Touchless Palmprint Recognition and Its Evaluation on a Large-Scale Dataset

Xu Liang
https://orcid.org/0000-0003-4332-3494
The Chinese University of Hong Kong, Shenzhen, China

Chunsheng Zhang
https://orcid.org/0000-0002-6642-8996
The Chinese University of Hong Kong, Shenzhen, China

Wei Jia
Hefei University of Technology, China

David Zhang
The Chinese University of Hong Kong, Shenzhen, China

INTRODUCTION

Biometric recognition refers to using the inherent physiological or behavioral characteristics of the human body to perform personal identification. In general, physiological characteristics include palmprint, palm vein, palm dorsal vein, fingerprint, face, iris, retina, ear, knuckle print, lip print, voice print, etc., while behavioral characteristics include gait, signature, keyboard typing, and so on. With decades of development, biometric recognition has been widely used in everyday life.

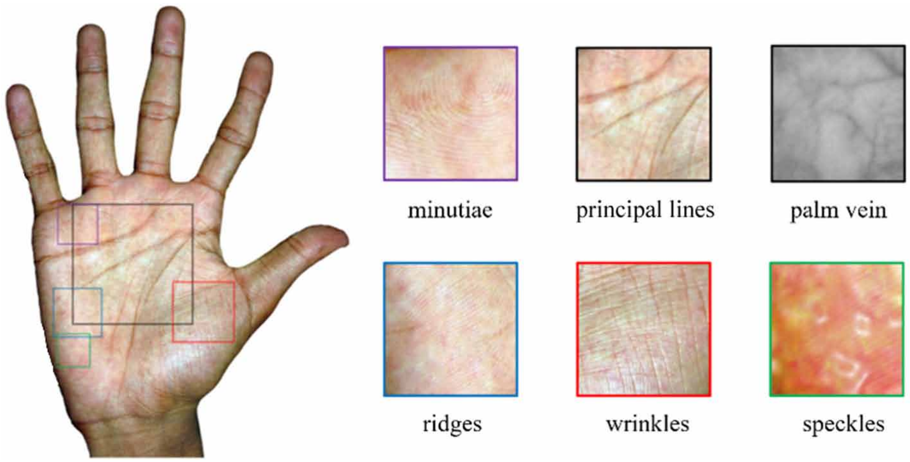
Palmprint recognition is a member of the biometric recognition family. It is a technology that uses the unique features of the palm surface for biometric identification. As shown in Figure 1, the palm contains a wealth of features such as palm shape, principal lines, wrinkles, ridges, minutiae, textures, subcutaneous palm vein, and three-dimensional (3-D) surface curvatures.

Advantages of Palmprint Recognition

Among biometric recognition methods, face recognition has problems in situations, such as covering with a mask or goggles, and similar faces between identical twins; fingerprint recognition has issues of counterfeits, wet/dry fingers, and workers and elders who cannot offer clear fingerprints because of years of manual labor or problematic skins. Compared with these recognition methods, palmprint recognition has the advantages of high accuracy, high anti-counterfeiting capability, low privacy sensitivity, and low risk of germ transmission when considering public health, especially during the global COVID-19 pandemic. The prominent palmprint recognition with varieties of advantages has attracted a wide range of attention from academia and industry in recent years (Fei et al., 2018; Zhong et al., 2019).

DOI: 10.4018/978-1-6684-7366-5.ch047

Figure 1. Sample images of the palmprint and its features



Categories of Palmprint Recognition

According to different criteria, palmprint recognition can be divided into different categories. Considering the palmprint image dimensions, it can be divided into two-dimensional (2-D) and 3-D palmprint recognition. When taking image resolution as a criterion, it can be divided into high-resolution and low-resolution categories (Zhang & Shu, 1999). According to whether the hand touches the capture device or not, it can be divided into touch-based and touchless palmprint recognition (TLPR). Along with the practical requirements, TLPR is more convenient and flexible. With more attention being paid to it, numerous kinds of TLPR systems have been proposed (Genovese et al., 2014; Zhang et al., 2017; Liang, Guo et al., 2021; Liang, Lu et al., 2022) and it has become the cutting-edge subject of palmprint recognition.

Application Scenarios

Due to the attractive advantages, low-resolution palmprint recognition is expected to have a wide range of practical applications. For instance, in the medical field, TLPR can avoid secondary pollution when identifying doctors and patients; In the traffic control field, TLPR can be applied in scenarios such as personal identification for intelligent turnstiles; In the field of finance with high secrecy and security demands, the effective anti-counterfeiting characteristics of TLPR can significantly improve the security of personnel authorization. Furthermore, in law enforcement agencies, TLPR can provide secure verification of personnel in scenes such as weapons and ammunition management. In contrast, high-resolution palmprint recognition is of much prospect in forensic applications, where partial-to-full matching is performed. For example, the latent palmprint obtained from knife hilts, gun grips, steering wheels, or glass surfaces from the crime scene, can be used to match against a registered database of full palmprints. However, due to complex backgrounds, small overlap regions, and a large number of detail features (e.g., creases and minutiae), latent palmprint matching is more challenging than the full-to-full template matching used in low-resolution palmprint recognition (Jain & Feng, 2008).

Related Content