ISSN: 2277-9655
[Verma* *et al.*, 6(5): May, 2017] Impact Factor: 4.116
IC™ Value: 3.00 CODEN: IJESS7

IJESRT
INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY

FINGERPRINT DETECTION AND RECOGNIZATION TECHNIQUES USING GABOR FILTER

Yogita Verma*, Prof. Bhagwati Charan Patel
* Shri Shankaracharya group of Institution Dept. of Information & Technology Bhilai, Chhattisgarh, India
Shri Shankaracharya Group of Institution Dept. of Information & Technology Bhilai, Chhattisgarh, India

DOI: 10.5281/zenodo.801293

ABSTRACT
Fingerprints are most extensively and effectively appropriate for the proof of identity in present days. Mostly because of their uniqueness among the people, public acceptance, originality, stability through life, and their least risk of invasion. Fingerprint technology, which is basically a biometric system, is utilized to identify an individual based on their physical qualities. Fingerprint matching is the trendiest biometric method appropriate to provide authentication. Fingerprint verification is one of the most trustable biometric security system in the world of computers. In this paper we proposed fingerprint algorithm which uses Gabor filter to capture local and global minute details in a fingerprint. The matching is based Euclidean distance between input image to test compared to trained fingerprints images. We are able to detect fingerprint with marginally best results. Our fingerprint framework performs best as compared to any other techniques.

KEYWORDS: FingerPrint Recognization, FingerPrint Detection, Biometric, Identity, Authentication.

INTRODUCTION
The most popular Biometric authentication of a person is fingerprint. It is most unique and permanent throughout the life of a person. There are mainly two types of biometric characteristics. They are

- Physiological characteristics- Physiological characteristics are one of the unique characteristics which are physically present in the human body. For example, face, fingerprint, iris, ear etc.
- Behavioral characteristics- Behavioral characteristics are completely related to the behavior of a person. For example, signature, voice etc.

The most important advantage of biometrics is that biometric classification is always carried by a person. So therefore is less chance of losing or forgetting it. Also, it is impossible to loose or steal biometric identity. Fingerprint technique is one of the most important biometric techniques used for identifying a person [1].

Fingerprint
A pattern feature of fingerprint as shown in Fig. 1. It is impression of the furrows and friction ridges on all the parts of a finger and these furrows and friction ridges consisting good matching in every small local window.

Fig.1. fingerprint sample

ISSN: 2277-9655
Impact Factor: 4.116
CODEN: IJESS7

Fingerprints are not only distinguished by their ridges and furrows but also are distinguished using a method called Minutia. Minutia are some abnormal points on the ridges which are as shown in Fig.2. [2]. among the different variety of minutia, two are mostly significant and widely used:

- Ridge bifurcation - a single ridge which divides into two ridges
- Ridge ending - the unexpected end of a ridge

The various other features of minutia are shown in Fig.3.

Fig.2. two important minutia features

Fig.3. other important minutia features

Classification of Finger Print Patterns
There are three types of fingerprint patterns.

Arches
The specific pattern whose ridges route from one side to another side by lacking any type of rotation known as arches. Basically, noarch pattern allows the delta. If there is a delta point present, in the middle no recurring ridge point obtain as shown in Fig.4.
Arches are specified into four types:

- Plain arches
- Ulnar arches
- Radial arches
- Tented arches

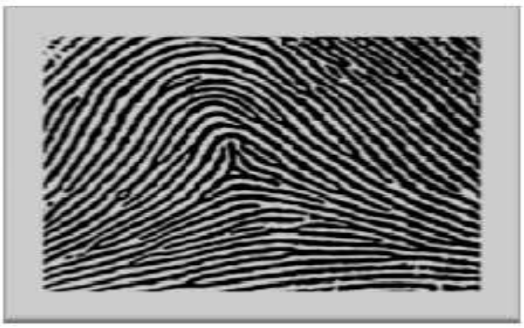

Fig.4. arches patterns

ISSN: 2277-9655
Impact Factor: 4.116
CODEN: IJESS7

Loops

Loops are nothing but the pattern whose ridges moves inwards to its origin is called loops. Ridges are basically a side of the reserves, imprint and ends in the where the ridges come in. The basic loop pattern of finger is shown in Fig.5.

There are four types of loop are as follows [3].

- Plain loop
- Lateral Pocket loop
- Twinned loop
- A Central packet loop.

Fig.5. loop patterns

Whorls

Whorls are the Patterns whose ridges generates a circular formation around a central point is known as whorls shown in Fig.6. Based on the pattern helps to comprises of two or more delta points in whorl pattern are also illustrate in following four groups:

- Plain whorls
- Central pocket loop whorls
- Accidental whorls
- Double pocket loop whorls.

