Removal of False Minutiae with Fuzzy Rules from the Extracted Minutiae of Fingerprint Image

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Abstract. Human fingerprints are rich in details called minutiae, which can be used as identification marks for fingerprint verification. Minutiae are the two most prominent and well-accepted classes of fingerprint features arising from local ridge discontinuities: ridge endings and ridge bifurcations. In today's world minutia matching is most popular and modern technology for fingerprint matching. .If there is enough minutia point in one fingerprint image that are corresponding to other fingerprint image, then it is most likely that both images are from the same finger print. In this paper, we proposed a complete system for minutiae extraction and removing the false minutiae from the extracted ones.

The main objective of this paper is developing a new idea for extracting minutiae points and removing the false minutiae by implementing some fuzzy rules. It comprises of various steps. It begins with the acquisition of the fingerprint image. This is followed by binarization ie, converting the gray image to binary image and then thinning ie, making the ridges just one pixel wide. Finally the minutiae points are extracted based on Tico and Kuosmanen[1] and the Crossing Number(CN) method. Then, among the extracted minutiae, false minutiae are removed with fuzzy rules. Thus our system could be a better pre-processing technique for authentication.

Keywords: Fingerprint, Minutiae, Ridge, Bifurcation, Binarization, Thinning, False minutiae.

1 Introduction

The recent advances of information technologies and the increasing requirements for security have led to a rapid development of automatic personal identification systems based on biometrics. Biometrics [4, 5] refers to accurately identifying an individual based on his or her distinctive physiological (e.g., fingerprints, face, retina, iris) or behavioral (e.g., gait, signature) characteristics.

A fingerprint is the pattern of ridges and valleys on the surface of a fingertip. A total of eight different types of local ridge/valley descriptions have been identified [2].

S.C. Satapathy et al. (Eds.): Proceedings of the InConINDIA 2012, AISC 132, pp. 853–860.
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Instead, in accordance with the representation of fingerprints in the U.S. Federal Bureau of Investigation (FBI) [3], ridge endings and bifurcations, called minutiae, are taken as the distinctive features of the fingerprints.

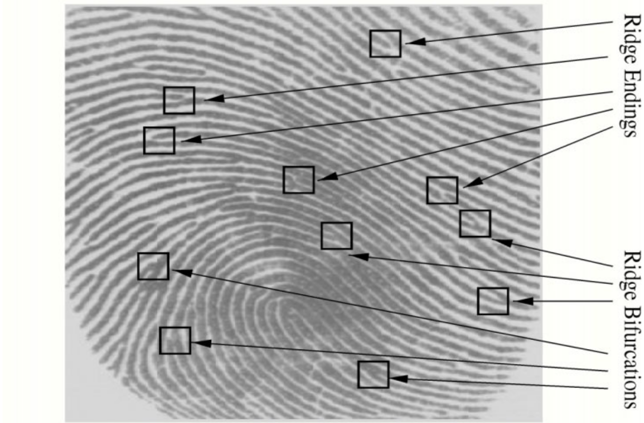

Fig. 1. Ridge endings and bifurcations

The method that is selected for fingerprint matching was first discovered by Sir Francis Galton. In 1888 he observed that fingerprints are rich in details also called minutiae in form of discontinuities in ridges. He also noticed that position of those minutiae doesn't change over the time. Therefore minutiae matching are a good way to establish if two fingerprints are from the same person or not.

Quality of fingerprints can significantly vary, mainly due to skin condition and pressure made by contact of fingertip on sensing device. This problem can be handled by applying an enhancing algorithm that is able to separate and highlight the ridges from background; this type of enhancing is also called binarization.

A more effective and faster minutiae extraction realization can be achieved by minimizing data that represents minutiae without corrupting it. Since minutiae are determined only by discontinuities in ridges, they are totally independent of ridges thickness. Thinning of the ridges to only 1-pixel wide lines also called skeletons, not only preserves minutiae but it does it with minimum possible data usage. The thinning method is often called skeletonization.

Most of the finger-scan technologies are based on Minutiae. Minutia based techniques represent the fingerprint by its local features, like terminations and bifurcations. This approach has been intensively studied, also is the backbone of the current available fingerprint recognition products [6].

Once the minutiae points are extracted from the thinned image, then the system proceeds to further task of removing the false minutiae. In the process of thinning, some points appear to be minutiae which actually are not. These false minutiae have to be removed. This is done by implementing some fuzzy rules and the actual minutiae points of the image could be stored.