etc. In the research, two palms are considered for implementation. The triangle based palm geometry based biometric system has proven to be the most acceptable trait for medium and low security application.

Keywords: Anterior, Binarization, Biometric, Palm, etc.

I. INTRODUCTION

Biometric system is a method for verifying or recognizing the identity on the basis of some physiological characteristics. This system based on physiological characteristics is more reliable than behavioral features. Now it is easier to merge within certain specific applications. The finger print based systems have been proven to the effective in protecting information and resources in a large are a of applications.

Nowadays technology leads to design low cost systems whose performance makes them well suited for a broad range of applications. Biometric identifiers are the distinctive, measurable characteristics used to label and describe individuals. Biometric identifiers are often categorized as physiological versus behavioral characteristics. Physiological characteristics are related to the shape of the body. The palm is the central region of the anterior part of the hand, located superficially to the metacarpus. The skin in this area contains dermal papillae to increase friction, such as are also present on the fingers and used for fingerprints. The dorsal area is the corresponding area on the posterior part of the hand. The heel of the hand is the area interiorly to the bases of the metacarpal bones, located in the proximal part of the palm.

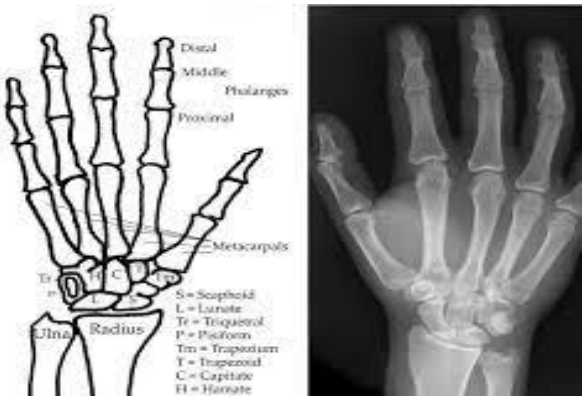

Figure 1: Palm Structure.

Palm scanner is the advanced product that increases the authentication rate, with a considerable reduction in the verification time to about half the time of the primary model. The sensor used in palm vein technology can only identify the biometric palm vein pattern if the deoxidized hemoglobin is dynamically flowing through an individual's vein. The opportunities to implement biometric palm scanner extends to a broad range of vertical markets, including security, financial/banking, healthcare, commercial enterprises and R&D facilities. Men are more likely to have abnormal fingerprint patterns

than women. Researchers suggest this is because they are more vulnerable to their environment.
There are fingerprint abnormalities in people with schizophrenia and diabetes. Researchers believe this might have something to do with maternal illness during gestation. With the increasing demand of biometric solutions for security systems, palm print recognition, a relatively novel but promising biometric technology, has recently received considerable interest. Palm-print based individual identification is regarded as an effectual method for identifying persons with high confidence. Palm-print with larger inner surface of hand contains many features such as principle lines, ridges, minutiae points, singular points, and textures.

II.LITERATURE SURVEY

Slobodan Ribaric [3] describes the design and development of a prototype system for the automatic identification of an individual based on the fusion of palm and hand geometry features. Hand gesture recognition research is classified in three categories. First "Glove based Analysis" attaching sensor with gloves mechanical or optical to transducers flexion to fingers is used into electrical signals for hand posture determination and additional sensor for position of the hand. This sensor is usually an acoustic or a magnetic that attached to the glove.

Milan Markovic [4] dedicates his research on the problem of two-dimensional shape recognition from the point of view of possible optimization, regarding feature extraction and classification methods. Two types of moments were used; they are central moment and moment invariant. it consists of two modules. Module1: the input to this module is the hand's image. The first stage in this module performs the preprocessing operation (it includes image binarization, edge detection, and chain code). The second stage is for feature extraction.

Two types of feature extraction were used, they are geometrical features (length of fingers, width of fingers, hand span, distance between joints) and the non-geometrical features (find central moment of the shape of each finger). The result of this module is creating feature vector for each input image. Module 2: the input to this module is the feature vector. The system will apply the feature analysis to decide which of these features have a good recognition. After finding the good discriminating features, then the matching step is performed between the unknown person features with the representative feature vectors listed in the database which contains the required template features for number of hand image samples taken for each person. The result of this module is person ID (index).

Hiba Zuhair [5] involves several proposed methods based on extracting the hand geometry features from the captured hand images, and compare the extracted features with the template of claimed user, which should previously enrolled to the system and stored in a database.

Saraf Ashish [6] involves hand geometry based identification systems which utilize the geometric features of the hand. The system accepts a gray scale handprint from which it extracts the finger lengths, finger widths, diameter of the palm and the perimeter. The hand region of interest is first extracted using in-depth skeleton-joint information images from a Microsoft Kinect Sensor version 2, and the contours of the hands are extracted and described using a border-tracing algorithm. The K-cosine algorithm is used to detect the fingertip location based on the hand-contour coordinates model, and the result of fingertip detection is transformed into the gesture initialization in order to spot hand gestures. Finally, a gesture is recognized based on the 3D convolutional neural network.

