

Fingerprint Image Segmentation using Fuzzy Logic

S.M.S. Piyarathana¹ and R.D. Yapa²

¹Postgraduate Institute of Science, University of Peradeniya

²Department of Statistics and Computer Science, Faculty of Science,
University of Peradeniya

Image segmentation is an important pre-process to recognize the region of interest (ROI) for fingerprint matching. In order to extract minute points from the fingerprint image, the foreground of the image must be segmented from the background. In 2010, Malathi et al., have proposed a method to segment fingerprint images by using pixel distribution over a fingerprint image. In addition, Bazen et al., in 2001, proposed an adaptive method to segment the fingerprint image by using three pixel features; namely, coherence, mean and variance.

In this paper a Fuzzy logic approach is proposed for fingerprint image segmentation. In this method, fingerprint image is partitioned into 16*16 blocks and coherence, mean, standard deviation and ratio between the mean and the standard deviation were calculated for each block. The calculated values for coherence and the ratio between the mean and standard deviation were normalised into a value between 0 and 1. The calculated standard deviations and means were normalised into a value between 0 and 1.5. The normalised coherence, mean, standard deviation and ratio between the mean and the standard deviation values were taken as inputs for the Fuzzy logic system to determine whether the block is in the background or foreground.

All the above methods were tested for images from *DB2_B* of *FVC_2004* and averages of matching percentage were calculated and compared with manually segmented images (Table 1).

Table 1. Comparison of segmentation methods

Method	Matching percentage
Fuzzy Logic System	88.47
Threshold	87.81
Adaptive	85.35

High matching percentage gives better segmentation of the fingerprint image for further operations in fingerprint matching. According to the analysis, average matching percentage of the Fuzzy logic system is higher than that of the other methods (Table 1). Therefore, it can be concluded that the Fuzzy logic approach is the most appropriate method for fingerprint image segmentation.