

# A Study on Binary Number of Gender Identification Based on Fingerprints

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**Abstract**— Scantlings of researches have been conversed in the literature for the identification of fingerprint. Gender identification from fingerprints is an important step in forensic anthropology in order to identify the gender of a criminal and minimize the list of suspects search. In this paper, gender identification is carried out by using Wavelet Transform, Pixels calculation and Binary Transform. Right thumb impression of each sample of the internal database of 200 male samples and 200 female samples of good quality are selected. This identification is portrayed in the result and discussion section.

**Index Terms**— Binary Length, Binary Transform, Discrete Wavelet Transform, Image Pixels, Wavelet Transform

## 1 INTRODUCTION

Gender information is important to provide investigative leads for finding unknown persons. The science of fingerprint has been used generally for the identification or verification of person and for official documentation. Fingerprint identification algorithms are well established and are being implemented all over the world for security and person identity. Although Fingerprints are one of the most mature biometric technologies and are considered legitimate proofs of evidence in courts of law all over the world, relatively little machine vision method has been proposed for gender identification. In this paper, gender of a person is identified from fingerprints using Wavelet Transform, Pixels calculation and Binary Transform. Fingerprint analysis plays a role in investigation of crime. There are different methods to identify gender of human which are listed below and explain one by one in next part of paper.

## 2 LITERATURE SURVEY

A technique on Fingerprint Based Gender Classification using multi- class SVM by which have use some features of finger such as ridge thickness, ridge density to valley thickness ratio and ridge measurement for gender detection. Proposed methodology uses Multi Class SVM as classifier which overcomes the problem of SVM (Binary Classifier). They have used multi class SVM method for classification and achieve overall success rate in gender classification is 91% [1].

A technique on Fingerprints based gender classification using Discrete Wavelet Transform and Artificial Neural Network using two methods have been combined in the

proposed work for gender classifications. The first method is discrete wavelet transformation employed to extract fingerprint characteristics by doing decomposition upto 5 levels. The second method is the back propagation artificial neural network algorithm used for the process of gender identification. The overall recognition rate achieved of about 91% [2]. The work on age and gender of a person from finger print impression using RVA and dct Coefficients is described the novelty in the solution lies in the fact that the identification of age and sex is independent from the pressure i.e. finger prints thickness or ridge/valley thickness [3].

A method for Fingerprint Based Gender Classification through frequency domain analysis to estimate gender by analyzing fingerprints using 2D Discrete Wavelet Transforms (DWT) and Principal Component Analysis (PCA). A dataset of 400 persons of different age and gender is collected as internal database. They have used minimum distance method for classification and achieve overall success rate in gender classification of around 70% [4]. The feature set is obtained using DWT and SVD and the internal database of 3570 fingerprints in which 1980 were male fingerprints and 1590 were female fingerprints. They obtained Finger-wise gender classification which is 94.32% for the left hand little fingers of female persons and 95.46% for the left hand index finger of male persons. Gender classification for any finger of male persons tested is obtained as 91.67% and 84.69% for female persons [5]. The feature set is extracted from Fast Fourier Transform, Discrete Cosine Transform and Power Spectral Density (PSD). A dataset of 220 persons of different age and gender is collected as internal database. Frequency domain calculations are compared with predetermined threshold

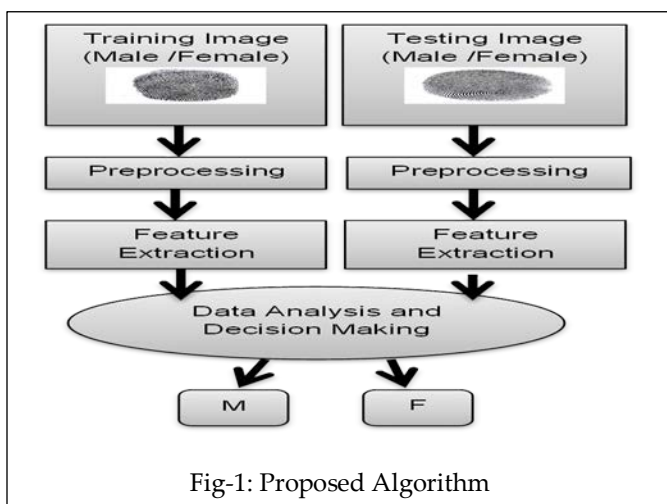
and gender is determined. They obtained results of 90%, and 79.07% for female and male samples respectively [6].

