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Fingerprint Authentication System using Log-Gabor Filter

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ABSTRACT

Fingerprint authentication is one of the unique and reliable method of identification and verification processes. This paper presents different techniques used in fingerprint authentication system. Here in this paper to extract the features Log - Gabor filter is used. After that, these extracted features are compared for identification and verification of a person. Two test cases are used. Three distance metrics Spearman, Euclidean and Cosine is used to evaluate the performance.

Keywords: *Fingerprint Authentication, Gabor filter, Accuracy on 100% Training, Accuracy on Exclusive Training.*

1. INTRODUCTION

In modern world, many automatic systems are developed to identify and verify the person. Password or personal identification number based system can be easily cheated. That is why a prominent & reliable automatic system is mandatory to identify the person. Such an efficient and reliable automatic system can be developed using biometric methods. Biometric authentication is divided into physiological (Fingerprint, face, iris,) and behavioral cues. Fingerprint authentication and recognition is popularly used in biometric authentication process because of its uniqueness, its authenticity and long term stability. Fingerprints are unique for everyone even twins with same DNA also have different fingerprints. Therefore, finger print authentication techniques are most secure, robust and reliable technique of person identification and verification.

By mixing of ridges and valleys the fingerprints are formed. The small region where ridge line end abruptly is known as termination and where the ridge line separates into two branches is said to be bifurcations. These two are the very important features of minutiae. There are basically two process of fingerprint authentication. In identification process, firstly the system will compare the features of fingerprint image with fingerprint images that is available in database. On the other hand, in verification process, query fingerprint image along with identity number is provided to system then it verifies these biometric data with database template in context with respective identity number. Verification is faster, more reliable and robust process as compared to identification. [7].

2. LITERATURE REVIEW

A Model proposed by *M. Horton, P. Meenen, R. Adhami, P. Cox.* in which 2- D Gabor filter is used for investigating a fingerprint in fingerprint matching system. Marginal improvements is provided only in complex filter rather than real filter however the computational cost for using the complex filter is relevant. [2]

The execution of Minutiae based approach of fingerprint recognition and authentication had been proposed by *F.A. Afsar, M. Arif and M. Hussain.* For indexing the fingerprint classification system is used during fingerprint matching which increase the performance of the matching algorithm greatly. Use of FVC 2000 fingerprint database is obtained effective result. [3]

C.J. Lee, T.N. Yang, I.H. Jeng, and K.L. Lin introduce the model of speed up the procedure of minutiae matching in fingerprint identification and verification. They evaluated several techniques to check the movement of minutiae in gray-level fingerprint pictures from coarse to fine level. It take less time in overall pixel-level computations [4].

A hybrid fingerprint verification system introduced by *Shanker Bhausaheb Nikam, Pulkit Goel ,Rudrajit Tapadar,Suneeta Agarwal*, which is based on local texture pattern got by gabor filtering & wavelet global features extracted by multi resolution analysis of fingerprint. [5]. *Chih-Jen Lee* has done sampling by a complete set of Gabor basis functions. Memory space is reduced in this approach and processing time is also improved [6].

Fingerprint authentication using Gabor filters presented by *Satish Kumar Chavan, Parth Mundada, Devendra Pal* which is used to extracting the features of fingerprint images. To evaluate the algorithm, FVC 2000 and DBIT fingerprint databases are used. [7].

3. PROPOSED WORK

There are several steps of proposed fingerprint authentication is based on log-Gabor filter as follows.

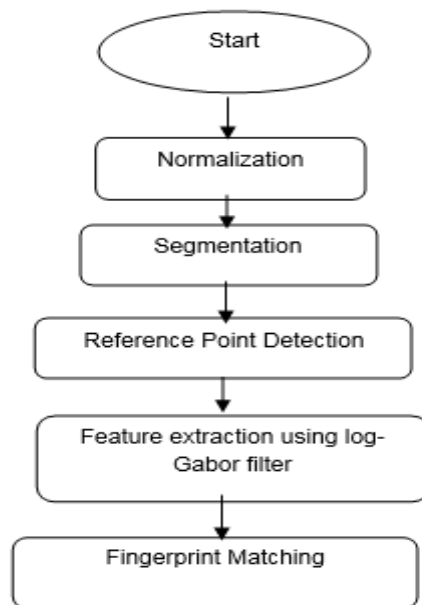


Fig 1 Steps involved in Proposed Fingerprint Authentication

The very first step is preprocessing of image to get better contrast. Then segmented the image and cropped it so that user can select the (ROI) region of interest from scanned image. After that next step is locating the reference point from ROI. Then log- Gabor is applied and feature vectors are generated. Feature vectors of these query fingerprint image is compared with the database fingerprint image that is stored in database.