Fig.6. whorls patterns

LITERATURE SURVEY

Some important literature are discussed as follows. Shuvra Chakraborty et al, presents a fingerprint matching system which uses eight directional Gabor filter bank, a popular method for enhancing poor quality image, to capture global and local information available in the fingerprints [4]. Alessandra A. Paulino et al, Identifying suspects based on impressions of fingers lifted from crime scenes (latent prints) is a routine procedure that is extremely important to forensics and law enforcement agencies. Latent are partial fingerprints that are usually smudgy, with small area and containing large distortion. Due to these characteristics, latent have a significantly smaller number of minutiae points compared to full (rolled or plain) fingerprints. The small number of minutiae and the noise characteristic of latent make it extremely difficult to automatically match latent to their mated full

ISSN: 2277-9655
Impact Factor: 4.116
CODEN: IJESS7
prints that are stored in law enforcement databases. Although a number of algorithms for matching full-to-full fingerprints have been published in the literature, they do not perform well on the latent-to full matching problem. Further, they often rely on features that are not easy to extract from poor quality latent. In this paper, we propose a new fingerprint matching algorithm which is especially designed for matching latent [5].

Rakesh Verma et al, Biometric recognition refers to the use of biological characteristics for identification and verification of individuals. Use of biometric is increasing nowadays because biometric characteristics are difficult to replicate and lifelong. Applications which require only the authorized persons to access the resources are information systems, National id systems, voter and driver registrations, documentations, military area and ATMs. Among all biometrics, fingerprints is the most widely used and accepted by the user as the acquisition of fingerprint image is minimally invasive and require little hardware [6]. Shehnaz M. et al, Fingerprint identification is very popular among the identification in biometric security systems. The identification process comprises of image enhancement, feature extraction and pattern classification. The adjustment of grey scale values improves the intensity values of the image. A region mask is generated which provides a stable sampling window to extract features [7]. Mouad.M.H.Ali at al, there are various types of applications for fingerprint recognition which is used for different purposes .fingerprint is one of the challenging pattern Recognition problem. The Fingerprint Recognition system is divided into four stages. First is Acquisition stage to capture the fingerprint image, the second is Pre-processing stage to enhancement, linearization, thinning fingerprint image [8].

C. C. Han et al applied four directions of Sobel operators to extract the feature points of ROI of palm print, and then applied a complex morphology operator to extract the features of palm print image [9]. Wei and Zhang et al. extracted the datum points and the line features from the palm print image. The datum points are defined as the points of palm print registration. Therefore, it detected the principle lines and their endpoints by using the directional projection algorithm. Moreover, the authors have improved template algorithm to extract the ridges and wrinkles as straight lines [10].

Problem Identification
A limitation to the right execution of the calculation is spoken to by the need of having the entire zone of interest accessible [11-13]. This is not generally conceivable if the center is near the picture fringe. All things considered two issues may emerge:

- A piece of the circle that characterizes the range of interest falls outside the picture, with the goal that it is impractical to remove the total component vector.
- Despite the fact that the entire hover is inside the picture, some outside parts fall on the foundation and not on the genuine unique finger impression.

In the last case, which may happen e.g. on the off chance that the finger was not touching the capacitive sensor in this locale, or if there was a drop of ink in this area in an inked unique mark picture, making the division be totally dark, highlights relating to this segments are not important and may prompt expanded acknowledgment mistake rates.

PROPOSED METHODOLOGY
Our work consist of two major steps:

- Construction of Database of different fingerprint images.
- Finding Match for a given image, using constructed database.

Reference Point Location
Fingerprints have numerous obvious historic point structures and a blend of them could be utilized for setting up a reference point as shown in Fig.7. We characterize the reference purpose of a unique finger impression as the purpose of most extreme arch of the curved edges in the unique fingerprint picture [12].

The slightest mean square introduction estimation calculation has the following steps.

1. Divide Input Picture I, into non-overlapping blocks of size w x w.
2. The gradients ∂x (i, j) and ∂y (i, j) are calculated for each pixel (i ,j). Sobel operator is used to calculate the gradients.
3. The local orientation are estimated for blocks centered at pixels (i, j) using below equations.

ISSN: 2277-9655
Impact Factor: 4.116
CODEN: IJESS7

$$\mathcal{V}_x(i,j) = \sum_{u=i-w/2}^{i+w/2} \sum_{v=j-w/2}^{j+w/2} 2\partial_x(u,v)\partial_y(u,v)$$

$$\mathcal{V}_y(i,j) = \sum_{u=i-w/2}^{i+w/2} \sum_{v=j-w/2}^{j+w/2} (\partial_x^2(u,v) - \partial_y^2(u,v))$$

$$\mathcal{O}(i,j) = \frac{1}{2}\tan^{-1}\left(\frac{\mathcal{V}_y(i,j)}{\mathcal{V}_x(i,j)}\right)$$

Where O (i, j) is the least square estimates for the local orientation calculated block wise at pixel (i, j).

