

A Review and Study on Fingerprint Based Gender Classification using Classified Techniques

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Abstract—In the era of technology and science, a gender classification have immense value. Fingerprint based gender classification helps to analyze the data in easy way and help to sort out the data. Now a days finger print based gender classification is seen in civilian, industrial, commercial, and unique Id of nation as AADHAR card. As the fingerprints are unique, gender classification helps to minimize the large data. It is utilized by using simple scanner which is available in affordable prices. This review study introduces various methods of fingerprint based gender classification, its limitations and strengths. After having study of this review we can try to increase the efficiency which will help for further research work also. This paper will help to design and develop an efficient algorithm for the fingerprint based intelligent gender identification system and after testing the samples, the performance efficiency of the proposed system found to be 88% for female and 78 % for male.

Index Terms— Descrete Wavelet Transform (DWT), feature, fingerprint, gender, minutiae, ridge, singular value decomposition

1 INTRODUCTION

Fingerprint is the unique identity of any person of the world. It takes place in pregnancy and lives for whole span of life of a person. Though finger of a person is injured, burned, the prints damages for little period of time after getting well, it occurs as usual. Means there is no changes in the fingerprints. So fingerprints are unique id of person. In judicial matters law also believes and accepts the fingerprints due to its most reliability in criminal study also fingerprints are most valuable. There are no exactly same fingerprints of two persons though they are twins. It can be classified gender wise, which narrows the suspects. If we want to find suspicious person from 100 or 1000 of employees of industry, and if there are 50% of female and 50 % of male employees, this classification reduces the 50% of data automatically.



Fig. 1. Original Fingerprint Image

1. **Ridge**-is a single curve segment
2. **Ridge ending** - a ridge that ends abruptly
3. **Bifurcation** - a single ridge that divides into two ridges
4. **Valley**-region between two adjacent ridges
5. **Core** -is the inner terminus of the pattern

As the age grows, fingerprints also develop to grip the things. Every ones gripping capacity is different, while he or she grips the things, fingerprints are impressed on that thing. From the site of crime, fingerprints can be obtained and analyzed for identification and matching. Physical features of fingerprint like ridge, valley, core, ridge count, ridge thickness, etc. which have most potentiality. Due to its uniqueness fingerprint have immense importance, with the help of which we can easily find out the various properties and which will be very much useful for the various applications.

2 GENDER CLASSIFICATION PROCESS

The gender classification using fingerprint consists of a process which requires various steps like, Collection of database, Preprocessing, Extraction of features, Matching, Classification, etc.

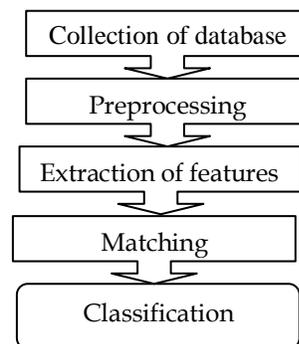


Fig. 2. Steps of Gender Classification

3 REVIEW OF LITERATURE

Lin Hong and Anil Jain [1] presented an approach to classify the gender as per their paper, gender can be efficiently classified by using various methods. System is based on a prototype

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biometric system which integrates faces and fingerprints for personal identification and authentication. The integrated system operates in an identification made and overcomes the limitations in face recognition and fingerprint recognition systems. The performance of system is increased by integrating the multiple cues with different confidence measures. Experimental results show that the integration system is best. T. Arulkumaran et al. [2] has described a system which is based on 2D-discrete wavelet transforms and principal component analysis which includes 400 fingerprints of the persons having age group between 12 to 60 years. To improve the performance, data base clarity should be increased. Feature vector extraction is time consuming. The system based on $\frac{3}{4}$ of the fingerprint data base for training and remaining was used for the purpose of testing. The success rate for system is 68% for the available data base. This system is basically used for age estimation & can be used for gender estimation by using an appropriate algorithm and with the help of ridges and valleys. Gornale et al. [3] has worked on gender identification which is carried out by using combine features, like FFT, eccentricity and major axis length. There is 550 female samples and 450 male samples by using left thumb impression of good quality. For the better result optimal threshold is chosen. The proposed algorithm has accuracy upto 80% for male and 78 % for female. The accuracy can be extended for frequency domain and region properties to find various parameters like gender, age etc. for various applications. Nitin M. D. et al. [4] Presented a study to determine the gender which is based on finger ridge count. Their is 275 male and 275 female samples from south Indian population between the ranges 18 to 65 years. According to result female have significantly higher ridge count than male & ridge density is less than 13 ridges /25mm² for male candidate and 14 ridges/25 mm² for female candidate. The ridge density is one of the most important factor for gender identification using fingerprint analysis. Ritu Kaur et al. [5] described novel method to estimate gender by analyzing fingerprint using Fast Fourier Transform (FFT), discrete cosine transform (DCT) and power spectral density. A data set of 220 different age and gender is collected as internal database. Initially the fingerprints of subject were tested and after manual analysis a threshold is specified. Frequency domain calculations are compared with predetermined threshold and a gender is determined of the sample tested, 99 samples identified exactly out of 110 female samples and 87 samples identified exactly out of 110 male samples. In this system algorithm gives an accurate decision of 90 % for female and 79.09% for male. Xiong Li et al. [6] has worked on multimodal gender recognition. To achieve a robust and discriminative performance for gender recognition, visual observations from both face and corresponding fingerprints are fused to serve for the task. System employed bag-of-words model to structure the image representation. System gives a novel supervised method to construct the visual words, by which the redundant feature dimensions are discarded and the important dimensions for gender classification are highlighted. Aligning the feature dimensions to a common normal vector of the hyper plane between categories is used to achieve dimension rearrangement. This system developed novel discriminative LDA (DLDA) model by maximizing the inter-class margins, which

