

Research Article

Scope analysis of different kinds of fingerprint

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Abstract

As Biometrics are the most widely used technique for person identification and verification with different applications, this research paper is mainly focused on the different kinds of Fingerprints based on availability and acquisition process. Fingerprints can broadly be categorized into three categories: Live Scan, Latent, and Patent Fingerprints. The main objective of this research is to present importance of different kinds of fingerprint with their recognition techniques. The quality of fingerprint image also plays an important role during the recognition process, because it requires extra time to improve quality of image. There are different types of image enhancement methods are available applicable differently on different kinds of fingerprint images. This research provides basic information about fingerprints to the research direction.

Keywords: Fingerprint Authentication System, Fingerprint Matching Techniques, Live Scan Fingerprint, Latent Fingerprint, and Patent Fingerprint.

Introduction

In many fields biometrics become a key element for safety, interoperability, availability and efficient border control. Fingerprint Authentication System is progressively applied for verifying the identity of individuals in everyday life. Fingerprints are most used biometrics characteristics in those applications where a high level security is required. Biometrics is a field of science and technology which are used for measuring and analyzing biological data. There are several ways for analyze human body characteristics such as: Face, Finger-print, Hand-geometry, Hand-vein, Iris, Retinal-scan, Signature, Voice-prints, etc. Biometric verification is a method which is used to uniquely identify a person by evaluating their one or more differential biological characteristics. Fingerprint is most widely used biometric data for person authentication because of its small size, accuracy, reliability, easy to collect or capture and relatively easy computing process. Another important thing of using fingerprints for authentication is its uniqueness and permanency from birth to death. Recently, there are many uses of fingerprint authentication system in many areas like internet access, ATM, credit card, cellular phones, medical records, National ID card, Driver's License, Social Security, Passport Control, Criminal Investigation, and Terrorist Identification etc.

Fingerprint Authentication System

Fingerprint Authentication System is an automated method for matching 'Unknown Fingerprint' to 'Known Fingerprint'. Known Fingerprint is also called as reference or template fingerprint. Fingerprint Authentication System consists of a known fingerprint

database which is called respectively reference or template database.

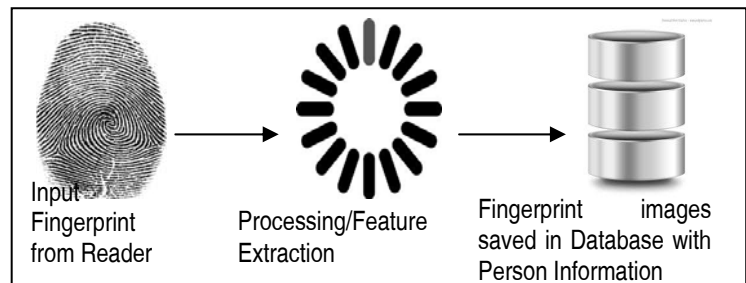


Figure.1. Enrollment Process in Reference Fingerprint Database

Each Automated Fingerprint Authentication System have two types of method first one is Verification of Fingerprint and another one is Identification of Fingerprint.

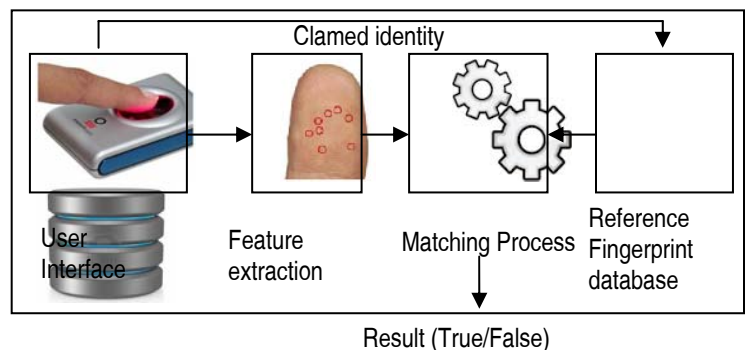


Figure.2 Architecture of Fingerprint Authentication System

Reference fingerprints are the special type of fingerprint which is collect under ideal condition and enrolled in the system with person name, address and other identity. The accuracy and availability of such fingerprints are very high [1].

Verification of a fingerprint is a method to verify known person identity with 1:1 (one-to-one) matching. Database of fingerprint verification system contains fingerprint image respective to the user account, this method is generally used in computer and mobile devices login system.

Identification of a fingerprint is a method which matches the fingerprint of a person with multiple fingerprints store in the database i.e. 1: N (one-to -many) matching.