III.PROPOSED METHODOLOGY

The input images are collected from the students of the St.John's College of Arts & Science, Ammandivillai for the purpose of experiments and research. All the images are in bitmap (.bmp) format. The resolution of the images is 800*600 pixels. The available database is from 25 users, ten images from each person, from each of the left and right hand, are acquired in varying hand pose variations. The median filter is used for the removal of impulse noise (also known as binary noise), which is manifested in a digital image by corruption of the captured image with bright and dark pixels that appear randomly throughout the spatial distribution.

Impulse noise arises from spikes in the output signal that typically result from external interference or poor sensor configuration. This interactive part explores the removal of impulse noise from a digital

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image using the median filter, and how the application of this and related filtering techniques affect the final appearance of the filtered image.

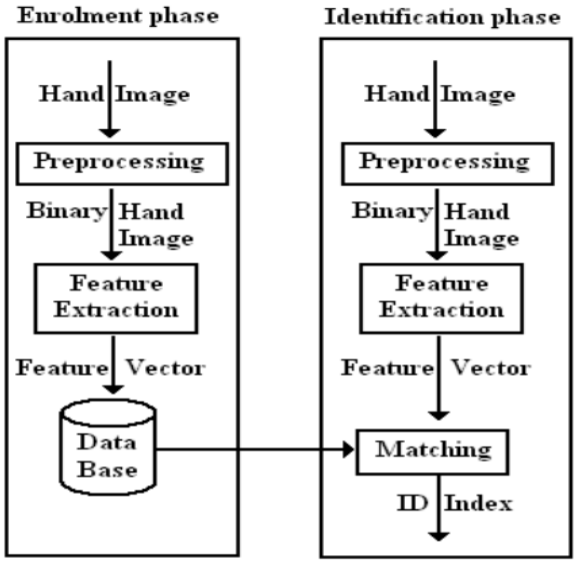

Figure 2: Proposed methodology

A median filter will be applied to the following simple one-dimensional signal:
x = (2, 3, 80, 6, 2, 3).
So, the median filtered output signal y will be:
y1 = median (2, 3, 80) = 3,
y2 = median (3, 80, 6) = median (3, 6, 80) = 6,
y3 = median (80, 6, 2) = median (2, 6, 80) = 6,
y4 = median (6, 2, 3) = median (2, 3, 6) = 3,
i.e. y = (3, 6, 6, 3).
A square-shaped mask can erode edges of the rectangular objects, while a cross-shaped neighbourhood mask will leave edges intact. This analysis has lead to the development of a hybrid median filter, which is a multiple-step brightness-ranking algorithm. For the two direction, 5 × 5 hybrid median filter included in the tutorial, the median brightness values of the neighbours forming an "X" shape are computed, along with the median brightness values of the neighbours forming a "+" shape.

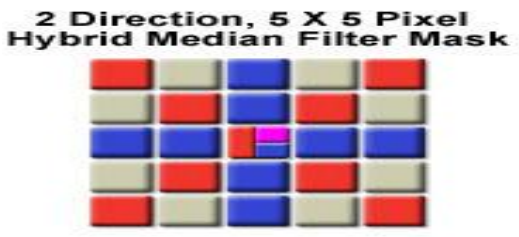

Figure 3: Filtering Mask

Sobel Edge Detector converts the image from an RGB scale to a Gray scale image. Then from there, we will use what is called kernel convolution. A kernel is a 3 x 3 matrix consisting of differently (or symmetrically) weighted indexes. This will represent the filter that we will be implementing for edge detection. When we want to scan across the X direction of an image for example, we will want to use the following X Direction Kernel

X – Direction Kernel

-1	0	1
-2	0	2
-1	0	1

Y – Direction Kernel

-1	-2	-1
0	0	0
1	2	1

Table 1: Kernal with directions

By using Kernel Convolution, we can see in the image below there is an edge between the column of 100 and 200 values.

100	100	200	200
100	100	200	200
100	100	200	200
100	100	200	200

-1	0	1
-2	0	2
-1	0	1

-100
-200
-100
200
400
+200
=400

Table 2: Kernal Convolution

The first step in the measurement of the geometrical features is to find the top points and joint points of the finger. After finding all top and joint points, we can compute all geometrical features. To find the joint point A, a scanning to all the pixels that lay between the start-pixel and the top point H in the sequence of boundary points) is performed to find out point A (which is a pixel that has minimum distance with the joint point B). The same above method could be used to find the joint points E and G. to find the joint point E we scan the boundary pixels between the top point K and the joint point F, and we take the pixel of minimum distance with pixel D. The joint G could be defined by scanning the pixel between the top point L and the end-pixel, where G is the pixel of minimum distance with the pixel F.

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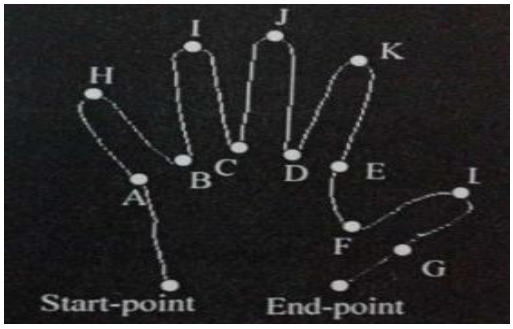

Figure 4: plotting points.