3.1 Extraction of Features by using Log-Gabor Filter

Gabor filter is overcome by Log- Gabor Filter. It create better statistics of natural images as compared to Gfilter & other wavelet filters. It’s describes a signal in forms of the local frequency responses. There are several examples which use the Log-Gabor filters in image processing. Edge detection is a primitive operation, where the edges of the image are found. Because edges of images appear as high frequency so, it is good to apply a filter like Log-Gabor [8,9] These edges are used as the input to a segmentation algorithm or an authentication algorithm.

4. RESULT AND DISCUSSION

Here we used FVC 2000 Database in testing of proposed algorithm. In these two types of test cases are performed first is accuracy 100 % training and other one is Accuracy Exclusive training. In Accuracy 100 % training we consider eight images of person and in Exclusive training, we consider only six images, rest are used for testing purpose.

Distance metric	Accuracy 100% training		Accuracy Exclusive training	
	Gabor	Log-Gabor	Gabor	Log-Gabor
Spearman	10	30	10	55
Euclidean	90	95	30	40
Cosine	90	100	10	25

Table 1.1 Comparison of Gabor filter with Log-Gabor Filter

Table 1.1 shows that three distance metric are used to match feature vectors by both Gabor and Log-Gabor filter. That are Spearman, Euclidean and Cosine distance metric. In this table we can see that log-gabor is performing better than Gabor filter in both the cases. In case of Gabor filter we are gaining 90% accuracy and in log-gabor filter, it is 95% using Euclidean Distance Metric.

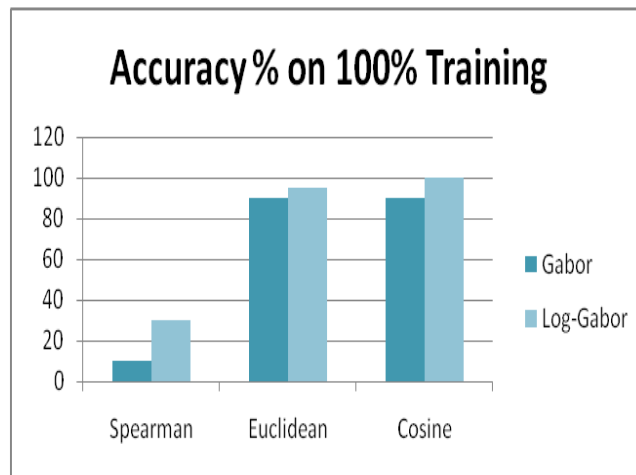


Fig 2 .Graph Chart of Accuracy on 100 % Training

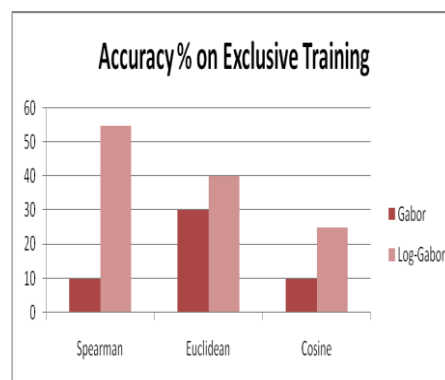


Fig 3. Graph Chart of Accuracy on Exclusive Training

Figure 2 and Figure 3 are showing clearly the comparison graph between Accuracy achieved in Gabor filter and Log-Gabor filter with respect to different Distance Metric.

5. CONCLUSION

In this paper, we reach on a conclusion that fingerprint authentication technique is very simple, secure, easy to use, more reliable and more robust technique to get person identification and verification. By using gabor filtering a small benefit is achieved but by using Log – Gabor, we can get higher accuracy. By using Log- Gabor we are gaining 95 % accuracy in terms of Euclidean Distance Metric.

It simply shows that the methods and metrics applied did not have sufficient effect to overcome the computational cost of complex filtering. By using classifiers we can achieve more significant improvement. So in the next proposed work, we can add the functionality of classifiers to get better performance.

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The hybrid system is efficient for real-time verification application with a small database.