Development of Association Rule Mining Model for Gender Classification

Meena Tiwari¹, Dr. V. Shanthi², Dr. Ashish Mishra³

¹,² SRK, University, Bhopal (M.P.) India
³Professor Gyan Ganga Institute of Technology and Science Jabalpur (M.P.) India
phmeenatiwari@gmail.com¹, shan_v2006@yahoo.com², ashish.mish2009@gmail.com³

Abstract. Fingers have unique and developmental properties for biometric authentication systems. This is because fingerprints have the following characteristics: workable, distinctive (clear), durable, accurate and reliable, and accept security and identity worldwide. Fingers are seen as legal proof of this evidence in courts around the world. SVM support machines, NN is a neural network, FCM is a fingerprint classification system used in various modes, such as the Fuzzy C method, which is widely used to adopt a model. Gender determination from fingerprints is an important step in reducing the list of offensive searches in anthropology, as few machine-based methods have been requested for gender acceptance and correction. Several researchers have carried out gender fingerprint analysis and obtained competitive results. This article explains the difference between the genders using communication methods and classification methods. It is recommended that competent studies be combined with different methods and methods with comparative indicators to predict results. This allows researchers to conduct a comprehensive study and further research on models for the management of gender-specific mines.

Keywords: support vector machine, Fuzzy C-means, SVM, Gender classification, fingerprint images, association rule mining

1. Introduction: Biometrics is a term used for measuring and examining the body. It refers to an artificial temptation. Biometrics authentication is used in computer science as a form of identifying or verifying the identification of a person based on unique physiological and behavioral characteristics. Physical symptoms include fingerprints, retinal appearance, iris, and facial expressions. Social characteristics include voice and marks. Excellent fingerprint recognition is a sign of human fingerprint recognition. Recovering fingerprints from wrong scenes is an important method for determining science. Moisture on your fingers or oil or metal on the outside of the mirror may cause fingerprints. Fingerprints are small edges, folds, and depressions on each fingertip. They consist of pressure on the baby's little things, forming fingers in the womb. Each edge contains pores that are added to sweat the subcutaneous organs. The unique signature database is an organized
version of unique fingerprint information often used for evaluation or certification. A specially designed fingerprint ID framework is generally required. It plays a broad role and is very important in scientific and conventional applications. Feature releasing is an important step forward in brand authentication processes. Finger verification is still difficult and is an important part of verification.

As with the installation of fingerprints on various frames (such as mobile phones), it turns out that it is very important to analyze the impact of biometric accuracy on the principle.

1.1. Finger print recognition: For many applications in the business area, gender recognition is vital and vital, which includes the utility of human-computer interplay and laptop-assisted body structure or psychoanalysis, because it includes vast statistics about the differences among male and female characteristics. Some individuals have proposed various techniques for programmed sex class the utilization of human body and additionally lead attributes. To begin with, this bulletin presents the difficulties and bundles of sexual orientation class contemplates. At that point, it depicts the turn of events and system of sexual orientation class. We in examination those contemporary methodologies, including creative and judicious fundamentally based techniques, natural records-based procedures, and informal community information based strategies to exhaustively diagram sex classification research. Next, we underscore force and talk the restrictions of each approach. At long last, this content talks about some encouraging bundles for fate compositions.

1.2. Association Rule Mining: From a real point of view, finding the connections between many variables is an automatic loading method. ARM is commonly used in a wide range of applications, including customer relationship management (CRM), time-limited packaging and consulting frameworks. In addition, it has joined other mining companies, such as Web mining as a group for mining anomaly discovery to improve productivity and survivability. CRM benefits greatly from ARM because it helps to understand customer behavior. Presentation managers can use element-specific rules to create collaborative incentive work to acquire new customers. For a long time, the strategic layout of using ARM for food products has been an effective attempt. In a specific analysis, such as personalizing products in a grocery store, ARM is widely used. In addition to the customer department, ARM also helped its revenue grow 1.8%. In the field of science, ARM is used to generate new information about protein-protein cooperation. Similarly, it can be effectively used in quality clarity testing to find the natural use relationship between different attributes or different conditions.