A dataset of 400 persons of different age and gender is collected as internal database and Frequency domain calculations are compared with predetermined threshold and gender is determined. They obtained the results of 92.88 % and 78 % for male and female respectively [7]. The ridge count and finger size features of left little fingers are used to achieve a classification. The best classification result of 86% accuracy is obtained by using ridge count and finger size feature together [8]. This method is experimented with the internal database of 400 fingerprints in which 200 were male fingerprints and 200 were female fingerprints. They found male-female can be correctly classified up to 91% [9]. The mean difference in the loop ridge counts across gender represented by these eighty subjects,  $F(1, 78) = .308$ ,  $p > .05$ ,  $MSE = 7.946$ . There is no difference in the number of loop ridge counts that males have (13.18,  $SD = 2.735$ ) then did females (13.53,  $SD = 2.900$ ). Here concluded there are no significant differences in loop ridge counts between genders [10].

A dataset of 10-fingerprint images for 2200 persons of different ages and gender was analyzed. Features extracted were, ridge count, ridge thickness to valley thickness, white lines count, and ridge count asymmetry, and pattern type concordance. Fuzzy- C Means (FCM), Linear Discriminate Analysis (LDA), and Neural Network (NN) were used for the classification using the most dominant features predicted results of 80.39%, 86.5%, and 88.5% using FCM, LDA, and NN, respectively [11].

### 3 PROPOSED METHODOLOGY

The Proposed method for classification of fingerprint image for gender classification is shown Fig-1



### 3.1 Fingerprint Image Acquisition

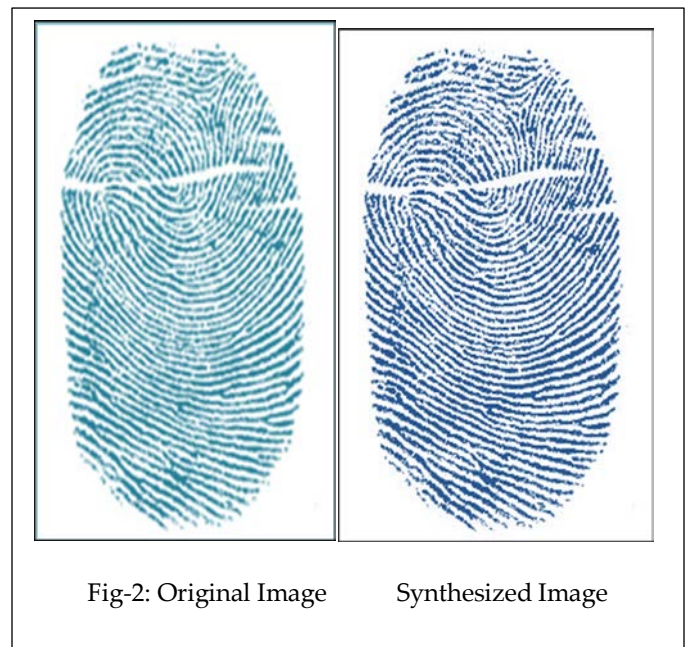
After obtaining clearance from institutional ethics committee, this prospective study was carried out over a period of two months among the students of Khulna University, Khulna, Bangladesh. Total 400 students (200 male & 200 female) are take part in the study.

### 3.2 Preprocessing

The fingerprint is resized to 320x256 and save it in JPEG (Joint Photographic Experts Group) format. The algorithm is implemented using MATLAB programming language. We use 2D- Discrete Wavelet Transform (DWT) to classifying a person's using his/her fingerprint.

### 3.3 Feature Extraction

After preprocessing the fingerprints undergo further processing. Apply DWT for each preprocessing fingerprint image. Since images are affected by various noises, so it transform into better stage. After compression of transform images are converted to gray scale images using the `rgb2gray` command in MATLAB. The input image which is gray scale is converted into binary. The obtained fingerprint goes through processing stage for enhancement and removing the noise using meadian2 filtering. Enhancement methods changes from fingerprint to fingerprint and for different databases. Poor quality fingerprints obtained can be enhanced for the betterment of the algorithms. The output of processing is shown in the following figures



