

Fingerprint Recognition Using Data Mining Techniques

P. Nishanthini

PG scholar, Department of Computer Science
Stella Maris College, Chennai
drnisahnthiniphd@gmail.com

Blessy Boaz

Asst.Professor, Department of Computer science
Stella Maris College, Chennai
blessy.research@gmail.com

ABSTRACT- Fingerprint is one of the biometric recognition technique which helps to recognize a person's characteristic features and authenticates the person's identity. Machine learning techniques helps to easily group the features and to train and test the classified features. This paper applies the data mining techniques for fingerprint recognition, it uses FVC2002, FVC2004 databases. Tool used for implementation is WEKA. The features are extracted and then filters are applied for pre-processing. Then the dimensionality reduction is performed using principal component analysis. To classify the features clustering algorithm is used in parallel processing framework.

KEYWORDS: *Fingerprint Recognition, Image filter, PCA, SPARK, K-means clustering.*

I. INTRODUCTION

Biometrics is an automated recognition of individuals based on their behavioural and biotic appearances. Biometrics recognition systems have become popular in this era since it gives effective and a secured confirmation to a particular person. Fingerprint recognition is one among the most commonly used biometric recognition. Biometrics includes face, iris, fingerprints, voice, palms, hand geometry, retina, handwriting, gait etc.

Fingerprints significance is its perpetuity and uniqueness throughout the life time. Fingerprint patterns offer more secure and consistent personal identification than passwords, id-cards or key can provide. Examples of such an application are computers and mobile phones equipped with fingerprint recognition devices. Fingerprint based password protection are being executed to replace fixed password defence methods.

Fingerprint recognition captures the digital image of the human fingerprint. A biometric recognition system uses the features which are unique for recognition and there is less availability of two humans having the same feature. Personal identification based on fingerprint recognition is one of the biometric systems with most reliable results.

In the recent years researchers have developed many mechanisms through which fingerprint recognition and matching can be implemented. In this paper fingerprint recognition is implemented using an image filter package, PCA, Distributed Weka Spark and K-means clustering in Weka.

II. LITERATURE REVIEW

Dario Maio et al, [1] have proposed the performance of the algorithm on each of the four databases. Three databases were created using different state-of-the art sensors and a

fourth database is artificially generated. The databases and result will be useful to all practitioners in the field not only as a benchmark for improving methods but also for enabling an unbiased evaluation algorithm.

In order to permit authentication of an individual identity the method proposed by J.S. Arunalatha et al, [2] for fingerprint verification using Dictionary Learning. Fingerprint Image Verification using Dictionary Learning (FIVDL) method is proposed to improve the recognition rate of fingerprint by reducing the effect of noise, blur and background in fingerprint images. Successive Mean Quantization Transform (SMQT) dynamic range adjustment and a nonlinear dynamic range adjustment method is used to estimate the local spectral features adaptively on corresponding fingerprint image for ridge frequency and orientation in frequency domain. Finally, Dictionary learning technique is used for spectral feature estimation to reduce errors in low quality images by dividing the images into smaller pieces to smoothen the background noise.

Neethu S et al [3] proposed a technique for fingerprint analysis using image enhancement. The fingerprint enhancement algorithm was developed and implemented. Many pre-processing and post-processing methods were introduced into this technique so as to increase the quality of output enhanced image. Fast Fourier Transform is used on a set of pixels from a small region of image allows reconnection of broken ridges following the same FFT orientation. Image is divided into overlapping blocks of size; Fourier Transform of a specific block was taken in order to get directional information of that block. If Fourier transform of a block that contains two or three parallel

ridges was taken, then dominant frequencies of that block corresponds to the ridges in that block.

Amjad Ali et al [4] proposed a Machine Learning Approaches which is a fusion of minutiae on fingerprint recognition evaluate the performance of the state-of-the-art machine learning algorithms employed in Minutiae based automatic fingerprint. Fingerprint image is initially pre-processed to enhance, binarize and skeletonize. The enhancement using the contextual spatial domain Gabor filters. Ridge ending and ridge bifurcation Minutiae features are then extracted and used for training and testing the Random Forest, Multilayer Perceptron, Radial Basis Functions and Naïve Bayesian machine learning Algorithms give better results for varying quality images compared to the other machine learning Algorithms and show the efficacy of these algorithms.