1.3. Gender Classification using fingerprint: Use standard side-by-side gender guarantees, written fingerprints and hand assessments. One of the limitations of limited labeling (Dillon et al., 2001; Gungadin, 2007; Nithin et al., 2011) is that the assessment of boundaries increases the level of sexual orientation. Due to weak ink printing, washing and fingerprint concealment, this procedure is always unknown. The low storage efficiency of ink equipment, fingerprints with unfamiliar substances, fractional fingerprints, fingerprints caused by finger sliding or deformation, and insufficient selection and participation of objects are important reasons for the unique marking effect. In addition, the thickness of the edge depends on the weight used and may lead to erroneous conclusions about the evidence of identifiable gender.

![Figure 1. Sample fingerprint](image)
The edges and their examples show various characteristics of human science. Unique tags have about 150 edge attributes (Hong et al., 1998). Different types of marginal measurements and side-by-side gender differences are considered (Cummins 1941 and Kralik. In addition, Nowotny 2003). With the latest success and the introduction of powerful classifiers, checking the edges of unique tags becomes easier for any preparation. Figure 1 shows a unique annotation with a single pattern (center and increment) and known edges of the fingerprint. Existing strategies for identifying sexual orientation use evidence, various classifiers and some restrictive methods.

1.4. Challenges in Fingerprint Analysis: The edges and their examples show various characteristics of human science. Unique tags have about 150 edge attributes (Hong et al., 1998). Different types of edge sizes and gender differences in edge width are considered (Cummins 1941, see also Kralik, Novotny 2003). With the latest success and the introduction of powerful classifiers, checking the edges of unique tags becomes easier for any preparation. Figure 1 shows a unique annotation with a single pattern (center and increment) and known edges of the fingerprint. Existing strategies for identifying sexual orientation use evidence, various classifiers and some restrictive methods.

Another important test is the weight on the fingers. The weight of the fingers will affect the main events on the side. Edge changes are affected by many factors, such as surface species and insomnia. The magnitude of the witness pressure is reflected in the blank or polished unique notes created by the smoothing or widening of the edges. In the shadows or shadows created by flattening or widening the edges, the magnitude of the original pressure is clearly visible. Tap the head to show the wipe edge, making the effect easier. Growth may occur on the upper edge, but not on the valley or lower consolidation edge. When the effect is lighter, the improvement may be at the higher edge, rather than at the valley or lower enhanced edge. Medium-sized milling cutting edges have more composition, suitable for the third level of detail and clarity. Medium size The ideal pressure (between 2 and 7 kg) when checking fingerprints.

2. Gender classification: Identifying gender is most important in several ways, eg. Due to the reduced speed of identification of criminals in the event of an accident in computer vision and the time in each application is reduced. In this way, many of the ways to identify gender have been engraved by abusing biologies as diverse as faces, fingers, voice patterns, etc., thus allowing the use of fingerprints to classify gender. Fingerprint recognition will be completed. 2 functions, one to identify the number of rib fingerprints, rib density, rib thickness to the ratio of the thickness of the valley, the width of the ribs, and the fingerprint model used for gender classification, both in men and women. Second, classification allows the associated input fingerprints to be compared only with a variety of information and is essential to speed up fingerprint identification. Search area reduction techniques for automatic and manual detection techniques. Nowadays, additional and additional citizens and business applications are bad attitudes or active consideration of fingerprint recognition due to the provision of cheap and compact solid-state scanners and their superior and well-tested compatibility with various biometric technologies.

3. Literature Review: Ramanjit Kaur [1] has introduced the provision of finger-based gender, which is a major advancement in the study of human sciences, the aim being to identify the sexual orientation of perpetrators and to reduce the rate of prosecutor's investigation. The device contains 10 unique fingerprints for 2,200 people, age and gender, 1,100 men and 1,100 women separated. Highlights are: marking the walls, equality to thickness, marking the white line and checking the tail, and type of model. Fluffy C means, in line Distinguished analysis and neural networks use the most well-known components for structure, using FCM, LDA and N to obtain results of 80.39%, 86.5% and 88.5%, respectively.

D.Gnana Rajesh [2] This paper suggests another technique for gender orientation recognizable proof utilizing fingerprints. DWT and GMM innovations are utilized for part joining and design to improve group precision, while principles are utilized for segment decrease. By altering the Gaussian proportion and the level of various leveled segments, a serious extent of exactness can be accomplished. The examination shows that this methodology can be considered as a key contender
for current instruction to diminish the quantity of suspected criminal examinations and offer some benefit to the gender orientation capability of the suspect.

