A Study and Analysis of Gabor Filter and K-Nearest Neighbor Approach on Minutia Matching for Fingerprint Recognition

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ABSTRACT *The Biometric used for authentication process of a person and Fingerprint is the very mature and most widely used form of biometric authentication system. Everyone is having unique, immutable fingerprints. In this paper I projected to implement the Gabor filter and k-Nearest neighbor approach for future extraction. Before that we need to perform preprocessing, it's contains Binarization and Thinning is used to provide the quality of image from input image.*

INTRODUCTION

Utilization of industrial waste products in concrete has attracted attention all around the world due to the rise of environmental consciousness. Accumulations of stockpiles of Tyres are dangerous because they pose a potential environmental concern, fire hazards and provide breeding grounds for mosquitoes that may carry disease. Tyre pile fires have been an even greater environmental problem.

Fingerprint-based identification is one of the most important biometric technologies which have drawn a substantial amount of attention recently. Humans have used fingerprints for personal identification for centuries and the validity of fingerprint identification system has been well ingrained. Indeed, fingerprint technology is so common in personal identification that it has almost become the synonym of biometrics. Fingerprints are should be unique across individuals and across fingers of same characteristic. And the identical twins having congruent DNA, but have contradistinction by fingerprints. These observations led to increased use of automatic fingerprint based identification and it's performing very important role in both civilian and law-enforcement applications.

To address the need for reliable, robust, and foolproof personal identification, authentication systems will be necessarily requiring a biometric component. This word "biometrics" comes from the Greek language and is derived from the words bio (life) and metric (to measure). Biometric systems use a person's physical characteristics (like irises or veins, fingerprints), or behavioral characteristics (like voice, handwriting or typing rhythm) to determine their identity or to confirm that they are who they claim to be. The most popular and widely used biometric systems are the fingerprint. In point of fact, fingerprint can be used to replace the passwords or PIN in most security aspect.

Anil religion et al [7] bestowed a fingerprint verification formula and reported to realize better performance. They acquired fingerprint options by the procedure of preprocessing, binarization, thinning and extracting trivia. Their method has been claimed strong. However, it's some disadvantages, that is, this formula includes some gratuitous steps and created the potency low. Since the step of binarization could lose some vital data keep within the original gray-level fingerprint pictures, D. Maio et al [2] projected a distinct formula that extracts trivia directly from gray-level fingerprint pictures. Then, X. Jiang et al [3] introduced associate improved approach supported the essential plan in [2]. Both of them square measure supported the analysis of geographics surface patterns during a gray-level fingerprint image. D. Maio gave his reasons to find trivia while not binarization and dilution [2] as follows:

1) plenty of knowledge could also be lost throughout the binarization method.
2) Binarization and dilution square measure time overwhelming.
3) The binarization techniques, that we have a tendency to experimented, established to be is satisfactory once applied to caliber images.

FINGERPRINT RECOGNITION

The fingerprint recognition problem may be classified into three sub-domains: fingerprint verification, enrollment and fingerprint identification. additionally, completely different from the manual approach for fingerprint recognition by consultants, the fingerprint recognition here is referred as AFRS (Automatic Fingerprint Recognition System), that is program-based. Verification is usually used for positive recognition, wherever the aim is to stop multiple individuals from exploitation an equivalent identity. This section provides a basic introduction to fingerprint recognition systems and their main elements, as well as a quick description of the foremost wide used techniques and algorithmic rule [7].
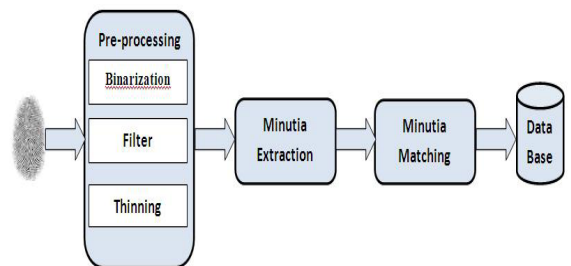
Figure 1: Schematic Structure of fingerprint verification system

PRE-PROCESSING

The pre-processing of fingerprint scanned image uses this Binarization to convert gray scale image into binary image by fixing the threshold range. The pixel ranges above and below the threshold are set to '0' and '1' appropriately [8]. An original scanned input image and the image after Binarization and thinning process are shown in the Figure 2.

Figure 2: (a) Original Fingerprint (b) Binarized image (c) after thinning

After this process we can get bright and dark result, for easiest way of removing the noise and unwanted thinks from the input data. And we can do the further next because the Binarized image is very clear [8].