Gowthami A, Dr.Mamatha H R have used Zone based linear binary pattern system, [5] have proposed and implemented linear binary pattern based feature extraction method for fingerprint images. Linear binary pattern is used to generate the feature vector for all fingerprint images. Neural network and nearest neighbour classifiers are used for the recognition. From the experimentation, we noted that the neural network classifier recognizes the fingerprint images more accurately than nearest neighbour classifier.

III. METHODOLOGY

The objective of this paper is to extract the features from fingerprint images using image filters. Principal Component Analysis is performed for dimensionality reduction. K-means clustering algorithm was used to group the features of fingerprint images. To classify the features clustering algorithm is used in parallel processing framework.

- **Image Filter**

Image Filter package in Weka includes many filters that can be used to extract the features from the images before invoking filters to clean up the dataset. Filters help with data preparation. It easily removes the noisy instances that lead to better classification.

- **Principal Component Analysis (PCA)**

Principal component analysis (PCA) is a way to reduce data dimensionality. PCA projects high dimensional data to a lower dimension. PCA projects the data in the least square sense– it captures big variability in the data and ignores small variability.

- **SPARK**

The distributedwekaspark package that runs in local mode which is in-memory processing, distributed on the cores of the processor. The MapReduce framework partitions the data to be processed to the specified model

on all the cores of the processor, after the distributing the data for parallel processing the results of the individuals are aggregated to produce the result. Spark is available from knowledge flow in Weka tool.

- **K-means clustering (Parallel)**

Clustering is the task of assigning a set of objects into groups so that the objects in the same cluster are more similar to each other than to those in other clusters. k-means clustering is a method of clustering which aims to partition the data points into k clusters in which each observation belongs to the cluster with the nearest mean. The nearness is calculated by distance function which is mostly Euclidian distance. One important assumption to be made is the data points are independent of each other. In other words there exists no dependency between any data points.

IV. PROPOSED WORK

The experiment implemented in this paper is recognising fingerprint using image filter, PCA, K-means clustering algorithm in DistributedWekaSpark. There are series of steps involved in this process; the algorithm implemented helps cluster the extracted features from the images. Features are filtered using the filters. Principle component analysis methods applied to the extracted features then our extracted images are used in k-means clustering algorithm to group the image. By using this method high accuracy for fingerprint recognition is found.

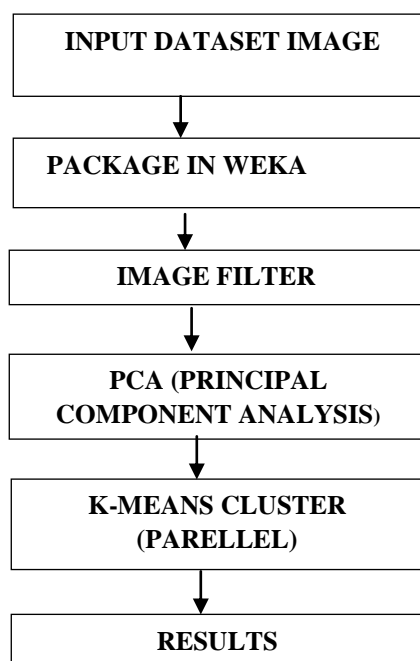


Fig 1.1 Process of recognition of fingerprint

V. EXPERIMENTAL RESULT

K mean clustering algorithm in weka, processing is sequential. The large amount of data processing in sequential environment consumes lot of time. To overcome this problem k mean clustering algorithm is implemented in parallel processing environment. K mean clustering parallel algorithm improves the accuracy and the time to process large volume of data is reduced drastically. For these reasons in the present work k mean parallel clustering algorithm is proposed to use for clustering the fingerprint image features.

VI. CONCLUSION

The proposed system shows that the performance of different classifiers with different dataset with different number of instances after applying the Principal Component analysis attributes evaluator. K-means clustering algorithm was used to cluster the fingerprint images.

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