Fig.7. shows the reference point location output

Filter

Fingerprints have nearby parallel edges and valleys, and well defined neighborhood recurrence and orientation. Appropriately tuned Gabor channels can expel commotion, protect the genuine edge and valley structures, and give data contained in a specific orientation in the picture. A minutia point can be seen as an abnormality in locally parallel edges and it is this data that we are endeavoring to catch utilizing the Gabor channels as shown in Fig.8.

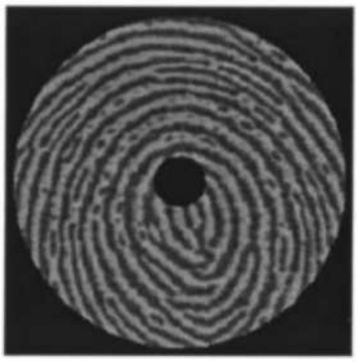

Fig.8. shows the filtered image output

The Fig.9. Shows the complete architecture of fingerprint reorganization system.

ISSN: 2277-9655
Impact Factor: 4.116
CODEN: IJESS7

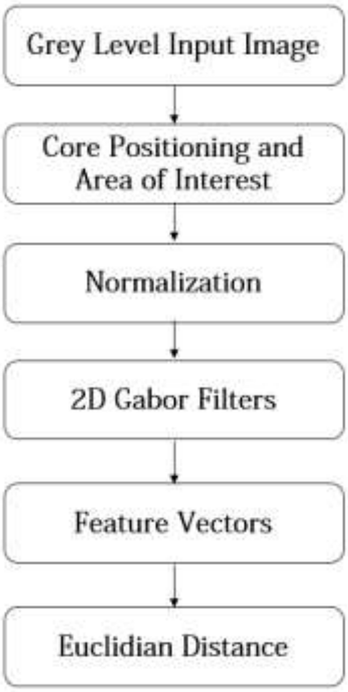

Fig. 9. Shows the architecture of fingerprint recognition system

Input Image for fingerprint training and recognition is shown Fig.10. Before sifting the unique fingerprint picture, we standardize the region of interest for every part independently to a consistent mean and variance. Standardization or normalization is performed to expel the impacts of sensor noise and dark level twisting because of finger weight contrasts [13]. Let I (x, y) indicate the grey level at pixel (x, y) and Mi and Vi, the evaluated mean and variance of sector Si, separately, and Ni (x,y), the normalized grey level an incentive at pixel (x,y). For every one of the pixels in segment Si, the normalized picture is characterized as

$$N_i(x,y) = \begin{cases} M_0 + \sqrt{\dfrac{V_0 \times (I(x,y) - M_i)^2)}{V_i}}, & \text{if } I(x,y) > M_i \\ M_0 - \sqrt{\dfrac{V_0 \times (I(x,y) - M_i)^2)}{V_i}}, & \text{otherwise} \end{cases}$$

Where MO and VO are the coveted mean and difference values, individually. Normalization is a pixel-wise operation which does not change the lucidity of the edge and valley structures. On the off chance that normalization is performed on the whole picture, then it can't make up for the force varieties in various parts of the picture because of the flexible way of the finger. Isolate normalization of every individual area mitigates this issue.

Feature Vector

Let $F_{i\Theta}$ (x, y) is the theta direction of filtered picture for sector S_i.

For all i belongs to {0, 1, 2... 79} and theta belongs to {0°, 22.3°, 45°}, the feature vector value $V_{i\Theta}$ is the average deviation (absolute) from the mean presented as:

$$V_{i\theta} = \frac{1}{n_i}\left(\sum_{n_i} |F_{i\theta}(x,y) - P_{i\theta}|\right)$$

Where n_I, is the various number of pixels in S_i and $P_{i\Theta}$ is the mean of pixel values of $F_{i\Theta}$ (x, y) in segment S_i.

ISSN: 2277-9655
Impact Factor: 4.116
CODEN: IJESS7

Matching

Unique finger impression coordinating depends on finding the Euclidean separation between the relating FingerCodes. The interpretation invariance in the FingerCode is built up by the reference point. In any case, in our present usage, components are not rotationally invariant. A rough pivot invariance is accomplished by consistently pivoting the elements in the FingerCode itself.

Fig.10. Input Image for fingerprint training and recognition

RESULT AND DISCUSSION

To evaluate our metrics we have used MATLAB. Image Processing tools are used in our evaluation. We have taken various number of fingerprint dataset available online for free.

