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Fingerprinnts: oriantation free minutiae extraction and using distances between minutiae for identification and verification

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Abstract

Fingerprint recognition has become a standard in both access control and forensics. This is because fingerprints are unique to an individual. While there are many ways in which a fingerprint can be recognised one of the most common is to look at the endings and splitting of the ridges. These are called minutiae. This research undertakes to improve upon existing methods used in all parts of a minutiae based fingerprint verification system. This study aims to find a new way to extract these minutiae. It also seeks to use them in a novel way to identify an individual and verify that two fingerprints come from the same person. This was done in an effort to improve speed in fingerprint recognition systems by reducing the processing overhead.

There is one key difference between the new extraction algorithm and standard methods. In the new method for extraction the orientation of the ridges is not found. This was done to speed the process of extraction. To verify that two fingerprints are the same the distances between minutiae was considered to be binary attributes of a graph. This turned the verification into a graph-matching problem. The distances between the minutiae were split into a histogram and the values in the bins were the inputs to a Multilayer Perceptron (MLP). This MLP was used to group fingerprints into classes to speed the identification process. The MLP was trained using Particle Swarm Optimisation.

The new extraction algorithm finds minutiae very quickly. However, it finds many false minutiae. The graph-matching approach is unable to distinguish between a match and a non-match and is very slow to run. This is also true for the case when the unary attributes are included. These attributes are the type of minutiae and angle of the ridge at the minutiae point. The classifier runs quickly, but places all the fingerprints in the same class. Thus it will not improve identification time.

It is possible that a filtering system could be developed to combat the amount of false minutiae. This would make the new algorithm viable. Care must be taken to

avoid increasing the runtime to beyond industry standard. The amount of spurious minutiae could be affecting the performance of the graph matching and classification. Alternatively it could be due to different minutiae being extracted between scans. This is due to different parts of the finger are observed with each scan. The cause will need to be investigated.

While positive results were not obtained, this research forms the basis of future investigation. Two questions will now need to be answered. The first is can a filter be developed to remove spurious minutiae from the extraction process? The second, are the spurious minutiae the cause of the problem or will only using the distances be sufficient? If the latter is the case, then finding the angle of the ridge is no longer necessary and the minutiae extraction process can be speeded up by using the new algorithm.