# Gender Discrimination Through Fingerprint- A Review

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**Abstract:** In modern era, fingerprints are used for identification and authentication purposes. Discrimination between men and women also describe using their fingerprints, by counting white line, ridge thickness to valley ratio (RTVTR) and ridge width. Fingerprints are remain unchanged as individual, throughout life. Other advantages of fingerprints are: accurate, reliable, permanent and acceptable as security. In this paper we study the implementation of a system which will used to describe the relation between fingerprints of individuals with their gender and blood group.

**Keywords:** Fingerprint, gender, ridge density, ridge width, RTVTR, blood group

## 1. Introduction

Today generation is based on new technology and amount of information is increasing day by day [1]. So protection and storing of data has become difficult. Individual identification becomes main requirement for personal, legal, social and for other reasons. Other methods e.g. DNA, blood groups, measurement height and autopsy reports are also used for personal identification. Accurate identification and authentication plays a major role for security. In this generation importance of privacy, security, identification and automatic authentication methods are used instead of traditional methods e.g. keys, passwords, lock and access cards [2]. To measure personal identification and authentication there are three methods which are given below [3]:

- Knowledge: something you know (PIN, registration number, password, etc.)
- Ownership: something you have (lock, key, access card, etc.)
- Biometrics: something you are (fingerprints, face, voice, etc.)

The main reason of not using traditional methods are may be forgotten passwords or stolen electronically gadgets. Electronic gadgets are not able to make differentiate between approved person and fraudster. In these days, a fingerprint has become the most common technique for secure and fast identification. We know fingerprints are used for identification and authentication purpose because of its uniqueness and do not change in one's life [4].

## 2. Classification of Fingerprints

Fingerprint is produced when a finger is pressed upon a smooth surface. There are three level of information is contained in a Fingerprints. Level 1defines macro details of fingerprint such as ridge flow and pattern type e.g. arch, loop, whorl etc. Level 2 defines the Galton characteristics in which ridge bifurcation or ridge termination e.g. eye, hook ending etc. Level 3 defines all dimensional attributes of ridge e.g. ridge path deviation, ridge width, scars and other permanent details [5]. The thickness of ridge determined by applied pressure on smooth surface [6, 7]. Ridge density is determined as number of ridges divided by corresponding

area in fingerprints. Ridge breadth is determined as the distance between the centres of two adjacent valleys [8]. Fingerprints are classified as given below [9, 10, 11]:

### 2.1. Loops:

There are 60% people have loops. Loops accounts for 65% of all fingerprints which are formed by ridges. Ridges flow in form one side, which goes towards up in centre like tented arch, curve back around then goes out from the entrance side.

**Fig.1.** Loop [9-11]

### 2.2. Whorls

Only 35% people have whorls. Whorls are defined in four different patterns. All the four have common features. These features are given below:

- They have two or more than two deltas.
- One or more than one ridge line curves around the core to make circle or spiral.
- A group of patterns which do not contain any feature given above is called accidental whorls.

**Fig.2** Whorls [9-11]

### 2.3. Arches

There are only 5% people have arches, which is simple but very rare. It is also classified into two forms; one is plane and second is tented arches. Ridge lines flow in print, then rise in the middle of pattern and flow out to the other side of the print.

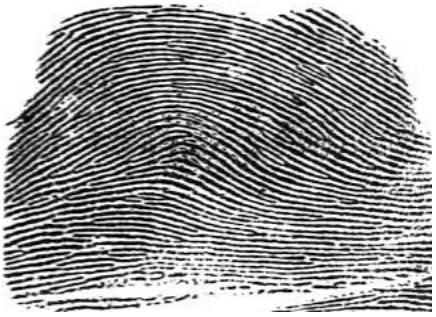

**Fig.3** Arches [9-11]

## 3. Methods

After studying various analysis, sex discrimination has defined using various parameters e.g. ridge density, ridge count, the ratio of ridge thickness to valley thickness, fingerprint patterns, ridge width. Blood group identification of each individual also determined with the density of occurrences of whorls, loops, arches. There are few other methods has been proposed for gender identification. In this section we discuss the researches in gender and in blood group classification.

In 2013, R. Kaur [12] has discussed a novel method using Fast Fourier transform (FFT), discrete cosine transform (DCT) and power spectral density (PSD) to differentiate gender through fingerprints. Primary data set of different age and gender is collected from 220 persons. Threshold value is set carefully after testing fingerprints. Comparison function between frequency domain calculations and the predetermined threshold is performed to determined gender.
The following steps explain the block diagram in Fig.4:

1. First block contain the data base which is given to the FFT, DCT and PSD.
2. FFT block performed the transform function and forward the output to the TH1 block. SET TH1 block set the first threshold value. To make the discrimination in gender a rule is set that is, if the fundamental frequency (FF) is greater than TH1 then decision is female and if the fundamental frequency (FF) is less than TH1 then decision will be male.

