Biometric Palm Line based matching using basic statistical Properties.

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Abstract: - This paper proposes a Biometric Palm lines extraction using image processing morphological operation. The proposed work discusses the significance; since both the palm print and hand shape images are proposed to extract from the single hand image acquired from a sensor. We can have approach for palm lines feature extraction using image processing techniques and according to that matching can be done.

Keywords- Biometrics, Morphological operation, PolyU_Palmprint_Database, Palm print recognition.

1. Introduction:-

Multimodal biometric systems have recently attracted the attention of researchers and some work has already reported in literature. Most of the reported work has bimodal biometric system such as Finger prints, Face recognition, Iris, Hand and Palm print recognition [1].

The biometric use of palm prints uses ridge Patterns to identify an individual.

Palms of hands epidermal ridges, thought to provide a friction surface to assist with gripping an object on surface[2].

Palm print identification systems measure and compare ridges, lines and Minutiae found on the palm. Palm print recording and identification for law enforcement purposes has been in existence almost as long as palm prints systems are reported to comprise 30% of all crime scene marks[2].

As much as another 20% are made up of the edge of the hand, fingers between the palm and fingertips and other parts of the hand. A key driver for law enforcement agencies to adopt full-hand scan technologies is the high incidence of hand related crime scene marks.

Joao de Barros, an early explorer and writer, wrote that the Chinese merchants distinguished young children from each other by recording palm prints on paper with ink.

One of the earliest AFIS systems built to support palm prints is believed to have been developed in Hungary in the early 1990's. In 1997, the technology was bought by a US company. In recent years, most AFIS vendors have added palm print records capabilities to their systems.[4]

2. Methods used in Recognition:

There are three groups of marks which are used in palm print identification:

- Geometric features, such as the width, length and area of the palm. Geometric features are a coarse measurement and are relatively easily duplicated. In themselves they are not sufficiently distinct;[3]

- Line features, principal lines and wrinkles. Line features identify the length, position, depth and size of the various lines and wrinkles on a palm. While wrinkles are highly distinctive and are not easily duplicated, principal lines may not be sufficiently distinctive to be a reliable identifier in themselves; and

- Point features or minutiae. Point features or minutiae are similar to fingerprint Minutiae and identify, amongst other features, ridges, ridge endings, bifurcation and dots[3].

Palm creases and ridges are often superimposed which makes feature extraction difficult. An important issue in palm print recognition is to extract palm print features that can discriminate an individual from the other. There are two popular approaches to palm print recognition. One of the approaches is to transform palm print images into specific transformation domains[2].

Palm print authentication is one of the relatively new physiological biometric technologies which exploit the unique features on the human palm print, namely principle lines, wrinkles, ridges, datum points, etc[3]

2.1 Statistical Properties:-

Statistics is the science of the collection, organization, and interpretation of data. It deals with all aspects of this, including the planning of data collection in terms of the design of surveys and experiments. [8]

The basic steps of a statistical Experiment is:

1. Planning the research, including finding the number of replicates of the study, using the following information: Preliminary estimates regarding the size of treatment effects, alternative hypotheses, and the estimated experimental variability. Consideration of the selection of experimental subjects and the ethics of research is necessary. Statisticians recommend that experiments compare (at least) one new treatment with a standard treatment or control, to allow an unbiased estimate of the difference in treatment effects.

2. Design of experiments, using blocking to reduce the influence of confounding variables, and randomized assignment of treatments to subjects to allow unbiased estimates of treatment effects and experimental error. At this stage, the experimenters and statisticians write the experimental protocol that shall guide the performance of the experiment and that specifies the primary analysis of the experimental data.

3. Performing the experiment following the experimental protocol and analyzing the data following the experimental protocol.

4. Further examining the data set in secondary analyses, to suggest new hypotheses for future study.

5. Documenting and presenting the

results of the study.

Statistics rarely give a simple Yes/No type answer to the question asked of them. Interpretation often comes down to the level of statistical significance applied to the numbers and often refers to the probability of a value accurately rejecting the null hypothesis (sometimes referred to as the p-value).[8]

Referring to statistical significance does not necessarily mean that the overall result is significant in real world terms. For example, in a large

study of a drug it may be shown that the drug has a statistically significant but very small beneficial effect, such that the drug will be unlikely to help the patient in a noticeable way.

