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Gender Classification from Palm Images

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[1]***Abstract—in our proposed work we are predicting the gender from the palm image. Using ROI segmentation, we can extract the palm region, from the segmented palm region extract the geometrical features and calculate various parameters. from the various parameters will train the machine and classify the trained data using SVM. finally generating the confusion matrix to assess the efficiency. Here we are proposing a method which extract the feature of the segmented palm region, considering it as a square and calculate the sides and diagonal, based on that we will classify the palm based on gender***

Keywords—Fingerprint model, Biometric systems, Fingerprint matching, Pattern matching, Support vector machine and Feature extraction

I. INTRODUCTION

Fingerprint recognition is one of the prominent biometric recognition. Fingerprint recognition have been using for a long time, by the betterment of the technology the matching and recognition become fully automated. Digital image processing is used to recognize or match the palm images. Digital image processing is a method of operation on a digital image by the help of computers. It's a form of signal processing that is the input will be an image and the output will be an image or feature related with the image. The major tasks which image processing is focused on is to improve the content or pictorial representation in the image for better human understandability, and processing the image data for delegation, storage for independent machine perception. One of the common uses of digital image processing is to improve the image quality by preprocessing, to remove noise by applying algorithm on images. Digital image processing is very helpful in various sectors like industrial inspection, law enforcement, artistic effects etc. image recognition has more contribution for forensic reports and medical field.

Palm print recognition is one of the advanced method in biometric recognition, previously people used fingerprint as a biometric security, its less accuracy and availability lead to palm print recognition. The main features of the palm are principal lines, wrinkles, and ridges. These three features are genetically related also. These features are seen in the inner region of the palm between fingers and wrist. The complex structure of the lines and ridges in the palm will help to improve the accuracy in identification. The system has the ability to recognize low or high resolution palm images. Shape of the hand and its area has equal importance in distinguish a person by his/her gender. Compare to male female palm area will be lesser. Even there are many characteristics to determine a person's gender by analyzing his palm, the palm print recognition sector is not technically rich, with this paper we are trying to make the algorithms more convenient use and make them more accurate to produce better result. Comparing to fingerprint recognition the palm print identification has more chance to produce accurate result, the complex structure of the palm is the first criteria which makes it unique, area of the palm, ridge density all these features makes the palm print more convenient to use over fingerprint.

II. LITERATURE SURVEY

Ravi Subban et.al [1] invented A Study based on the biometric approach using fingerprint identification, a biometric recognition is a method of identifying a person by their behavioral or physiological characteristics. Fingerprint recognition is common biometric method because of its easiness in obtaining, availability of more resources for adding data and their established use. The fingerprint matching performance is evaluated by means of Equal Error Rate (EER), Genuine Accept Rate (GAR). Traditional methods are used to examine the fingerprint and features are isolated. Only the quality image's features can be extracted. Image with high noise rate, poor intensity, poor edge cannot be processed. For less noise images CCD (Charge coupled device) has to be used. A charge coupled device can capture good quality image with good lenses. Le Hoang Thai et.al [2] proposed a standardized model for Fingerprint recognition in his work he created an efficient model for fingerprint recognition the work says that Fingerprint recognition is one of the widely used and accurate Biometric technology. For recent days' fingerprint recognition was used for lots of real time applications. Even though, identifying fingerprints from low quality images was a difficult problem in most of the cases. This paper concentrates on the standardized fingerprint model, these models are used to combine the fingerprint templates.

The method he proposed is that for each and every fingerprint image, locate the area and then finds the 1-pixel width thin ridge lines. After processing fingerprint image, a point P is selected from the image. They used genetic algorithms to match the fingerprints. Based on the experiment result threshold and value of parameter are chosen. Satya Prasad et.al[3] proposed a fingerprint recognition method, they aims to design this method in different steps; data set acquisition, fingerprint isolation, fingerprint enhancement if, then feature extraction. For the implemented system two fingerprint images are considered that is left and right hand thumb, which indicated adequate results.