The binarized image is thinned using Thinning Filter to reduce the thickness of all ridge lines to a single pixel width to extract minutiae points effectively. Through this can get better and accurate thinned fingerprint image. Thinning does not change the location and orientation of minutiae points compared to original fingerprint which ensures accurate estimation of minutiae points. Here all noise is eliminated and now the image is ready for assigning a score. Thinning process preserves beyond the pixels by placing white pixels at the boundary of the minutia image, as a result of first five and last five rows, first five and last five columns are allocate a value of one. Expansion and erosion are used to thin the ridges [8].

GABOR FILTER
The different process steps from pre-processing to matching because the final step of the fingerprint authentication measure

- ➢ Gabor filters.
- ➢ Quantized co-sinusoidal triplets.
- ➢ Discrete Fourier transforms.

The first step is that the standardization, which ends in an exceedingly higher distinction of the fingerprint image. After that, the fingerprint is divided, that crops areas of the recorded image, that don't contain any relevant info. This is often the top of the pre-processing. The last pre-processing step sometimes consists of a fingerprint improvement as delineated in [8]. However, tests have shown that the following point of reference detection works on non-enhanced fingerprint pictures also as on increased. Therefore, any longer improvement isn't needed for the following process steps. After that, the fingerprint image is filtered using a Gabor filter. Now, it is possible to create the feature map, which is used as the template. This template is matched in the subsequent matching step with templates of other fingerprints. The result of the matching is the score, which represents how the two fingerprints resemble each other. And alternately the Gabor filters will be used to extract the features directly from the gray level fingerprint images. Preprocessing stage is not necessary before extract the features [8].
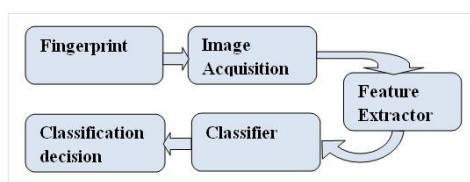

Figure 3. Schematic blocks of Gabor approach

Image Acquisition
A number of ways are accustomed acquire fingerprints. Among them, the inked impression technique remains the foremost well-liked one. Inkless fingerprint scanners are present eliminating the intermediate conversion method [6]. Fingerprint quality is incredibly vital since it affects directly the minutiae extraction algorithmic program. 2 varieties of degradation typically have an effect on fingerprint images: 1) the ridge lines don't seem to be strictly continuous since they generally embody little breaks (gaps); 2) parallel ridgelines don't seem to be forever well separated owing to the presence of scatter noise. The resolution of the scanned fingerprints image should be 500 dpi whereas the size is 300 x 300.

Feature Extractor
Gabor filter primarily based options are with success and wide applied to face recognition, pattern recognition and fingerprint improvement. The family of 2-D Gabor filters was originally conferred by Daugman (1980) as a framework for understanding the orientation and abstraction frequency properties of the filter. The fingerprint print image are scanned by a 8x8 window; for every block the magnitude of the Gabor filter is extracted with totally different values of m (m = 4 and m = 8). The features extracted (new reduced size image) are used as the input to the classifier.

Classifier
The classifier is predicated on the k-nearest neighborhood algorithm KNN. "Training" of the KNN consists merely of grouping k images per individual because the training set. The rest of the images consists the testing set. The classifier finds the k points within the training set that are the nighest to x (relative to the Euclidian distance) and assigns x the label shared by the bulk of those k nearest neighbors. Note that k could be a parameter of the classifier; it's generally set to Associate in Nursing odd value so as to forestall ties. The last section is that the verification section phases the testing fingerprint image [5]:
1) Is inputted to the system
2) Magnitude options are extracted
3) Perform the KNN algorithmic program
4) Determine the person

CONCLUSIONS
Image quality is said on to the last word performance of automatic fingerprint authentication systems. Smart quality fingerprint pictures would like solely minor preprocessing and improvement for correct feature detection algorithmic rule. This paper reviewed an outsized range of techniques delineate within the literature to extract trivialities from fingerprint images. The approaches are distinguished on the idea of many factors like: the type of input images they handle i.e. whether or not binary or grey scale, techniques of binarization and segmentation concerned, whether or not dilution is needed or not and also the quantity of effort needed within the post processing stage. so as to attain desired accuracy and system performance, 2 strategies are wide used, initial is minutiae and second is Gabor filter based mostly. Trivialities are native discontinuities within the fingerprint pattern. for little scale fingerprint recognition system, it might not be economical to bear all the preprocessing steps (edge detection, smoothing, dilution etc. as like of minutiae based mostly technique), instead Gabor filters are going to be accustomed extract features directly from the grey level fingerprint. The Gabor filter methodology is wide accepted approach for the fingerprint matching.

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