Fuzzy feature matching is clear that the resemblance of two images is conveyed through the similarities between regions from both images. Thus it is desirable to construct the image-level similarity using region-level similarities. Since image segmentation is usually not perfect, a region in one image could correspond to several regions in another image. Using fuzzy feature representation, these similarity observations can be expressed as

$$l_i^{\mathcal{B}} = \mathcal{S}\left(\widetilde{\mathbf{A}}_i, \bigcup_{j=1}^{C_b} \widetilde{\mathbf{B}}_j\right).$$

$$\vec{l}^{\mathcal{B}} = [l_1^{\mathcal{B}}, l_2^{\mathcal{B}}, \ldots, l_{C_a}^{\mathcal{B}}]^T.$$

$$l_j^{\mathcal{A}} = \mathcal{S}\left(\widetilde{\mathbf{B}}_j, \bigcup_{i=1}^{C_a} \widetilde{\mathbf{A}}_i\right).$$

$$\vec{l}^{\mathcal{A}} = \left[l_1^{\mathcal{A}}, l_2^{\mathcal{A}}, \ldots, l_{C_b}^{\mathcal{A}}\right]^T,$$

$$\vec{L}^{(\mathcal{A},\mathcal{B})} = \begin{bmatrix} \vec{l}^{\mathcal{B}} \\ \vec{l}^{\mathcal{A}} \end{bmatrix},$$

Suppose there are matched minutiae pairs, and there are matched sample points for every minutiae pair, then the sum of matched sample points is calculated as follows

$$n = \sum_{i=1}^{n_1} s_i$$

The mean of distance difference between every two minutiae is calculated as

$$d = \frac{1}{n_1 \bullet (n_1 - 1)} \sum_{i=1}^{n_1} \sum_{j=1(j \neq i)}^{n_1} \text{len}_{\text{diff}}.$$

IV.RESULT AND DISCUSSION

The input images are collected from the students of the St.John's College of Arts & Science, Ammandivillai in 2021 for the purpose of experiments and research.

All the images are in bitmap (.bmp) format. The resolution of the images is 800*600 pixels. The available database is from 25 users, ten images from each person, from each of the left and right hand, are acquired in varying hand pose variations. Based upon fuzzy feature representation of palms, the similarities between the fuzzy features are used to characterize the similarity between them. The FFM method maps a similarity vector pair to a normalized quantity, within the real interval [0, 1], which quantifies the overall image to image similarity. The image-level similarity is constructed from similarities.

The proposed system can analyze to predict whether a person should be claimed as a true client or an imposter. In order to evaluate the success of the system, a standard measurement is used to verify the acceptance errors and rejection errors. They are defined as follows

:(False Reject Rate (FRR)
(False Acceptance Rate (FAR)
The FRR is the percentage of clients or authorized person that the biometric system fails to accept. FRR is defined as

$$\text{FRR} = \frac{\text{Number of rejected clients}}{\text{Total number of client access}} * 100\%$$

The FAR is the percentage of imposters or unauthorized person that the biometric system fails to reject. FAR is defined as

$$\text{FAR} = \frac{\text{Number of accepted imposter}}{\text{Total imposter access}} * 100\%$$

The accuracy of the biometric system is defined as
Accuracy = max (100 –(FRR+FAR)/2)

Traits	Algorithm	FAR (%)	FRR (%)	Accuracy (%)
Palm	Fuzzy Feature Matching	8.49	0.87	95.37

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Table 3: Experimental Outcome

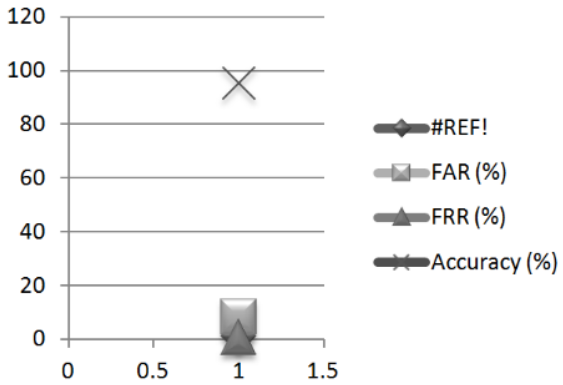

Figure 5: Graphical Outcome

V.CONCLUSION

The palm-print based person identification usually designed for providing high quality pattern matching using differing features like principle lines, ridges, minutiae points, singular points, and textures with high confidence may not give satisfactory result for accuracy during pattern matching. To improve the accuracy of palm-print features matching and reduce the time taken on multiple palm-print features matching efficiency on palm-print images, Fuzzy Feature Matching (FFM) method based on procedure and enhancing multiple feature matching procedure has been implemented.

Finally, a fuzzy based closed loop control system has been included to increase the accuracy of object recognition and pose estimation. The idea is to extract two different types of SIFT features, from model and query images. These features are matched separately providing two independent affine transformations. The dissimilarity between these transformations is used as signal indicates to the matching quality.

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