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The work is done based on the objective such as Data Collection of fingerprint images for many persons. Classifying and refining the fingerprint images according to their characteristics. Construct the algorithm to recognize the fingerprint images. These biometric characteristics are not primarily determined by biology instead they are collected and learned over time. Biometric characteristics such as finger prints, palm lies etc are depend upon both physiological and biological characteristic. Youssef elmir et.al[4] proposed a method that is Fingerprint Identification using support vector machine. Here this method is reserved for developing an algorithm which helps for original image processing. The method works as a model of SVM and RBF, this model is designed and trained to identify the finger code of the databases that are used. An imaging system is used, which helps to transform each and every fingerprint image to finger code by using a collection of Gabor filters. By this method the final result is representing each fingerprint images as a vector of 256 real values. The steps involved are by using Histogram Equalization Pre-processing of the image has been done. Max concavity estimation and sector wise normalization method is used for core point location, at last by identifying standard deviation values of all the sectors feature code generation will happen, in a very few seconds the algorithm will create a particular fingerprint codes, even for a large database the algorithm can generate fingerprint codes in few seconds, a matching between previously stored fingerprints and the matrix of pixels generated from an image of fingerprint is compared to see any of the finger code is matching between the previously stored values. When matrixes of fingerprints are being compared to live one, to reduce the false matching the decision threshold will be automatically adjusted, this happens even when large number matrices of finger prints are being compared. Long B. Tran et.al[5] proposed an idea person authentication using RVM (Relevance Vector Machine) for fingerprint and face. Its proven that compare to singe biometric systems multimodal biometric systems are far more efficient in personal verification and identification. In the paper, fingerprint images features are extracted by using ZM (Zernike Moment), by using these features the authors present a multimodal biometric system, by using RVM (Relevance Vector Machine) and feature-level fusion technique fingerprint authentication has done. The proposed system has the advantage of tolerating the variations in the fingerprint image of a person, this implies that this system can overcome the limitations of a uni model biometric system. Bernoulli distribution Laplace‘s approximation method. To authenticate a person’s finger, print the input images has to go through technique, the various methods in the work are acceptance and verification. Feature extraction is done by ZM (Zernike movement) method. To recognize each fingerprint image ROI (Region of interest) is helpful. The proposed method is one of the best model for identifying gender by using finger print specifications using MLP (Multi-Layer Perceptron).

S. Falohun et.al[6] in their work created a system which is predicting the age and gender by analyzing the fingerprint pattern. Work says that there are some distinct characteristics which are different for each and every one and not even similar for twins, these features can be used to identify each and every one. Biometrics identification method helps in identifying a person by measuring his physical characteristics or by his anatomy. In finger print based identification, ridge thickness, valley thickness is considered for identifying the gender. (DWT) Discrete Wavelet Transform and (PCA) Principal Component analysis are the two methods to predict the age and gender. Gnanasivam P et.al[7] proposed an approach for classifying gender using fingerprints that is using Wavelet transform and singular value decomposition gender is classified. The proposed method is based on singular value decomposition and discrete wavelet transform; gender is classified by applying it on the fingerprint images. Combining the features of singular values that received from SVD of fingerprint images and energy received from all sub bands of DWT, the gender classification is achieved. KNN (K nearest neighbor) usually used method for classifying objects based on most matching training examples in the feature space. For image processing and for feature extraction wavelets are used frequently. Ming Wu et.al[8] proposed an idea to classify the gender using fingerprint. By examine the geometry features of the palm gender of a person is classified, this proposed method is simple, fast and very easy to handle. There are two main attributes, which are important for this method. The first one is by image processing feature extraction can be done. The next one is PSSVM (polynomial smooth support vector machine) based classification of gender. The gender classification system depends on geometric invariants of a palm images. Frequently considered characteristics include length and width of palm images and aspect ratio of the palm. The method of analyzing palm images brightness feature a filter algorithm is proposed. Pattanawit Soanboon et.al[9] proposed an idea, from fingerprint ridge density the determination of sex difference is identified. This study aims in classifying the sex group and age group from fingerprint ridge density. radial and ulnar was the two topological areas were ridge density is assessed. In both counting areas a large difference between genders and age group was found. Using Bayes’ theorem ridge density threshold for discrimination of sex in all area and age group is found. In the statistical analyses, the RD values for the radial and ulnar areas of all 10 fingers were calculated means in each subject were used to compute the mean for each area and each hand in both sexes. S. S. Gornale et.al[10] proposed a method for gender classification. Fusion of fingerprint and age biometric for gender classification using frequency and texture analysis. Classification of gender from fingerprints is one of the important steps in forensic anthropology. This forensic anthropology is used to identify the gender of a criminal in order to minimize the suspects list of search. A very few researchers have worked on gender classification using fingerprints and have gain the competitive results. In this work we are trying to fuse the fingerprint and age biometrics for gender classification. After collecting fingerprint samples in bitmap format are pre-processed such as background elimination, cropping, converting color image into binary image. Feature extraction of pre-proposed fingerprint images through texture analysis like DWT(Discrete wavelet transform), DCT, and Region Properties like major axis length, area, eccentricity, minor axis length, convex area, solidity, perimeter, extent, Euler number and filled area.

