Fingerprint Authentication System using Log-Gabor Filter

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ABSTRACT
Biometric authentication using fingerprint is one of the unique, prominent and reliable method of verification processes. The paper presents different techniques used in fingerprint authentication system. Log - Gabor filter algorithm is used to extract the features of fingerprints. Then, these features are compared for identification and recognition of a person. To evaluate the accuracy, Two test cases are used. Three distance metric is used: Spearman, Euclidean and Cosine in which Euclidean distance is performing better with Log- Gabor Filter. Using Log - Gabor filter based matching algorithm, Accuracy on 100 % training 95% and accuracy on exclusive training 40 % is achieved in case of Euclidean Distance Metric.

General Terms
Gabor Filter Algorithm, Log-Gabor filter, Accuracy

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

1. INTRODUCTION
In modern computerized world, many automatic systems are developed to recognize the person. Traditional methods like password or personal identification number based system are prone to be easily cheated.That's why an efficient automatic system has become necessary to verify the person's identity.Such efficient automatic system can be developed using biometric authentication methods. Biometric authentication is broadly classified into physiological (Fingerprint, face, iris, retina) and behavioral (Signature, voice) cues. Fingerprint identification and verification is popularly used biometric authentication process because of its uniqueness and long term stability. Fingerprints are unique for individual even twins with same DNA also carry different fingerprint. Therefore, fingerprint authentication methods are most popular , secure, robust and reliable methods of person identification.

The fingerprints are formed by mixing of ridges and valleys.The small region where ridge line end abruptly is called termination and where the ridge line separates into two branches is called bifurcations. These two are the important features of minutiae .There are two ways of fingerprint authentication-Identification and verification. In identification process, the system compares the features of query fingerprint image with available fingerprint images in database. In verification process, query fingerprint image along with identity number is provided to system verifies these biometric data with database content in context with identity number. Verification is much faster, reliable and robust process as compared to identification.[7]

2. LITERATURE REVIEW
M. Horton, P. Meenen , R. Adhami, P. Cox proposed the model in which the utility of complex, 2- D Gabor filter for a fingerprint matching system is investigated. Complex filter provided only marginal improvements over the real filter although the computational cost for using the complex filter is significant. [2]

The implementation of Minutiae based approach of fingerprint identification and verification had been presented by *F.A. Afsar, M. Arif and M. Hussain.* The system used fingerprint classification for indexing during fingerprint matching which enhances the performance of the matching algorithm greatly. Good results were obtained by using FVC2000 fingerprint databases.[3]

C.J. Lee, T.N. Yang, I.H. Jeng, and K.L. Lin proposed the model to speed up the procedure of minutiae matching in fingerprint verification. They proposed a different technique to directly check the positions of minutiae in gray-level fingerprint images from coarse level to fine level. An efficient fingerprint matching is achieved because it avoids the time consuming overall pixel-level computations [4].

Shanker Bhausaheb Nikam, Pulkit Goel ,Rudrajit Tapadar,Suneeta Agarwal, proposed a hybrid fingerprint verification system which is based on local texture pattern obtained by gabor filtering and wavelet global features extracted by multi resolution analysis of a fingerprint. The hybrid system is efficient and suitable for real-time authentication application with a small size database [5]. *Chih-Jen Lee* used Gabor transform, sampling by a complete set of Gabor basis functions.. By using this approach, memory space is reduced and processing time is also speeded up [6].

Satish Kumar Chavan, Parth Mundada, Devendra Pal presented fingerprint authentication using Gabor filter which is used to extract features of fingerprint images. FVC 2000 and DBIT fingerprint databases are used to evaluate the algorithm and it achieves the average efficiency of 82.95 % and 89.68% respectively [7].

3. PROPOSED WORK
The various steps of Proposed fingerprint authentication of a person based on log-Gabor features are shown in fig. 1.

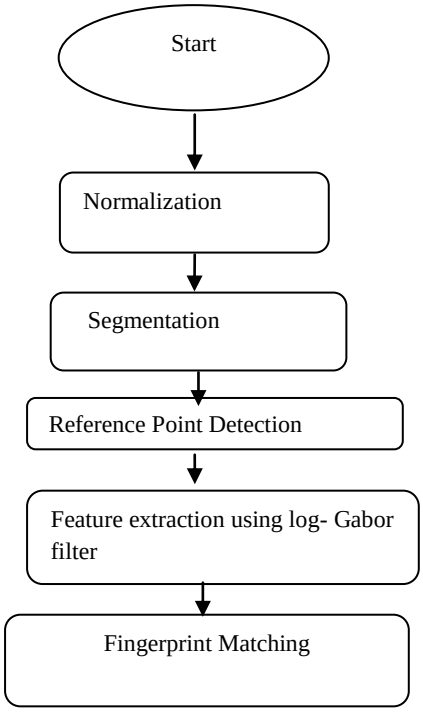

Fig 1 Steps involved in proposed Fingerprint Authentication

The first step is preprocessing the image to get better contrast. Then Fingerprint image is segmented and cropped so that we may select the region of interest from scanned image. The next step is locating the reference point. After that log- Gabor is applied and feature vectors are generated. These feature vectors of query fingerprint image is compared with the database fingerprint image.

