

Fingerprint Recognition using Fuzzy based image Enhancement

BhartiYadav¹, Ram NivasGiri²

P.G. Student, Department of Computer Engineering, Raipur Institute of technology, Raipur, Chhattisgarh, India¹

Asst. Professor, Department of Computer Engineering, Raipur Institute of technology, Raipur, Chhattisgarh, India²

ABSTRACT: Biometrics is the study of life. Fingerprint, iris, face, signature recognition comes under biometric study. Among all these traits fingerprint is one of the best trait. Fingerprint plays a very important role for identification purpose. Soft computing is one of the best areas for fingerprint recognition. In this approach FIS(Fuzzy Inference System) is used to enhance the fingerprint images and SVM(Support vector machine) is used for classification purpose. Fingerprint is unique for individuals and it is unique because of its various features such as ridges, valley etc. because of its uniqueness fingerprint is used for identification and security purposes. There are various approaches used for fingerprint recognition which uses different features of fingerprint for the recognition process.

KEYWORDS: biometric, security, identification, SVM, FIS.

I. INTRODUCTION

Fraud identity has growing need for biometric technology for person recognition and identification [1]. Biometric techniques are used for identification purpose. Biometric recognition is classified on the basis of following characteristics that are physiological and behavioral characteristics, physiological characteristic include fingerprint, face, iris and retina recognition, and in behavioral characteristic gait and signature. Generally human behavior is similar for the same family members so gait and signature is not as much as useful to identify the fraud. In face recognition, there is a possibility that face of identical twins may be extremely similar. But it is not necessary that these characteristics are available in the crime scene. Fingerprint is the only characteristic which is unique for individuals and is generally left by the criminal in the crime scene [2].

A fingerprint is the impression of the friction ridge skin on a fingertip [1]. Fingerprint recognition play a very important role in the forensic science and it is included in forensic science because of following reasons like, no two finger prints same for the person so it gives accurate identification of criminals. Fingerprints are used to identify the criminal history. To recognize the particular person various physical and behavioral characteristics like fingerprints are used so it is referred to as biometric system or the biometrics. In biometric system, there are two phases of fingerprint recognition: enrollment and recognition [3]. Enrollment phase is the phase where a sensor is used to collect the biometric data. Features are extracted using these data. Then data are stored in the database with unique identity. Next phase is recognition phase, in this phase collecting the biometric data again, extracting the same features and comparing them with the stored data [3].

In [9] proposed, a weak descriptor based on radon transform for matching partial fingerprint images. This method can be generalized for image matching problem where the transformation model between the images is affine. Give the better performance against other method. Current process is slow as compared to other methods and is limited with small dataset. In [6] proposed a method that is based on indexing approach and is used for latent finger prints. This improves computational efficiency and accuracy is maintained of latent search. In [5] proposed a method based on "Minutiae based" algorithm for efficient and more secured because of some features like Universality, Uniqueness, Permanence, Collectability, Acceptability, Circumvention and Performance when compared to the existing system. The security can be increased using various technologies like advanced sensors, e.g. Retina Sensors, but this increases the cost of the project. In [10] proposed method, comparison is done between RBF and MLP. This shows that RBF

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 12, December 2015

gives better result as than MLP.Comparison is done successfully between the two networks.Comparison is limited with two networks only

About Fingerprint

Fingerprint usually is a series of dark lines that represent the high and peaking portion of friction ridge skin [4]. There are various features of fingerprint which makes fingerprint unique for individuals. Features play a very important role for identification and recognition processes and it is categorized into three levels [5] that are-

1. **Level 1** feature includes singular points, ridge flow and pattern type. These are the macro details of the fingerprint.
2. **Level 2** features called as minutiae , refer to, ridge bifurcations, and endings, ridge skeletons
3. **Level 3** features require high resolution images to extract. Level 3 features include ridge contours, pores, dots, sweat and incipient ridges.