can significantly enhance the discriminative power of the whole model. D. Gnana Rajesh et al. [7] worked on an efficient algorithm to clarify the gender by using fingerprint which is based on un-decimated wavelet transform (UWT) to extract the features from the fingerprint. The Gaussian mixture model (GMM) technique is used as classifier. There is database of 100 males and 80 females for the gender analysis. The proposed approach is tested by rescaling the input fingerprint image into three different sizes, 1.32x32 pixels, 2.64x64 pixels, 3.128x128 pixels. The characteristics of fingerprint are extracted from UWT decomposed sub bands and applying t-test class ranking to select the dominant UWT co-efficient. The performance is measured to find the gender. The results given by author are about satisfactory and with more than 90 % accuracy. Gnanasivam P. et al. [8] proposed novel method of gender classification from fingerprint based on discrete wavelet transform (DWT), singular value decomposition (SVD). System computed all the sub bands of DWT combined with spatial features of non-zero singular values which are obtained from SVD. The classifier used in this method is K nearest neighbor (KNN). System has huge internal data base of 1980 male fingerprint and 1590 female fingerprint. Their experimental result for various finger are for female person and few left hand little finger, it is 94.32 % whereas left hand index finger of male it is 95.46 %. It also shows the overall classification rate for male 91.67 % and for female 84.69 %. The system overall classification rate is 88.28 %. The success rate can be increased by testing various techniques and by using spatial parameters. Bindhu K. Rajan et al. [9] describes fusion of two biometric traits viz, iris and fingerprint to classify gender. Mean and standard deviation are the features extracted from an iris image, whereas Ridge Thickness to Valley Thickness Ratio (RTVTR) is extracted from a fingerprint image. The features extracted from both iris and fingerprint images are used to train a neural network. As a result, a suitable feature vector is formed which is used for classifying gender. The accuracy of the system can be enhanced by exploring better features and improving the classifier. Ahmed Badawi et al.[10] proposed methods for classification of gender for the criminal identification in forensic anthropology and also it is useful to minimize the list of suspects. There are 1100 males and 1100 females fingerprint images having different age groups and analyzed for the feature extraction. The ridge count, ridge thickness to valley thickness ratio (RTVTR), ridge count asymmetry, white lines count and pattern type concordance etc. features were extracted by them. The linear descendant analysis (LDA), fuzzy C-Means (FCM) and neural network (NN) were used by them for the purpose of classification. By using the most dominant features in this method, they have obtained results as

1. Using FCM, the results was 80.39 %
2. Using LDA, the result was 86.5 %
3. Using NM, the result was 88.5 %

Proposed methods are useful to minimize the suspects search list and to give a likelihood probability value at the gender of suspects. The accuracy is minimum, which can be improved by modifying the feature extraction and classifiers.

4 PROPOSED INOVATIVE METHOD FOR GENDER

IDENTIFICATION

The frequency domain analysis and spatial domain analysis are the approaches in the figure print analysis using image processing. The fingerprint ridge count, ridge density, ridge thickness to the valley thickness ratio, ridge width etc. parameters plays an important role to find the gender. The different methods and techniques proposed by various authors are based on fingerprint ridge parameters and other parameters also. By using an efficient technique, the accuracy level can be increased.

i MATLAB based Simulation Results

ii Verification of Analytical solution with simulated results

The samples are captured and analyzed with the help of MATLAB program. Seprate tabular data is prepared for the same.

Table 1
Results of FFT, DCT and PSD for samples of female

Finger-print Sample	FFT Threshold> 160000	DCT Threshold> 15500	PSD Threshold< 7500000000
1	2199667	22010.832	17040820064
2	1470102	13470.192	7452125365
3	1434325	12302.365	5696332154
4	2362231	20145.950	15608822658
5	2156987	19856.472	14789103659
6	1570526	13658.074	7849278132
7	2284175	22042.526	17124243356
8	1900789	17331.712	12148922712
9	2177389	19119.882	13458942462
10	1748965	16052.635	10568799167

Table 2
Results of FFT, DCT and PSD for samples of male

Fingerprint Sample	FFT Thresh-old> 160000	DCT Threshold> 15500	PSD Threshold< 7500000000
1	1620635	15769.437	9145345125
2	1111374	9212.310	3024365149
3	1716094	16592.571	10196352412
4	1437935	12365.179	6412066212
5	2148403	19236.955	14470156789
6	1636022	15962.381	92360902666
7	1555125	14256.625	83792551121
8	1365456	11235.112	4726838255
9	1256987	12753.354	5775451203
10	1666805	15365.472	9576535425

The total samples are tested, the performance efficiency of the proposed system found to be 88% for female and 78 % for male. Hence simulated results are closely matched with analytical analysis of proposed system.

5 APPLICATIONS

In various security based and surveillance based application, the gender identification plays vital role and reduces the lists

of suspect search. So that it becomes possible to find the result in short span of time.

6 CONCLUSION

As the fingerprints are unique for individuals in the universe, it gives a unique identification and there is no doubt that fingerprint evidence is most acceptable and reliable evidence. Most of the traditional methods used in identification of gender gave the satisfactory results but an efficient attempt is needed to give effective results with higher accuracy. Clarity of Image, Frequency domain analysis, singular value decomposition techniques etc. will play a very important role to increase the efficiency and still there is a scope to work on this to improve the results.

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