Fig. 11. Shows the output of recognized fingerprint

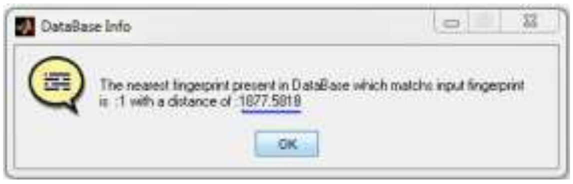

Fig. 12. Shows the output of un-recognized fingerprint

Our proposed algorithm simply detects fingerprint form the trained database. It uses Euclidian distance formula for finding the similarity between images. There can be two different output produced by this step.

a. Fingerprint identified shown in fig.11
b. Fingerprint not identified shown in fig.12

If the fingerprint is already available in database and trained with trainer then Euclidian distance calculated similarity will be 0. Otherwise it will be non-zero, representing the image is not available in our database or if it is somewhat near to 0, then we can say that fingerprint is recognized with minimum deviation. To build up the detection precision of our fingerprint representation and coordinating methodology, each finger impression picture in the database is coordinated with the various fingerprints in the database. A coordinating is marked right if the coordinated match is from a similar finger and off base, generally. None of the honest to goodness (adjust) coordinating scores was zero; the pictures from a similar finger did not yield an indistinguishable Finger Code on account of the revolution and irregularity in reference point area. The final output detects whether the inputted finger print is matched with database or not. Minimum score is calculated to find the match of two similar fingerprint image. If the algorithm returns value 0 then, the two image is same and matched 100%. If some variations are present in the output of distance, then the image are different.

CONCLUSION

A limitation to the right execution of the calculation is spoken to by the need of having the entire zone of interest accessible. This is not generally conceivable if the center is near the picture fringe. In This paper, we have considered two issues in our project: (i). If the region of interest which determines the unique finger print falls outside the centre image. And (ii). If all the region of interest are inside the image but some unnecessary marks present in the core. We deal with these two issues.

REFERENCES

[1] Madhuri and RichaMishr," Fingerprint Recognition using Robust Local Features",IJARSSE,Volume 2, Issue 6, June 2012, INDIA, pp. 441-447
[2] Manisha edhu and Dr.Balkishan,Department," Fingerprint Recognition Using Minutiae Extractar ",Applications (IJERA),Vol. 3, Issue 4,pp .2488-2497, Jul-Aug 2013,MaharshiDayanandUniversity , Rohtak, India pp. 2488-2497
[3] Sangram Bana and Dr.Davinder Kaur," Fingerprint Recognitionusing Image Segmentatio", IJAEST,Vol No. 5, IIT Roorkee, Roorkee pp. 12-23
[4] S. Chakraborty, "An optimized fingerprint matcher," 2011 6th International Conference on Industrial and Information Systems, Kandy, 2011, pp. 181-185.
[5] Paulino, A.A, Jianjiang Feng and Jain, A.K, "Latent Fingerprint Matching Using Descriptor-Based Hough Transform", Information Forensics and Security, IEEE Transactions on (Volume:8 , Issue: 1) Biometrics Compendium, IEEE Jan. 2013, pp. 31 – 45.
[6] Rakesh Verma, "Wavelet Based Fingerprint Authentication System: A Review", Electrical and Electronics Engineering: An International Journal (ELELIJ) Vol 5, No 1, February 2016 pp. 61-72
[7] Shehnaz M. and Naveen N., "A fingerprint identification algorithm: Combining image enhancement and chaos synchronisation classifier," 2015 International Conference on Control Communication & Computing India (ICCC), Trivandrum, 2015, pp. 491-494.
[8] M. M. H. Ali, V. H. Mahale, P. Yannawar and A. T. Gaikwad, "Fingerprint Recognition for Person Identification and Verification Based on Minutiae Matching," 2016 IEEE 6th International Conference on Advanced Computing (IACC), Bhimavaram, 2016, pp. 332-339.
[9] C. Han, H. Cheng, C.Lin and K. Fan, "personal authentication using palmprint features", PERGAMON pattern recognition, 2003, pp. 371-381
[10] R. Wang, D. Ramos, J. Fierrez and R. P. Krish, "Automatic region segmentation for high-resolution palmprint recognition: Towards forensic scenarios," 2013 47th International Carnahan Conference on Security Technology (ICCST), Medellin, 2013, pp. 1-6.

CITE AN ARTICLE

Verma, Y., & Patel, B. C., Prof. (2017). FINGERPRINT DETECTION AND RECOGNIZATION TECHNIQUES USING GABOR FILTER. ***INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY, 6*****(5), 722-729. doi:10.5281/zenodo.801293**