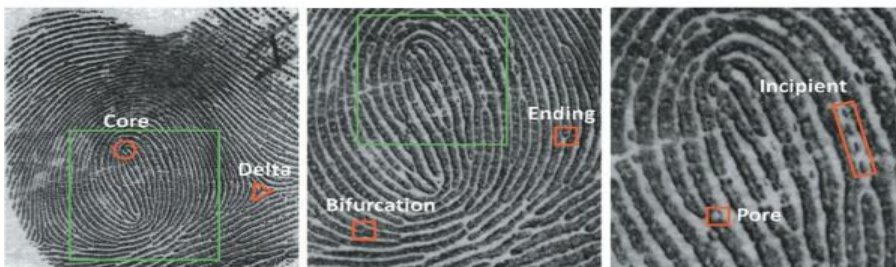


Figure 1: Features of Fingerprint (level1,level2 and level3)[9]

There are essentially three types of fingerprints in law enforcement applications plain, rolled and latent [6]

1. **Rolled fingerprint:** Rolled fingerprint capture the largest finger surface area so it contain the largest amount of information about the ridge structure on a fingerprint. It is obtained by rolling the finger “from nail-to-nail” either on a paper (in this case ink is first applied to the finger surface) or the platen of a scanner [7]. Rolled fingerprint is shown below in figure 2.



Figure 2: Rolled Fingerprint, plain fingerprint and latent fingerprint [8]

2. **Plain fingerprint:** Plain fingerprint is obtained by placing the finger flat on a paper or on platen of a scanner without rolling [6].Plain fingerprint is shown in figure 2.
3. **Latent fingerprint:** Latent fingerprint contains the least information. It is lifted from surfaces of objects that are inadvertently touched or handled by a person typically at crime scene. Surface is smudgy and blurred [7]. Latent fingerprint is shown in figure 2.

The work in this paper is divided in two stages. 1) Image enhancement 2) recognition. Image enhancement is done using FIS. And recognition is done using SVM.

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 12, December 2015

Paper is organized as follows. Section II describes the enhancement process. The flow diagram represents the step of the algorithm. Fingerprint recognition technique that is given in Section III. Section IV presents experimental results showing results of images tested. Finally, Section V presents conclusion.

II. RELATED WORK

The goal of this enhancement step is to correct degradations occurring in ridge patterns that are very noisy and/or corrupted. Image enhancement is performed by using FIS. This is used to enhance fingerprint image. In FIS editor there is one input and one output shown below in figure 3

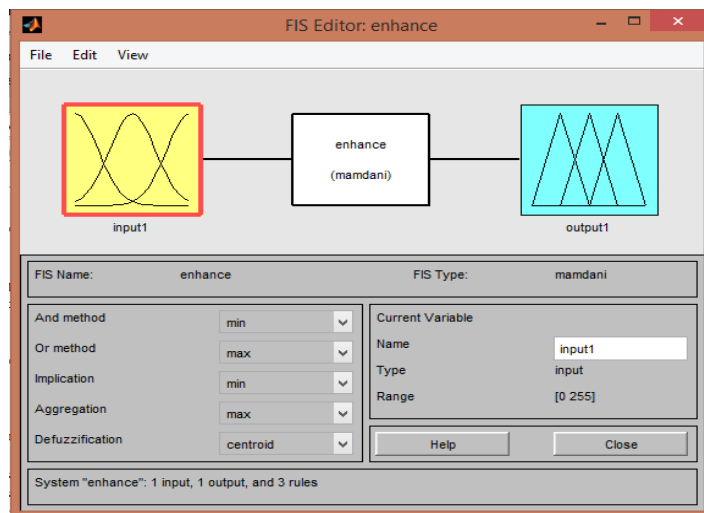


Figure 3: FIS editor for image Enhancement

In FIS, for input, three membership functions are used, shown below in figure:4.