3. Feature Selection :-

In our work the feature selection is based on the statistical measurements of a palm for Palm print Recognition System. There are various statistical measurements out of which part of our study and experiment are basic statistical properties of a palm image and are Area, Boundingbox and centroid.

a. Area —

The Scalar; the actual number of pixels in the region.

b. BoundingBox —

The smallest rectangle containing the region, a 1-by-`Q *2` vector, where `Q` is the number of image dimensions:`ndims(L)`, `ndims(BW)`

c. Centroid:-

It is 1-by-`Q` vector that specifies the center of mass of the region. Note that the first element of `Centroid` is the horizontal coordinate (or *x*-coordinate) of the center of mass, and the second element is the vertical coordinate (or *y*-coordinate). All other elements of `Centroid` are in order of dimension.

These basic statistical properties **F**can be used to measure the statistical property of image region.

The calculated values of palm lines extracted image can be useful for palm matching technique. The matching can be done by using basic statistical properties of palm and mostly useful on extracted palm lines image. Thus it can be very useful for palm matching technique with minimum time estimation.

4. About Database:-

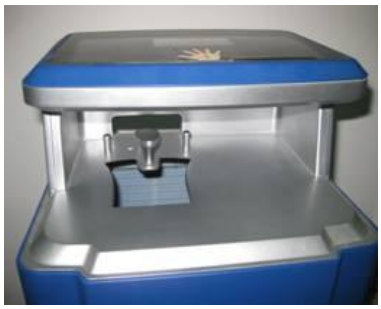
The Hong Kong Polytechnic University (PolyU) 2D_Palmprint Database.[11]

Palm print has proved to be one of the most unique and stable biometric characteristics.
Almost all the current palm print recognition techniques capture the two dimensional (2D) image of the palm surface and use it for feature extraction and matching. Although 2D palm print recognition can achieve high accuracy.[11]
The PolyU 2D Palm print Database contains 7680 samples collected from 384 different palms. Twenty samples from each of these palms were collected in two separated sessions, where 10 samples were captured in each session, respectively. The average time interval between the two sessions is one month.
The all palm print images are of same size and same dimension such as 384 X 284.[11]
And each 2D palm print image was recorded in BMP format image file.
The palm print images have a name sequence and can be interpreted as follows-

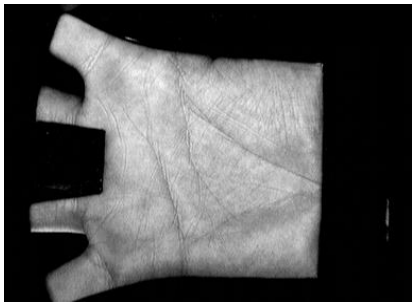
e.g. - A palm print image name "PolyU_001_F.bmp" can be interpreted as the initiated word 'PolyU' is the copyright for the Polytechnic University of Hong Kong.Then followed '001' indicate the subject enrollment number as it varies with person to person palm print image. The followed 'F' indicate the session enrollment that whether it is the First or Second.

And finally the format 'BMP' of the image file.

(a)



(b)



(c)

(a) The outlook of image acquisition device; (b) The device is being used to collect palm print image; (c) The "PolyU_001_F_01.bmp" palm print image. [11]

5. Experiment and Result

The Experiment was performed over the palm Image taken from the database developed by the Hong Kong Polytechnic University (PolyU) palm print database.

fig. An extracted palm line image PolyU_001_F_01.bmp from PolyU_Palmprint_Database(2nd version)[8]

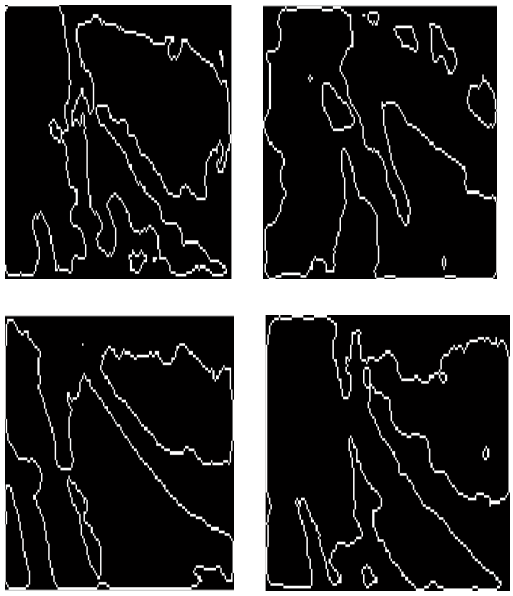


Fig. Compared palm line Images of PolyU_Database_001_F, 003_F, 007_F, 007_F. [8]