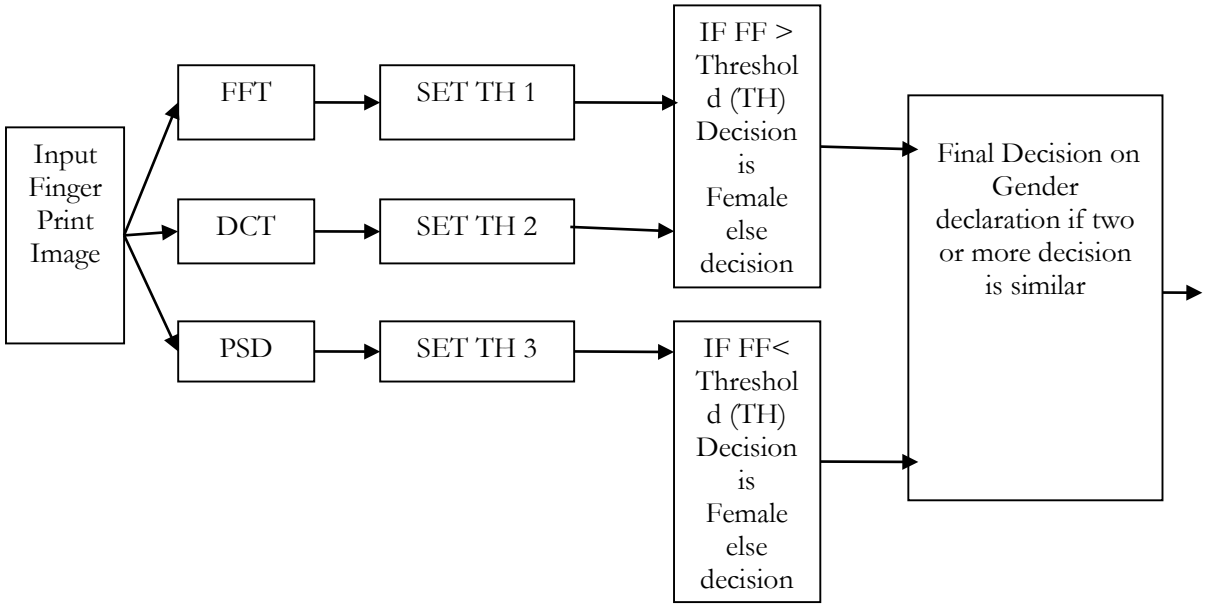


**Fig.4** Block diagram of proposed gender identification scheme [12]

3. DCT block performed the discrete cosine transform function and forward the output to the TH2 block. SET TH2 block set the second threshold value. To make the discrimination in gender a rule is set that is, if the fundamental frequency (FF) is greater than TH1 then decision is female and if the fundamental frequency (FF) is less than TH2 then decision will be male.
4. PSD block performed the power spectral density function and forward the output to the TH3 block. SET TH3 block set the third threshold value. To make the discrimination in gender a rule is set that is, if the fundamental frequency (FF) is greater than TH1 then decision is female and if the fundamental frequency (FF) is less than TH3 then decision will be male.
5. In last block, gender decided after comparing all the transform functions. We conclude that if two of them are male, the output is decided as male and if two of them is female, the output will be decide as female.

S.S Gornale [13] has defined the gender discrimination using FFT, Eccentricity and Major Axis Length functions. Left thumb impression of 450 male samples and 550 female samples are selected for data set. Threshold value is set for better result for each transform. This proposed algorithm produces accurate result of 80% of male and 78% of female.