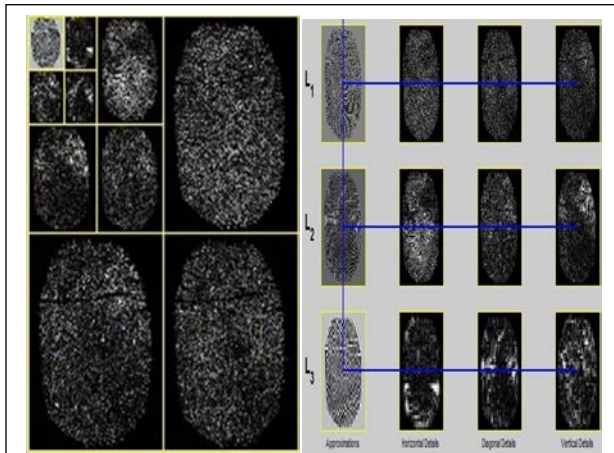


Fig-3: Decomposition at level 3

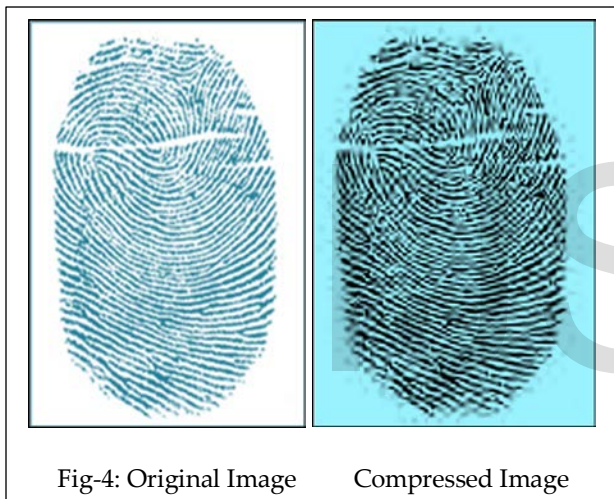


Fig-4: Original Image      Compressed Image

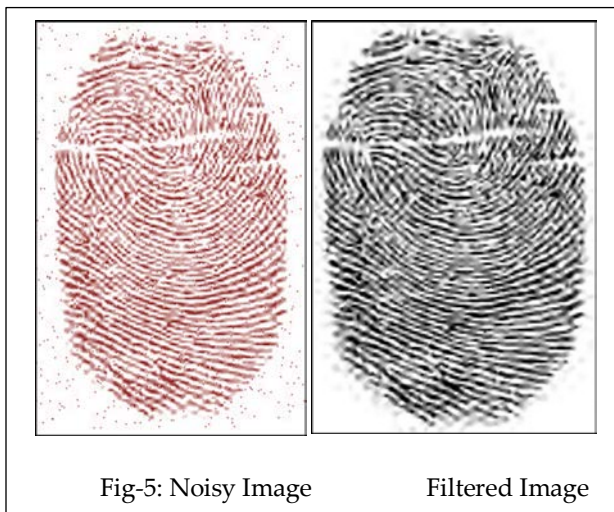


Fig-5: Noisy Image      Filtered Image

## 4 WORKING PROCEDURE

We have used 200 male fingerprints and 200 female fingerprints. Good results are obtained and the results have predicted only one feature like length of binary number, which is used to classify the gender (male or female). Input image from the database is given to the gender identification system.

- i). WT the given input image and generates the output.
- ii). Transform filtered gray scale image into a binary image.
- iii). Block and White pixels calculated using binary image.
- iv). Transform total Block pixel number into binary number.
- v). Find the length of above binary number and it set to 15 digits. If binary length  $\geq 15$  digits, the decision is male and if binary length  $< 15$  digits, the decision will be female.