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Computations of texture features, FFT features and DCT features has done by inputting the database i.e., fingerprint to the gender identification. The finger similarly recognition of fingerprint in light of deformities in ridge patterns due to cuts, dirt, or even wear and tear. One of the major complicated tasks is to acquire high-quality fingerprint images with distinctive ridges and minutia points.

P Sudharshan Duth et.al[11] proposed a method For medical imaging area, For the MRI brain image segmentation integrated spatial fuzzy clustering along with variation level set method is used. Improving the medical image processing technique helped in medical area also. To apply this method size, shape of the the structure is considered. The main drawbacks considered for this method is time complexity and loading of controlling constraints. P Sudharshan Duth et.al[12] proposed a method for medical image segmentation which is very efficient and fast. The method helps in improving understands the physicians, doctors to understand the patients more. Active contours help for path, segment and change the images to an atomic structure matching in this method a segment of the active contour family is invoked from the level set method.

III. PROBLEM STATEMENT

Classification of gender from the physical characteristics of palm: -

- Collect the dataset
- Preprocess the palm images using median filter and adjust the contrast using contrast adjusting method.
- Segment the palm image using threshold and region of interest method.
- Assessment of physical characteristics of palm such as area, length, width.

IV. PROPOSED METHODOLOGY

In our proposed work we are taking 500 dataset of palm images from IIT Delhi touchless palm print database. The dataset consists of the hand images of faculties and students. All the subjects are in the age group of 12-57 years.

In our proposed work we are segmenting our region and desired portion is retrieved and feature extraction algorithm is applied. The area of the palm has to be extracted from the image, for that efficient segmentation algorithm has to be applied. With the help of segmentation desired region can be extracted from the palm, then the extracted region has a unique property for male and female, area of the male and female palm has difference also length of the palm is different for male and female, considering those characteristics for perception the gender can be predicted. Combining the area and length of palm feature can improve the accuracy of the result. A set of palm size is given to the algorithm and according to that result is produced by the help of SVM method.

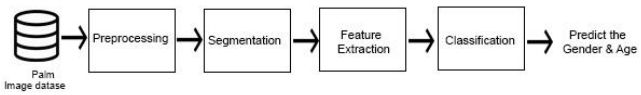

Figure 4.1 Work flow Diagram

Pre processing

The quality of the input palm image has a major role in the result and in the efficiency of the algorithm. Since the palm images are collected from different source using various image acquiring tools or sensors, so the quality of the images cannot be pre-determined early. The main aim of preprocessing is to reduce the unwanted distortions in the image, the there are many chances of getting low quality features and missing regions by preprocessing and enhancement method these issues can be solved.

- Median filter

Median filter helps in reducing the noise in an image. The RGB images are converted to greyscale images for preprocessing. The preprocessed images will help to improve the accuracy for further procedure. Median filtering is the famous filtering technology because it will help to conserve edges when removing noise.

$$V[l,m]= \text{median}\{U[a,b],(a,b)) \in N\}$$

N denotes the neighborhood defined by the user around the region [l,m] in the image.

- Contrast adjusting

Images need to have a minimum amount of contrast and brightness for segmenting. An image with less contrast means there is no proper difference between black and white region, only with a proper contrast feature can be extracted from the images. Contrast cannot be neither high nor less both will affect the result.

$$F(a) = \mu a + \alpha$$

A is the color component value. The slope μ controls contrast. The result will range from 0 to 255.

Fig 5.1 Palm image after pre processing

Segmentation

It is a process to partition an image into multiple regions based on some characteristics. Aim of segmentation is to segment or simplify a desired region of an image which is more meaningful or to make the image easier for further process.

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The particular region of an image may be similar to their intensity or texture value which makes a boundary, these boundaries are helpful for segmentation.

- Region of interest

Region of interest helps to derive a meaningful portion of an image. ROI can segment the portion in any shape which makes it a more convenient segmentation algorithm. The method is widely used for binary masked images. In the result image the portion which belongs to ROI will set to 1 and the region which is not belongs to ROI will have the value of 0.