Suchita Tarare [3] proposed a venture is separated into three segments, first is pre-handling of all dataset pictures, second is estimation of highlight vector of preparing pictures utilizing discrete wavelet change, the third is arrangement of testing unique mark as male unique mark or female unique finger impression utilizing k-nn classifier which utilizes Euclidean separation measure for separation figuring.

Farzam Kharaji [4] human finger internal print was presented as a biometric trademark for confirmation. The trial was done on 177 subjects and after the picture preprocessing, a list of capabilities which was a blend of WEF and Gabor superior highlights removed lastly, the five classifications of unrivaled highlights were arranged with four classifiers so as to check or reject the guaranteed character. Test results show that for ring and center fingers, 20 predominant highlights by utilizing KNN with k=5 and PW classifiers have best outcome individually and furthermore for both finger together, 30 unrivaled highlights by utilizing SVM have best outcome.

Ashish Mishra [5] has used the fingerprint data set, one is female data and the second is male data and this process converts the image data for each fingerprint image into a text numeric code sequence. The standard a priori algorithm is used for mining attractive rules. And then minimize association rules in the filtered dataset using predefined minimum confidence and minimum conditional support. For each text file processing for classification made by Association Rule Mining and Classification. After classification the data can be classified as either male or female data. This method is based on two main principles of data mining. First, the method calculates the relationship between fingerprint image characteristics using the specified support and confidence. Second, classification of individual fingerprint based on data mining classification algorithm. It is based on traditional methods of data mining.

Swapnil S. Shinde's [6] paper proposed a strategy dependent on shape highlight extraction and wavelet highlights (can rip discovery and DWT). The proposed framework yields improved outcomes contrasted with the strategies executed up until now. The outcome acquired for the proposed framework is 98% contrasted with the current strategies, which gives greatest arrangement exactness of 91%. Female fingerprints are best delegated contrasted with male.

Ravi Wadhwa [7] Proposed a method to obtain competitive results. These are same survey work discuss here Fingerprints based on age and gender are classified by the area from the ridge to the valley, the entropy and the RMS value of the discrete cosine transform coefficient. A method of categorizing gender according to the age and gender of fingerprint readers. The novelty of this method is that age and gender recognition are independent of pressure, namely fingerprint thickness or ridge/valley thickness. proposed a method to obtain competitive results.

S. Sudha Ponnarasi [8] Singular recognizable proof strategy dependent on toothpaste. The investigation was directed with in excess of 500 individuals, 250 of whom were men and 250 were ladies, somewhere in the range of 1 and 90. number of white lines, number of strings, and type conditions. A vector machine is utilized for the most significant part, and a serious outcome is gotten.

Gnanaswamy P [9] recommends a method to identify the genes used by the fingers by time classifying the details by detailing the finger to determine the gender. The components were obtained from Accelerated Medium Transform, Discrete Cosine Transform and Power Spectral Density. It aggregates an individual information base of 400 distinctive age and sexual orientation data. Estimates of the statistical modeling of the figure and its comparison with the proposed condition. They obtained 92.88% and 94.85% of the results for both men and women.
Naveen Kumar Jain [10] advises a real-time method of determining gender using fingers. The usual time to make use of the Code Composer Studio IDE. A set of 300 user records of different ages and types is stored in the facility. After first checking the fingers of the case and specifying the limitations of the classification details. Estimates of the statistical modeling of the figure and its comparison with the proposed condition. Out of the 150 samples sampled, 138 of the 150 female samples were validated and accurate.

S. S. Gornall [11] said the gender-regulated FFT, the specific moments and the fun and the landscape of the people from the combination use the Long Axis Length. A high prevalence of characteristics among 450 male and 550 female models of the left-hand side of the models was assessed. The best choice is chosen to get the best results. The algorithm yields an accurate classification of 80% males and 78% females.

Abul Hasnat.[12] In this capacity, the chose highlights in the lower some portion of the face picture ought to be considered. The proposed framework has highlights to confirm character, interoperability of PCs, get to control, and view eye to eye pictures. it has been tried on 75 male and female shading pictures. The consequences of the examination show that the accomplishment of this straightforward sexual orientation separation instrument accomplishes 94.34% precision of the test.