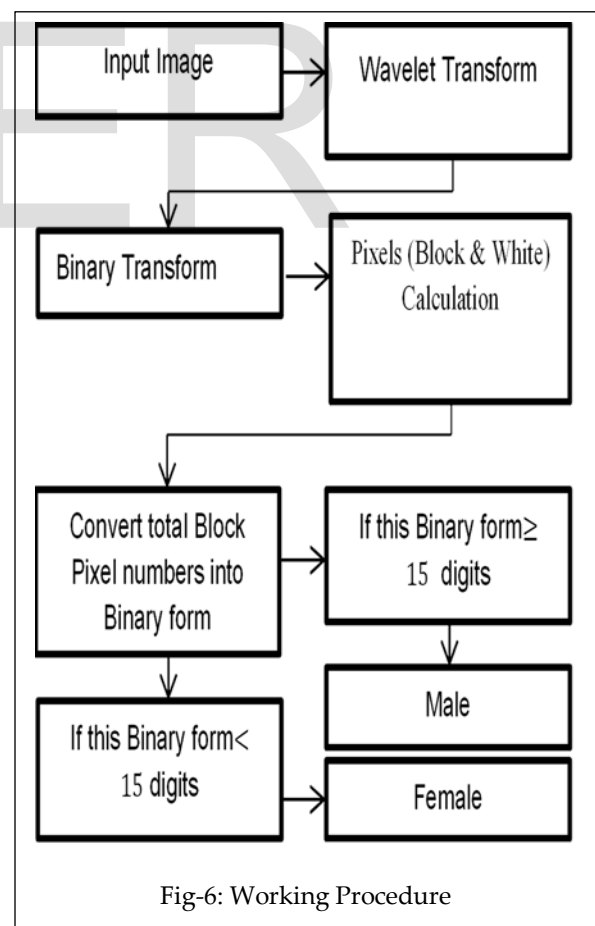


Fig-6: Working Procedure



## 4.1 Experimental Results

No.	White Pixel	Block Pixel	Binary Length
1	40875	41045	16
2	61944	19976	15
3	59981	21939	15
4	62535	19385	15
5	61994	19926	15
6	54899	27021	15
7	69818	12102	14
8	55491	26429	15
9	57640	24280	15
10	62401	19519	15
11	55980	25940	15
12	63129	18791	15
13	58614	23306	15
14	63338	18582	15
15	64854	17066	15
16	64382	17538	15
17	64559	17361	15
18	64495	17425	15
19	64179	17741	15
20	62834	19086	15
21	64247	17673	15
22	58521	23399	15
23	64669	17251	15
24	62770	19150	15
25	76216	5704	13
26	60670	21250	15
27	62812	19108	15
28	57551	24369	15
29	58917	23003	15
30	60511	21409	15
31	64587	17333	15
32	63635	18285	15
33	72867	9053	14
34	60619	21301	15
35	58569	23351	15
36	57811	24109	15
37	68817	13103	14
38	63625	18295	15
39	65513	16407	15
40	58912	23008	15

Table 1: Experimental Results for 40 Male Fingerprints

No.	White Pixel	Block Pixel	Binary Length
1	70760	11160	14
2	70925	10995	14
3	69418	12502	14
4	73192	8728	14
5	74509	7411	13
6	77359	4561	13
7	69892	12028	14
8	74823	7097	13
9	72382	9538	14
10	71478	10442	14
11	79321	2599	12
12	64370	17550	15
13	73084	8836	14
14	77074	4846	13
15	78189	3731	12
16	67746	14174	14
17	76026	5894	13
18	61586	20334	15
19	76500	5420	13
20	70837	11083	14
21	68569	13351	14
22	76293	5627	13
23	71615	10305	14
24	73472	8448	14
25	73397	8523	14
26	61943	19977	15
27	71794	10126	14
28	78573	3347	12
29	64051	17869	15
30	71849	10071	14
31	76349	5571	13
32	63895	18025	15
33	71139	10781	14
34	77823	4097	13
35	77982	3938	12
36	70552	11368	14
37	80823	1097	11
38	76297	5623	13
39	73119	8801	14
40	71309	10611	14

Table 2: Experimental Results for 40 Female Fingerprints

## 4.2 Discussion

From Table 1, we observed that out of 40 male fingerprints, 36 follows our mention process i.e, binary length  $\geq 15$  digits, but in that case 4 male fingerprints are not follow our mention process. Again, from Table 2, we observed that out of 40 female fingerprints, 35 follows our mention process i.e, binary length  $< 15$  digits, but in that case 5 female fingerprints are not follow our mention process. Our proposed process classified accurately by 90% for male and 87.5% for female fingerprints. Overall average identification rate of 88.75% has been achieved.

## 5 CONCLUSION

Gender classification using fingerprints is an emerging field of research in recent years. When a person is identified as male or female, then any suitable biometric trait can be used for further classification. Identification of gender can also provide an important clue in various security and surveillance based applications. Due to the immense potential of fingerprints as an effective method of identification, an attempt has been made in the present work to analyze their correlation with gender of an individual. Wavelets have been used frequently in image processing and binary transform is also more effectiveness for image identification.

## FUTURE WORKS

In future, for better results of gender, age and blood group estimation, we are working in collecting huge samples in the each category. In addition, the research work has been extended using other parameters of fingerprint.

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