International Journal of Innovative
Computing, Information and Control
Volume **7**, Number **9**, September **2011**

ICIC International ©2011 ISSN 1349-4198
pp. 5313–5326

FINGERPRINT SEGMENTATION: AN INVESTIGATION OF VARIOUS TECHNIQUES AND A PARAMETER STUDY OF A VARIANCE-BASED METHOD

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Received March 2010; revised October 2010

Abstract. *Fingerprint image segmentation plays an important role in any fingerprint image analysis implementation and it should, ideally, be executed during the initial stages of a fingerprint manipulation process. After careful consideration of various fingerprint segmentation approaches, this manuscript focuses on a block-wise method that is based on the gray-level variance of the image. Because the method of interest is subjected to a number of variable parameters, this document then presents a formal study of these parameters, using a carefully chosen set of experiments. This series of experiments is conducted on database Db1_a of the 2002 version of the Fingerprint Verification Competition (FVC2002).*
Keywords: Segmentation, Gray-level variance, Pixel-block size, Variance threshold

1. **Introduction.** The primary purpose of this study is to investigate and analyze an efficient method that can be employed to separate the fingerprint image into two distinct areas, namely, the foreground area and the background area. The foreground area is the part of the image that contains the fingerprint ridges and furrows, and hence, carries the majority of the information about the fingerprint. The background area contains no ridges and furrows, and hence, carries very little information about the fingerprint.

The process of separating the image foreground area from the background area is known as image segmentation [1], which is in line with the layman's definition of the word segmentation, which is the splitting of something into two parts. Figure 1 depicts a fingerprint image, with the foreground and the background clearly marked.

The secondary purpose of this work is to conduct a formal study of the parameters involved in the chosen segmentation technique. This is because of the fact that most of the segmentation methods have a number of non-constant parameters associated with them. The said study of parameters is executed through a set of carefully chosen experiments, with speed and accuracy taken into consideration.

The first key constraint accompanying this study is that literature has not yet revealed a formal tool or measure that can be employed to quantify the accuracy of a fingerprint image segmentation algorithm. The effects of this constraint can be offset by an image segmentation practitioner acting as an expert, and having to visually inspect the output image from the segmentation algorithm. Based on the expert's observation, a decision