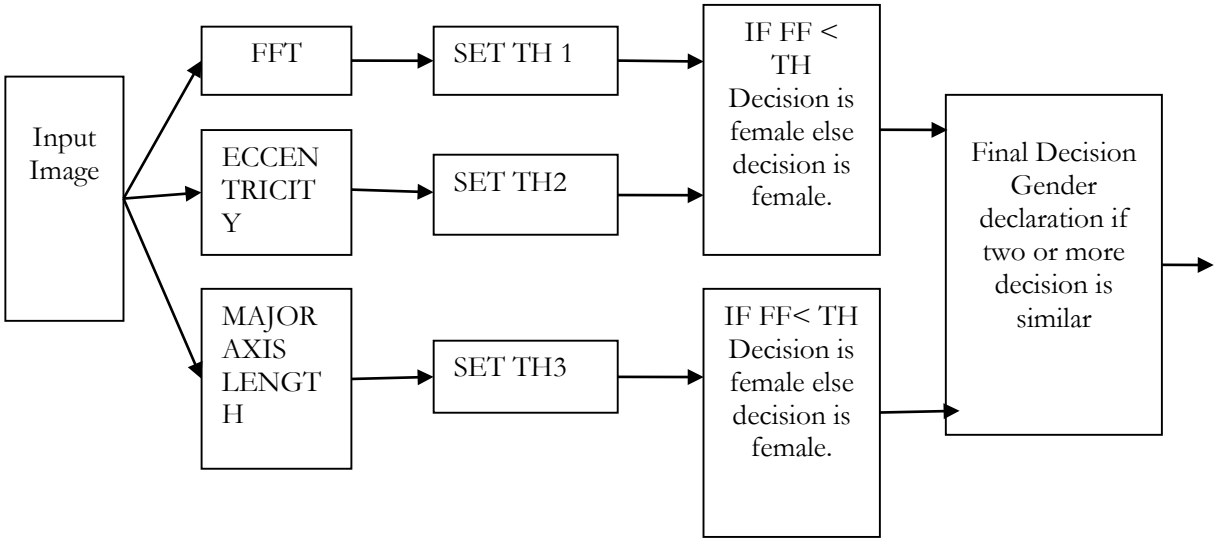


**Fig.5**. Block diagram for gender classification [13]

The following steps explain the block diagram in Fig.5:

1. Input image from the data set forward to the gender discrimination system.
2. FFT function generates the output signal corresponding input signal. SET TH1 block set the first threshold value. To make the discrimination in gender a rule is set that is, if the fundamental frequency (FF) is greater than TH1 then decision is female and if the fundamental frequency (FF) is less than TH1 then decision will be male.
3. Eccentricity computed the output signal to the given input signal. SET TH2 block set the second threshold value. To make the discrimination in gender a rule is set that is, if the fundamental frequency (FF) is greater than TH2 then decision is female and if the fundamental frequency (FF) is less than TH1 then decision will be male.
4. Major Axis Length computed the output corresponded given input signal. SET TH3 block set the third threshold value. To make the discrimination in gender a rule is set that is, if the fundamental frequency (FF) is greater than TH1 then decision is female and if the fundamental frequency (FF) is less than TH3 then decision will be male.
5. After comparing the results of all functions, if two decisions are male, the result is declared as male or else it will be female.

S.Tarare et al. [14], explained Discrete Wavelet Transform (DWT), in which wavelet used as basis function. This function gives energy based features of an image, in which dataset is collection of 100 male fingerprints and 100 female fingerprints. In this method, only measurable parameters of image e.g. frequency, pattern recognition are considered.

The following steps explain the block diagram given in Fig.6:

1. The function of this diagram is divided into three parts
2. First is pre-processing of all dataset, which is collection of 100 male and 100 female fingerprints. Dataset is collection of colorful images of different size, so all images converted into same size (512 * 512) and then into binary image.

3. In second part, output is calculated of feature vector of training images using discrete wavelet transform (DWT) function. Wavelet is mathematically term which cut up the data into different frequency components, then recognize the each component with its matched scale.
4. In last part tested fingerprint are classified as male fingerprint or female fingerprint with the help of K nearest neighbor (Knn) classifier, which is based on Euclidean distance measure for calculation of distance.

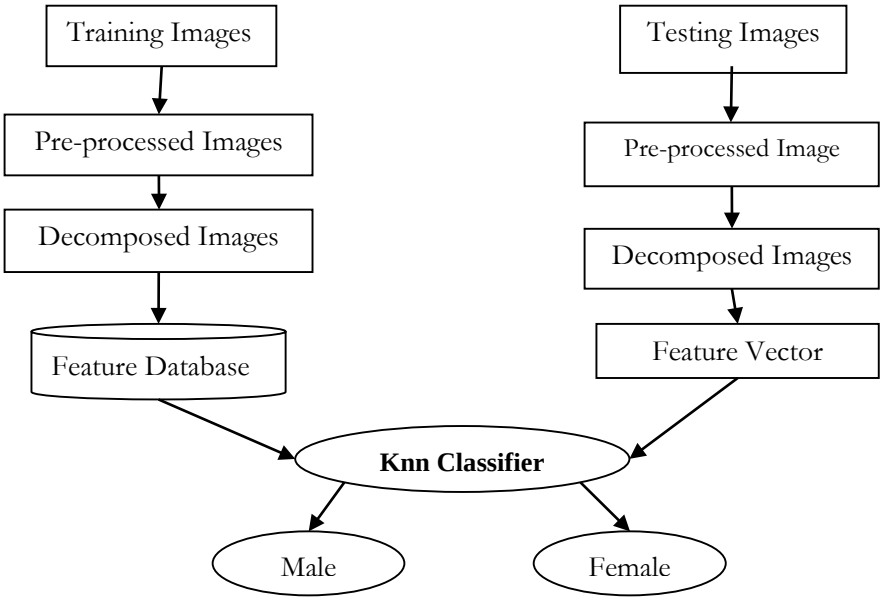


**Fig.6**.Overall process for gender classification [14]

## 4. Conclusion

Fingerprints are the most useful for identification and authentication purpose. The purpose of our research is to determine fingerprint discrimination thorough computer analysis using the advantages of new analysis. In this study, we found that female have more ridge density than male. We can also reduce the processing time by varying the length and difficulties of methods.

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