3.1 Feature Extraction using Log-Gabor Filter

Log – Gabor filter is an improvement over the Gabor Filter. It fits the statistics of natural images better as compared to Gabor filter and other wavelet filters. The Log-Gabor filter describes a signal in terms of the local frequency responses. In image processing, there are a few examples which use the Log-Gabor filters. Edge detection is one of such primitive operations, where the edges of the image are detected. Because edges appear as high frequencies in frequency domain so, it is natural to use a filter like Log-Gabor to pick out the edges.[8,9] These detected edges is used as the input to a segmentation algorithm or an authentication algorithm.

4. RESULT AND DISCUSSION

FVC 2000 Database is used in testing of proposed algorithm. There are two test cases are performed .First one is accuracy 100 % training and second is Accuracy Exclusive training. In Accuracy 100 % training we take eight images of each person and in Exclusive training, we take only six images , rest two are used for testing.

Table 1.1 Comparison of Gabor filter with Log-Gabor Filter

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

Table 1.1 shows that feature vectors calculated by Gabor and Log-Gabor filter are matched using three Distance Metric. Spearman,Euclidean and Cosine. From above table we are getting that log- gabor is performing better than Gabor filter. We achieve 90 % accuracy in case of Gabor filter and 95 % in log- Gabor filter using Euclidean Distance Metric.

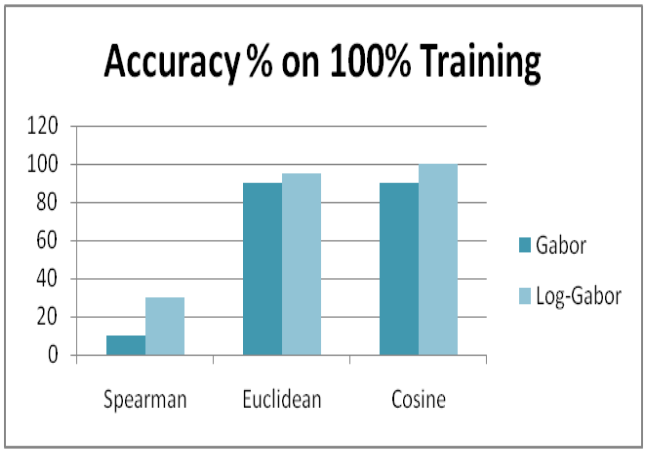

Fig 2 .Graph Chart of Accuracy on 100 % Training

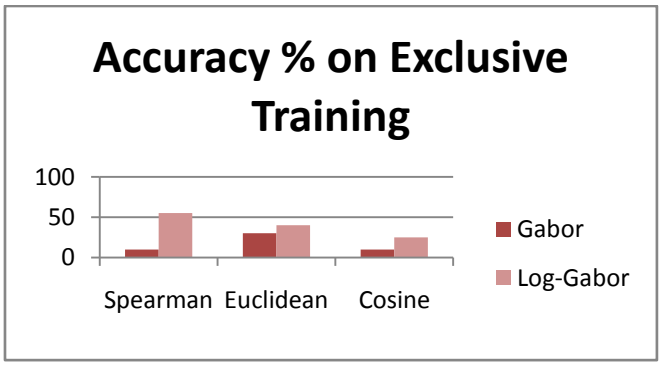

Fig 3. Graph Chart of Accuracy on Exclusive Training

Figure 2 and Figure 3 shows the comparison graph between Accuracy gained in Gabor filter and Log-Gabor filter according to different Distance Metric.

5. CONCLUSION

In this paper, we concluded that fingerprint authentication technique is very simple, easy to use, more reliable and robust technique to achieve person identification and verification. By using gabor filtering a small benefit is gained but Log – Gabor is performing better. By using Log- Gabor we are achieving 95 % accuracy in terms of Euclidean Distance Metric and if we talk about Exclusive Training even then also Log – Gabor is working better.

It simply shows that the methods and metrics employed did not have sufficient impact to overcome the computational cost of complex filtering. It may be possible to achieve more significant improvement if we use classifiers also. So in the next proposed work, we can add classifiers to get performance better..

6. REFERENCES

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