Fingerprint Recognition using fewer GLCM Features and Artificial Neural Network

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Abstract - This proposed work is recognizing fingerprint with minimum features by artificial neural network. Instead of considering all features generated from GLCM, only four features are used in the recognition process. The statistical co-occurrence features energy, entropy, correlation and cluster prominence are extracted from the GLCM matrix of single direction used for recognition. The Back propagation and Levenberg Marquardt algorithm are used for training the neural network. The experimental results show that the good recognition rate is obtained in this proposed work.

Keywords: Fingerprint Recognition, GLCM, Haralick Features, Artificial Neural Network.

1. INTRODUCTION

Fingerprint recognition is the oldest and most acceptable method of Biometric Systems. The useful properties lead to use fingerprint for authentication are its uniqueness and stability over a lifetime of a human being [1]. The uniqueness of fingerprints is determined by local and global features. The local features are represented as ridge bifurcations and ridge endings. The global features are represented as ridges and valleys. These features are known as minutiae [2, 3]. Fingerprint features are classified into three levels. Level_1 is Patterns, Level_2 is Minutiae and Level_3 is Pores and Ridges. These features are used for recognizing fingerprints [3]. The fingerprints patterns are divided into three parts. Loop such as right loop and left loop covers 65% of fingerprints, Arch such as plain and tented arch covers 1% of fingerprints and whorl covers 30% of fingerprints and accidental whorl covers 1% of fingerprints [3, 4]. The local ridge characteristics of a fingerprint image are known as minutiae. More types of minutiae features are characterized by the spatial location. The two main minutiae types are bifurcations and ridge endings (also known as termination) [5]. The other minutiae types are shown in figure 1.
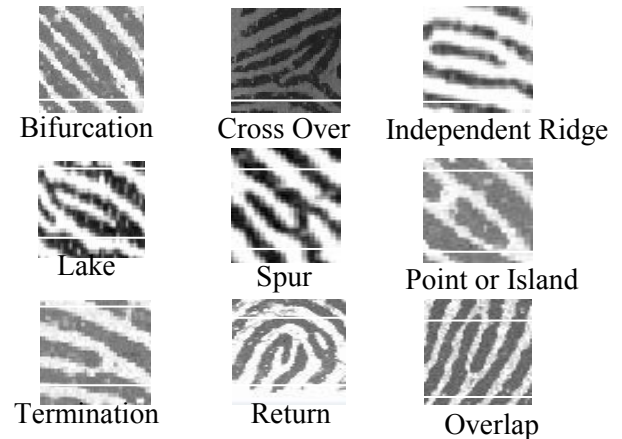

Bifurcation   Cross Over   Independent Ridge

Lake   Spur   Point or Island

Termination   Return   Overlap

Figure 1: Types of Minutiae

The Level-3 features consist of geometrical details of ridges and pore location and details of small characteristics from a fingerprint image. The fingerprint recognition is the process of identifying an individual person based on minutiae points [6] or features. The texture analysis methods are divided into four categories namely Model based, Statistical based, Structural based and Transform based [7, 8]. The method covered in this paper is statistical based method. The statistical feature extraction is classified into three categories such as: First-order, Second-order and Higher-order statistics [7]. In the fist-order statistics features are extracted from a single pixel. The higher-order statistics features are extracted from two or more pixels. The second-order based statistical method extract the features by pair of pixels [8]. The most popular second-order statistics feature extraction method is Gray Level Co-Occurrence Matrix (GLCM). The GLCM is also known as Gray Level Spatial Dependence Matrix. It displays the brightness occurs in an image. It defines the relationships between the neighboring pixels [9].