Sr. No.	Palm Image	Area	Bounding box	Centroid
1	PolyU_001_F_01.bmp	1000	971	776.251
2	PolyU_003_F_01.bmp	839	1256	1045.45
3	PolyU_007_F_01.bmp		1744	1607.4
4	PolyU_007_F_01.bmp	650	634	422.939
5	PolyU_009_F_01.bmp	830	417	286.812

Table: - The calculated basic statistical property such as Area, bounding box and centroid.

These calculated values are distinct for each and every individual.
So a palm matching can be done on the basis of individual basic statistical palm properties. And can be used to identify an individual.

The testing image that's basic statistical property such as area, bounding box and centroid of palm line image and values is being calculated as we input the testing image. The corresponding one to one matching has to be done by comparing it with our already trained samples.

The corresponding matching sample of testing palm sample will be got matched depending upon the similar area, bounding box and centroid values of the Palm image.

Hence the Biometric identification of individual can be done on the basis of its palm statistical properties such area, bounding box and centroid of palm line image.

6. Result:

1. The area, bounding box and centroid of palm line image values is being calculated.

2. The Perfect Match can be drawn by matching a testing palm line image sample with the trained sample depending upon the area, bounding box and centroid of palm line image values.

- The FRR, FAR and TSR are as follows.

	Mean Square error	**Signal to Noise Ratio**	**Standard Deviation**
FRR	**0.0%**	**0.0%**	**0.0%**
FAR	**0.0%**	**0.0%**	**0.0%**
TSR	**100%**	**100%**	**100%**

7. Conclusion

The biometric use of palm prints uses ridge patterns to identify an Individual. Palms of hands epidermal ridges, thought to provide a friction surface to assist with gripping an object on surface. Palm print identification systems measure and compare ridges, lines and Minutiae found on the palm.
In our work the feature selection is based on the statistical measurements and properties of a palm for Palm print Recognition System. There are various statistical measurements out of which the measurements which were the part of our work and mainly want to focus Is- area, bounding box and centroid.
The experiment is carried over the PolyU_2D palm print database. The experimental values were drawn from the experiment that was based on various area values, bounding box values and centroid values of palm line image and palm prints taken from the PolyU_2D palm print Database.Thus we can state that the basic statistical property can be considered as the features to identify an individual.

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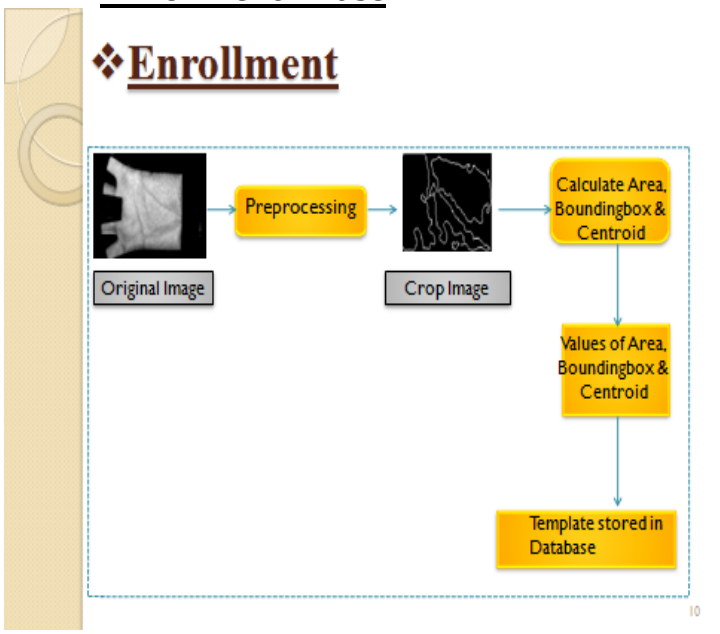
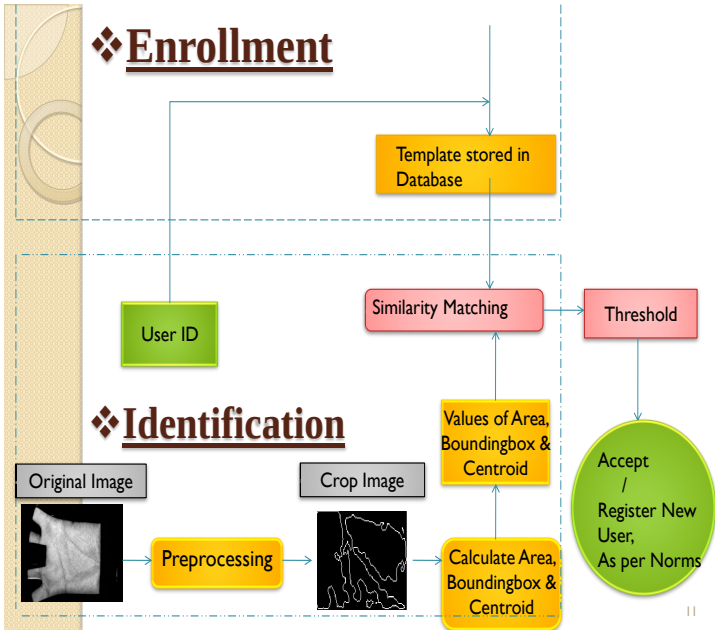
8. Work – Flow:

