Title	計算幾何的手法を用いた指紋画像解析
Author(s)	梁, 雪峰
Citation	
Issue Date	2006-03
Type	Thesis or Dissertation
Text version	author
URL	http://hdl.handle.net/10119/985
Rights	
Description	Supervisor:浅野　哲夫, 情報科学研究科, 博士

ABSTRACT

Fingerprint recognition is a complex pattern recognition problem; designing algorithms capable of extracting salient features and matching in a robust way is quite hard, especially for poor quality fingerprint images. There is a popular misconception that automatic fingerprint recognition is a fully solved problem since it was one of the first applications of machine pattern recognition almost fifty years ago. On the contrary, fingerprint recognition is still a challenging and important pattern recognition problem.

Automatic Fingerprint Identification Systems (AFIS) provide widely used biometric techniques for personal identification (e.g. authentication, forensic decision, etc.). Fingerprints are useful for biometric purposes because of their well known properties of distinctiveness and persistence over time. Existing AFIS face two critical problems. First is the preprocessing phase is known to consume almost $90 \sim 95\%$ of the total time of fingerprint identification. That is the reason why a considerable amount of research has been focused on this area. Second is the fingerprint distortion which changes geometric relationship among minutiae. This change makes minutiae matching quite difficult, meanwhile, decreases accurate of AFIS so as not to satisfy some strict applications (e.g. Bank Security System, etc.).

In this thesis, we have addressed the above two issues, and developed several novel algorithms for them using computational geometric techniques.

A crucial idea of the research behind reducing preprocessing time is a linear time *Euclidean distance transform* (EDT). The same feature of Euclidean distance transform can be used for binarization, denoising, minutiae extraction and matching, almost through whole AFIS.

A matrix of Euclidean distance transform values is generated in binarization step. Through inheriting and using this same EDT matrix, denoising and minutiae extraction steps can efficiently obtain our expected results by several novel approaches. And this strategy in real application can save a lot of time. Experiments show our method decreases $20 \sim 30\%$ of computing time than other fast methods in the preprocessing stage.

To cope with fingerprint distortion, we in-depth investigated property of finger tips, and then propose an combined RBF distortion model to correct a non-rigid transformation of distortion according to several control points. Our method is dependent only on a few parameters determined by experiences and avoids definition of the size and shape of conventional tolerance box. These benefits guarantee our method more automatic and robust. Matching results show out method is 70% more accurate than conventional methods. It proves combined RBF model has a high capability to cope with fingerprint distortion, even can catch up with some manual distortion model.