Neha Yadav.[13] This distribution utilizes epact for reshaping symbolism. Euler's PCA has preferred execution over PCA. The chose finger techniques depend on the strategies for fusing particulars. This paper utilizes an exacting dependable guideline to make sure about the contact of the face and fingers.

Samta Gupta [14] have proposed a technique for unique finger impression based sexual orientation arrangement utilizing discrete wavelet change and fake neural system. The two strategies are consolidated for sexual orientation grouping. The principal technique is the wavelet change utilized to remove unique mark includes by doing decay up to five levels. The subsequent technique is the back spread counterfeit neural system calculation utilized for the procedure of sex distinguishing proof. This strategy is explored different avenues regarding the inner database of five fifty fingerprints wherein 200 seventy five were male fingerprints and 200 seventy five were female fingerprints. The general characterization pace of 91.45% has been accomplished.

4. Proposed methodology
The motivation behind the mining determination organization is to discover approaches to please unique mark databases. The unique finger impression subtleties in our framework are lined up with the mining devices of the association. Information acknowledgment assists with improving one point with another boundary. This assists with distinguishing the sort of fingers. On the off chance that the unique finger impression highlight is seen toward the start of the unique finger impression calculation, propelled execution dependent on finger impression play can be kept away from. Every area is obtained by including changes around the shut advanced circuit. When a little unique mark is seen as identified with the fingers, it tends to be determined, and part information can be gathered utilizing corporate digging innovation for finger development purposes. The fundamental preferred position of our framework is that it coordinates the comparability of its versatility. The arranged innovation fundamentally improves the general execution of a similar unique mark framework, and is useful in improving the condition of cutting edge unique mark innovation.
4.1. Customization description: Buying photos can be as simple as defined in the current image. Generally, stepwise images include preliminary preparations, such as zooming in. Computerized image preparation is one of the simplest and most satisfying fields.

4.2. Preparation: .jpg, .png, bitmap, etc. after collecting unique marker tests in various forms such as, it will be pre-processed for the main purpose, resize, convert cropped and shadowed images into paired images, and so on. Turn the shadow image into a double image to make the computer skilled.

4.3. Feature Extraction: In the literature, global methods for automatic fingerprint comparison have been proposed. The most popular is the fingerprint-based minute mode, and collectively referred to as the minute-based method. Although fundamentally different from one another, many of these techniques require a lot of processing (e.g., route traffic estimation, comb segmentation, comb thinning, and minute-by-minute detection) to extract small functions reliably. Do not use the minute fingerprint function. It either directly matches the fingerprint image, or matches the features obtained from the image through some filtering or modification operations.

4.4. Feature Matching: Several methods have been developed for programmed unique note sequences. These methods can be roughly divided into four basic types.

4.4.1. Information based: This is a graph that uses a special focus (center and increment) to characterize the fingerprint.

4.4.2. Structure-based: This classification method uses the predicted direction in the form of fingerprints to classify fingerprints.

4.4.3. Depth-based: It is identification method uses the frequency spectrum of fingerprints for classification.

4.4.4. Syntactic: It is identification method which formal grammar to presents fingerprints and group them.

4.5. Decision: By following the steps above, we consider the result to be male / female or transgender no matter what the outcome.
Figure 3. Classifier with different test option

5. Result and Discussion: Table 1 shows the results for each classifier and shows the results in a histogram as shown in Figure 4. It can be seen that the multilayer perceptron neural network classifier has a higher rank ratio for all unique tests compared to the nearest neighbor. It shows the lowest characterization rate. Multilayer perceptron neural network classifiers can provide 100% accuracy for 70% training and 30% test alternatives. It can be said that when working with a multilayer perceptron neural network, a higher level of information preparation will provide the lowest accuracy.

Figure 4. Accuracy of different classifier against different test option
From the results, the Support Vector Machine provides a feature rate of 96.95%, the most striking grouping that contrasts sharply with the other 10 cross-validated classifiers. All classifiers differ subtly in their characterization rate and can choose to achieve an order rate of 95% or higher. Compare the results of this survey and the sequelae of past sexual orientation in different countries. In 2006, Badawi et al. [18] guided her to investigate sexual orientation traits using unique trademarks in India. This exam uses three unique features as the classifier, namely RTVR, back number and white line number and neural network. The result of this review yielded a regulation rate of 87.46%. Instead, Manish et al. The literature [20] suggests using a backing vector machine as a classifier, using the two key points RTVTR and Ridge Density, and choosing to achieve a characterization rate of 88.00%. Table 2 lists the gender correctness and distribution results for the proposed technology. The results show that the post-effect of the proposed strategy shows a characterization rate of 96.95%, higher than previous studies.