Enrollment Phase

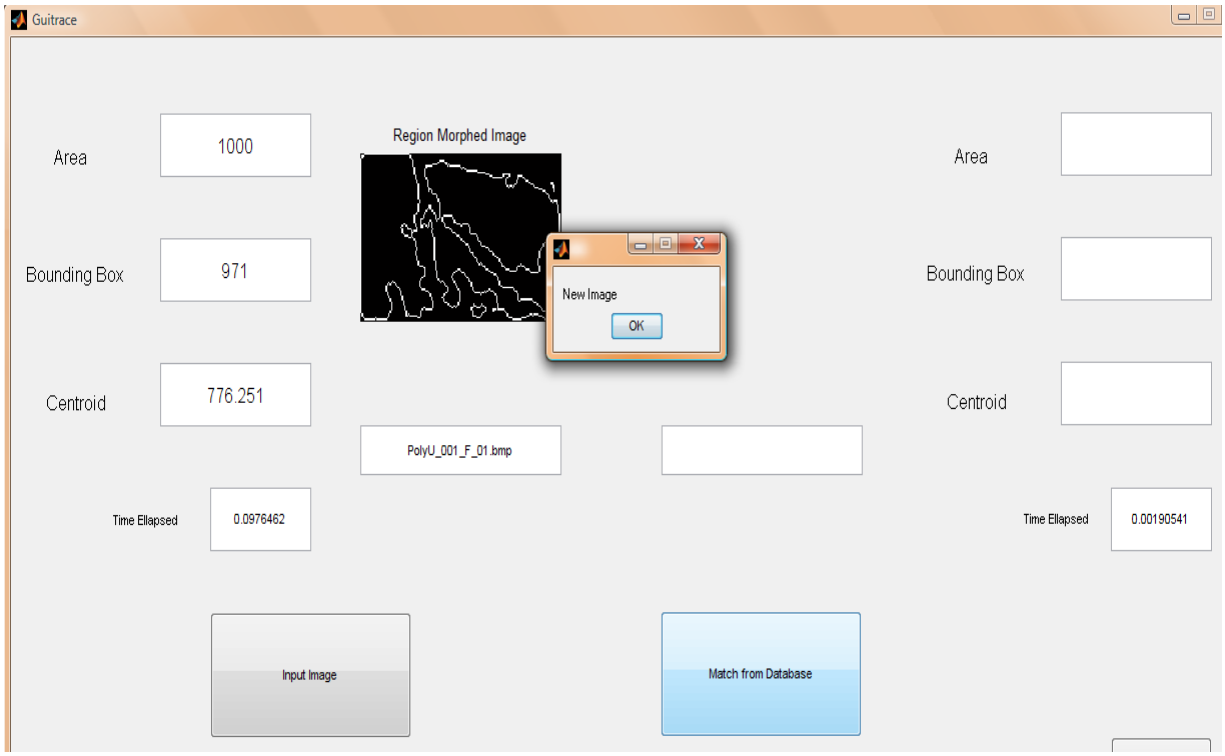


Matching Phase



9. GUI form module.

1. Enrollment Graphical User Interface with Basic Statistical Properties.



2. Verification Graphical User Interface with Statistical Properties