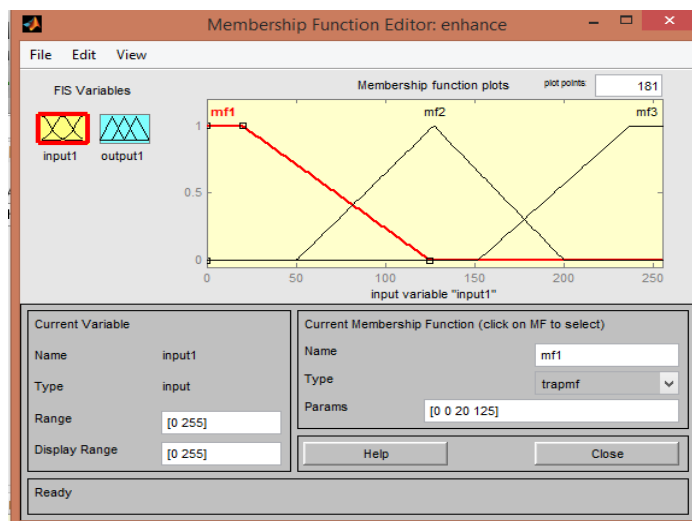


Figure 4: FIS membership function editor for input

For output, three membership functions are used. That is shown below in figure:5.

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 12, December 2015

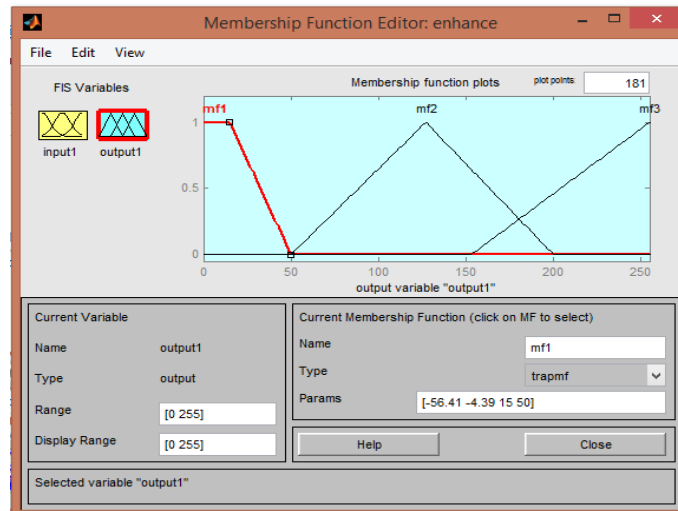


Figure5: FIS membership function editor for output

On the basis of following fuzzy rules, image enhancement is performed.

Rules are:

If (input is mf1) then (output is mf1)(1)

If (input is mf2) then (output is mf2)(1)

If (input is mf3) then (output is mf3)(1)

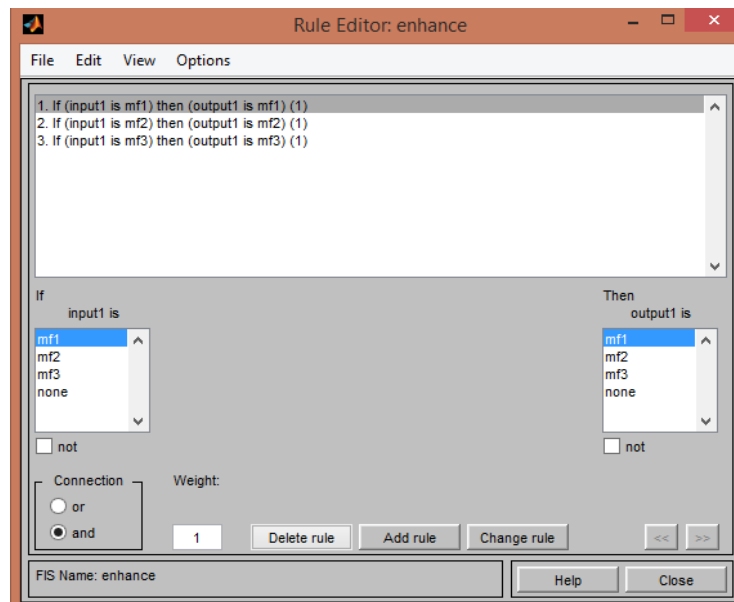


Figure 6: FIS rule editor

III. FINGERPRINT RECOGNITION

Finger print recognition has following steps that are shown below in figure 7 and are explained below -

