Chapter 9
Personal Authentication through Finger Knuckle Geometric and Texture Feature Measurements: Finger Knuckle Biometrics

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ABSTRACT

Finger Knuckle biometric is an emerging automated human identification approach that has received extensive significance in the area of research and real time applications in the recent past. Generally, a typical finger knuckle biometric system investigates the finger knuckle patterns present in the outer bend surface of the finger back region i.e., proximal phalanx region. In contrast, this paper focuses on the entire finger back region which includes proximal and distal phalanx of the finger knuckle surface for recognition. Further, this paper investigates a novel approach to achieve improved performance by simultaneous extraction and integration of finger knuckle geometric and texture features from a captured finger knuckle region. The geometric measures are derived by means of angular geometric analysis method which extracts angular-based feature information for unique identification. Similarly, texture measures are derived through statistical-based texture analysis methods.

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INTRODUCTION

Automated method of personal identification which utilizes physiological features has been widely used in highly critical security applications and forensics. The high level security applications include access control in physical or logical systems that impose new challenge of handling large volume of biometric data for accurate personal identification with high speed (Wayman et al., 2005). In the recent past, hand based biometric systems has drawn considerable attention of researchers due to its merits like i) hand traits can be easily captured using low cost acquisition devices ii) hand traits have highly discriminative features which are potential high enough for personal recognition iii) hand traits has high user acceptance rates since they were captured in a user friendly manner and iv) biometric system using hand traits yields high performance in terms of speed and accuracy (Hand-based Biometrics, 2003). Researchers have proposed various personal recognition algorithms using hand-based biometric technologies such as finger print, palm print, hand geometry, hand vein structures and finger knuckle print (Ribaric, & Fratric, 2005, Jain et al., 1999, Kumar & Prathyusha, 2008)

Recently, finger knuckle print technology was incorporated in personal identification since it has unique potential biometric identifier (Qiu et al., 2004). Generally, finger knuckle print is defined as texture patterns present in the proximal phalangeal region of the finger dorsum surface. In contrast, this paper investigates on the finger knuckle surface containing dermal patterns of both proximal and distal phalanx regions (Lin Zhang et al., 2009). This paper focuses on deriving both geometrical and texture features from finger knuckle surface patterns in order to improve the performance with respect to accuracy. This paper analyses the captured finger knuckle regions by extracting ROI using binarization and threshold methodology. From the ROI of the finger knuckle print, the angular based geometrical feature information is extracted since the magnitude based feature information extracted by the traditional geometrical methods is not so discriminative to identify the individuals. Further, the texture pattern of the finger knuckle print need to be exploited to achieve improved performance in personal identification. The texture patterns of the captured finger knuckle features are studied based on statistical methods. Statistical methods are computationally simple methods which could yield better performance in terms of accuracy and speed. In this paper, co-occurrence matrix method and grey level difference vector method are implemented to extract statistical based texture feature information from the captured finger knuckle surface. This paper also focuses on integration angular geometric feature information and statistical texture feature information to attain improved performance in personal identification.

The organization of the paper is as follows. Section 2 presents the categorization of existing personal recognition algorithms and in-depth analysis of existing litera-

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