- Otsu thresholding

Otsu thresholding is performed to reduce a grey scale image into a binary image. This thresholding method differentiate the image into two classes of pixels, by calculating the optimum threshold value of the two classes.

$$Q_j = m_j / M$$

M is the number of image pixels. Histogram count for pixel value j is m_j

At some point of threshold value of T if K(a,b) is the thresholding version of q(a,b), it can be

$$K(h,i)=1 \text{ if } q(h,i) \geq T$$
$$K(h,i)= 0 \text{ if } q(h,i) < T$$

Thresholding operation can be represented as

$$T=N[h,i,p(h,i),q(h,i)]$$

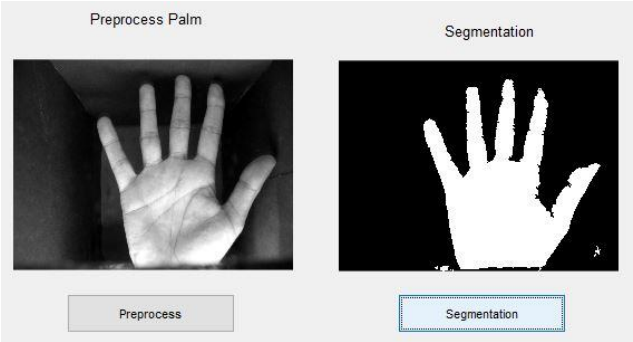

Fig 5.2 Palm image after segmentation

Feature extraction

Each image will have a unique property or unique signature which defines the image, extracting these properties is called feature extraction. Feature extraction implements on a measured set of data and then builds a derived set of data, these derived data is used to classify the gender.

- Algorithm

Step 1: Collect the fingerprint image dataset.

Step 2: Pre-process the palm image using efficient pre-processing method.

Step 3: Segment the palm area from the image using effective segmentation algorithm.

Step 4: Extract the desired region using manual/automatic segmentation method.

Step 5: Analysis of physical characteristics of the region and its area is to be calculated.

Step 6: Based on the value of area gender is classified.

Support vector machine based classification

To improve the accuracy SVM method is used, a set of sample is produced to the algorithm to learn, when the input is given to the algorithm it will produce the result according to the input.

V. EXPERIMENTAL RESULT

Male and Female palm images are collected, these images quality is improved by enhancement and preprocessing for better edge detection of the palm. Figure 5.1 shows the palm image after enhancement, the resultant image will help to get accurate region of palm.

The preprocessed images are then segmented using thresholding method and desired region is segmented. By analyzing the area of palm gender is predicted. 94% of the time the gender classification result was accurate. Out of 50 inputs 47 prediction went correct.

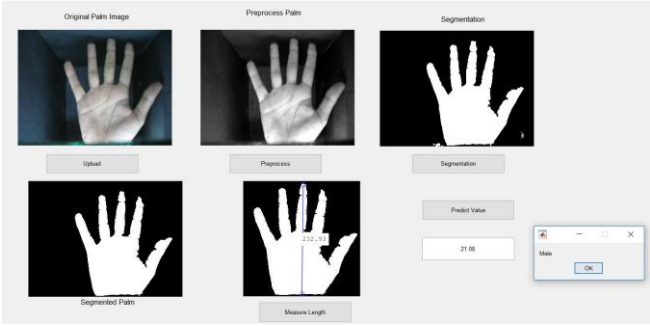

Fig 6.1 Classification of gender.

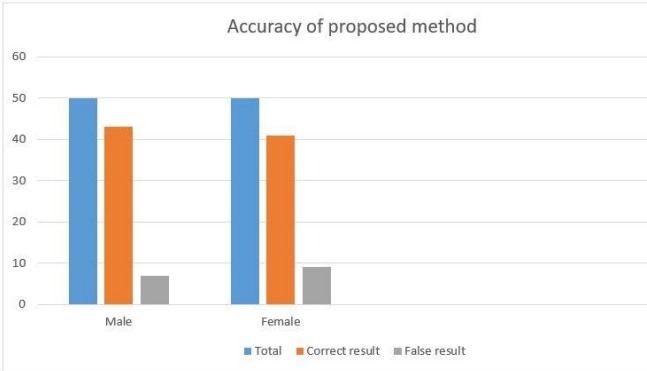

Fig 6.2 Chart for Accuracy of proposed work

VI. CONCLUSION

In our work we are classifying gender only with some geometric features like side as well as diagonal length of the palm, in future we can predict age from segmented lines marks from the palm.

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In our work we are considering only the geometric shape, but we can extract the marks inside the palm and measure the length, according to the length curvature length, width and thickness we can classify the gender. We can use deep learning classifier for an effective classification. In future work classifying the gender using texture can be added along with the existing method to improve the accuracy.

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