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 12, December 2015

1. **Fingerprint enhancement**- Since the images acquired with different kinds of sensors are not of the perfect quality and so they can't be used directly for the matching. Therefore to ensure the accurate working of the system the image is first enhanced. For image enhancement FIS is used that is explained above.
2. **Minutiae extraction** –Minutiae are the properties of fingerprint that differentiate a fingerprint from other fingerprints. Minutiae are extracted from the enhanced image. For extracting the minutiae various methods are used, one of them is cross number (CN). With the help of this method ridge ending and bifurcation can be extracted. One pixel is selected and cross number is calculated with the neighbouring pixels.
 - If value of CN is one, then the central pixel is termination.
 - If value of CN is two then the central pixel is usual pixel.
 - If value of CN is three or greater than three then the central pixel is bifurcation.
3. **SVM** – At the end classification is done by SVM. SVM is a binary classifier that helps in fingerprint recognition.

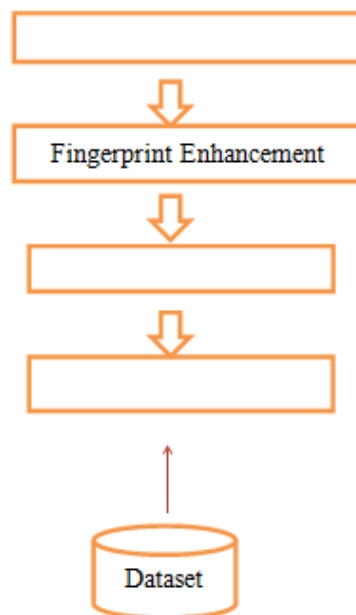


Figure 7: Flow chart for system.

IV. EXPERIMENTAL RESULTS

Figures show the results of fingerprint recognition of my system. Figs. 8 (a) shows the enhanced image. (b) Binarized image c) Thinned image d) minutiae points.