Table: 1 Accuracy and confusion matrix or different classifier in different test option

| Classifier               | Test Option                  | Confusion Matrix | Accuracy |
|--------------------------|------------------------------|------------------|----------|
| Multilayer Perceptron Neural | 10-fold cross validation     | 139 4 | \(a = L 6151\) | \(b = P\) | 96.62% |
| Network                  | 60% Train 40% Test           | 49 5 | \(a = L 066\) | \(b = P\) | 95.76% |
|                         | 70% Train 30% Test           | 38 0 | \(a = L 052\) | \(b = P\) | 100%   |
|                         | 80% Train 20% Test           | 31 0 | \(a = L 128\) | \(b = P\) | 100%   |
| k-Nearest Neighbors (1 Nearest Neighbors) | 10-fold cross validation     | 136 7 | \(a = L 7150\) | \(b = P\) | 95.27% |
|                         | 60% Train 40% Test           | 51 3 | \(a = L 363\) | \(b = P\) | 94.91% |
|                         | 70% Train 30% Test           | 36 3 | \(a = L 150\) | \(b = P\) | 95.50% |
|                         | 80% Train 20% Test           | 29 2 | \(a = L 029\) | \(b = P\) | 96.61% |
| Bayes Net                | 10-fold cross validation     | 135 8 | \(a = L 3154\) | \(b = P\) | 96.28% |
|                         | 60% Train 40% Test           | 51 3 | \(a = L 066\) | \(b = P\) | 97.45% |
|                         | 70% Train 30% Test           | 36 3 | \(a = L 051\) | \(b = P\) | 96.62% |
|                         | 80% Train 20% Test           | 30 2 | \(a = L 028\) | \(b = P\) | 96.61% |
| Support Vector Machine   | 10-fold cross validation     | 140 3 | \(a = L 6151\) | \(b = P\) | 96.95% |
|                         | 60% Train 40% Test           | 53 1 | \(a = L 363\) | \(b = P\) | 96.61% |
|                         | 70% Train 30% Test           | 38 1 | \(a = L 348\) | \(b = P\) | 95.50% |
|                         | 80% Train 20% Test           | 32 0 | \(a = L 127\) | \(b = P\) | 98.30% |

Table: 2 Comparison of fingerprint Gender classification accuracies

| Features Used | Features | Classifier | Accuracy |
|---------------|----------|------------|----------|
| RTVTR, WLC, RC, RT VTR | RCAPT, R W, RD | FCM, LDA, NN | 56.47 |
| DWT SVD | SVM | 84.52 |
| DWT | KNN | 87.64 |
| DWT | Back Propagation NN | 88.28 |
| RC, RD, WLC, RTVTR | GMM, Bayes Net | 91.45 |
| SVM | MLPNN | 92.67 |
| k-NN | | 96.28 |
| 96.95 | | 96.95 |
| 96.62 | | 95.27 |

6. Conclusion: Four classifiers are used in this study, these are Bayesian network, multilayer perceptual neural network, k nearest neighbor and support vector machine. In addition, four unique
experiments were used to test the classifier. These are cross-validated cases with 70% training 30% testing, 60% training 20% testing and finally 60% training 40% testing 10 overlapping cases. From the results we can conclude that all normal groupings of the classifiers complete a characterization rate of more than 90%. However, SVM is still the best recommended classifier for calculation. Fingerprints are the most dependable proof are as yet legitimate in court. Regarding its incredible potential as a viable strategy for recognizing fingers, this work endeavors to examine connections between ladies. Examination and arrangement are the consequence of our calculation and a portion of the explanations behind recognizing the right principles of sex. The framework requires an implicit unique mark observing framework to diminish numerical time and improve execution. The unique finger impression acknowledgment framework requires a successful framework to diminish PC time and increment execution. Many analysts take photos in various ways and in a sexually oriented manner and expect some encouraging results, while using a variety of cutting-edge technologies (such as some age groups that rely on rust), this fact may be extended to perform detailed calculations, And Metropolis, for suitable gender groups, needs a particularly strong label.

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