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 12, December 2015

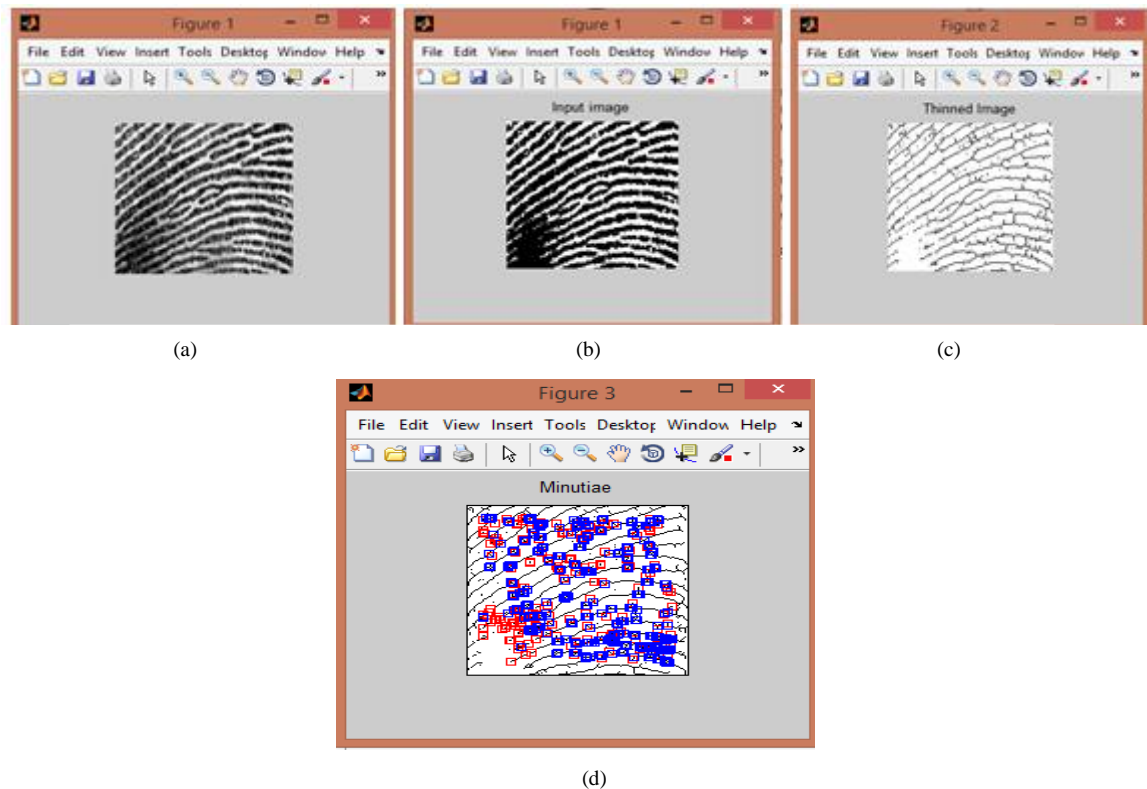


Fig. 8.Fingerprint recognition (a) Enhanced image (b) Binarized image (c) Thinned Image (d) minutiae points

V. CONCLUSIONS

Fingerprint recognition is very difficult task, because if there is small change in pressure or angle of fingerprint and may be because of any dust, oil on fingertips, features are changed and this makes our task very difficult. On the basis of that I have developed my system. And this system gives 96.67% result with training data and about 67.79% result with unknown data.

REFERENCES

- [1] Michalewicz, Z., Genetic algorithms + Data Structures = Evolution Programs, Springer-Verlag, Berlin, 1992.
- [2] S.C. Das and A.K.Jain, fingerprint based recognition, *technometrics* 49(3),262-276, 2007
- [3] Data warehousing fundamentals a Comprehensive Guide for IT Professionals by Paulraj ponniah2002
- [4] P devi, M Manju, Dr V Kavitha "A hybrid fuzzy rule based neuro genetic approach for fingerprint recognition" IEEE, ICoAC,2010
- [5] J.Angeline Rubella, M.Suganya1, K.Senathipathi, B.Santhosh Kumar, K.R.Gowdham, M.Ranjithkumar "Fingerprint based license checking for automobiles", , IEEE- Fourth International Conference on Advanced Computing, ICoAC 2012 MIT, Anna University, Chennai.,978-1-4673-5584 ,December 13-15 2012
- [6] IEEE transactions on pattern analysis abd machine intelligence, Anil K. Jain, Fellow, IEEE, and JianjiangFeng, Member, IEEE "Latent Fingerprint Matching", vol. 33, no. 1, january 2011
- [7] A. A. Paulino, J Feng and A.K. Jain "Latent fingerprint matching using descriptor based hough transformation" in int'l joint conference on biometrics, pp1-7oct 2011
- [8] "Fingerprint Minutiae from Latent and Matching Tenprint Images," NIST Special Database 27, <http://www.nist.gov/srd/nistsd27.htm>, 2010.
- [9] ManasaNadipally, A.Govardhant, and Ch.Satyanarayana"Partial Fingerprint Matching using Projection based Weak Descriptor". IEEE 2013 International Conference on Signal Processing, Image Processing and Pattern Recognition [ICSIPRI], 2013
- ShahzadShapoori , "GA-Neural Approach for Latent Finger Print Matching", In Second International Conference on Intelligent Systems, Modelling and Simulation, 2011.