Person Recognition can be possible fingerprinting (especially, used by police to identify the criminals) has been the most widely accepted around the world. Fingerprints have three main characteristics which make them very important for authentications in various departments, as:

They are unique.

They are not change during the life time of a person.

Fingerprints contains its own characteristics:

Types: Live Scan, Latent, Patent.

Pattern: Arch, Whorl and Loop.

Minutiae Points: Ridges-End Point, Bifurcation Point.

Secondary Features: Relative Distance (Euclidean Distance) and Radial Angle (Orientation Estimation) [2].

Fingerprint Matching techniques

Fingerprints are the unique patterns, formed by ridges and valleys present on the skin of fingertips on the human. It is an impression of friction ridges apply by fingers on the surface. A fingerprint contains ridges and valleys, ridges are the dark area of the fingerprint and valleys are the light area exists between the fingerprints.

The skins of human beings are covered with Eccrine Glands, which produce a liquid called sweat (mixture of salt, water and other trace compounds). When a finger places on a surface such as glass, plastic, etc, through friction ridges the sweat affixed on the surface and emitted fingerprint.



Figure.3. Normal Fingerprint image

It has been observed from the several studies that the fingerprints of two persons are always different; hence they are unique for

every individual. Many hurts like cuts, burns and bruises can temporarily damage fingerprints quality. Valleys and ridges line of the fingerprint generate some unique points which is known as Minutiae Points.

TABLE 1: DIFFERENT TYPES OF MINUTIAE POINTS

Types of Minutiae Points	Pattern
Ridges-end Point	
Bifurcation Point	
Independence ridges	
Dot Or Island	
Lake	
Spur	
Crossover	

Minutiae points are the points where the ridges lines become discontinuous. Using minutiae points matching become very easy and accurate. Minutiae matching technique is most popular and widely used technique for fingerprint matching. The Minutiae based fingerprint matching technique first extracts and marks the Minutiae Points and then matches these points based on constraints:

- 1) Total number of minutiae points,
- 2) Location of minutiae points,
- 3) Euclidean distance between minutiae points,
- 4) Angles between minutiae points.

Types of Fingerprints

Fingerprints are categorized into three kinds on the basis of their acquisition process. They are: Live scan fingerprints, Latent Fingerprints, and Patent Fingerprints [3].

Live Scan Fingerprints

Basically, Live Scan is an inkless electronically captured fingerprint. Most of the law enforcement agencies use live scan fingerprints for person recognition as their elementary resource. Live Scan is commonly used in vehicle license, criminal booking, and civil applicant registration and for background checking. To capture live scan fingerprint images the package includes PC workstation with fingerprint capture devices.

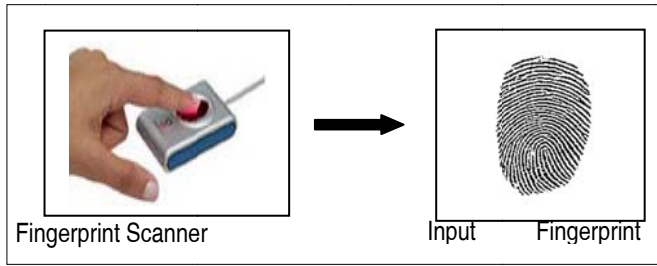


Figure.4. Live Scan Fingerprint Reader

There are three major advantages for using Live Scan fingerprints: It solves the problem of over and under inking. It's fast processing speed. There are no chances of mistakes by human and machines in comparison to other traditional methods of fingerprinting.

B. Latent Fingerprints

The word Latent means hidden or invisible, it is a modern usage for forensic science. Latent prints means any chance or incidental impression left by friction ridge skin on a surface, whether it is visible or invisible at the time of adhere. There are many electronic, chemical and physical processing techniques which are permit visualization of invisible latent fingerprints which left behind from natural sweat glands on the human skin or from other contaminant such as oil, paint or some other form of dirt. Latent prints may be smudged, distorted, overlapped by other or even same individual fingerprints. For this kind of reasons, latent prints generally offered an indispensable source of error in making comparisons. Latent fingerprints are generally contains less clarity, less content, and less undistorted information of the fingerprint in comparison of already enrolled fingerprints.

on different surface to enhance visibility of latent fingerprints. Analysis of this type of fingerprinting is specially used form crime scenes to assist law enforcement agencies with apprehending criminals [4].

C. Patent Fingerprints

A Patent Fingerprint is comparatively visible image of a person fingertip left on a surface in contrast of latent fingerprint. Patent fingerprint can be created by:

Dirt

Liquid: Blood, Oil, Ink, etc.

It leaves the friction ridges impressions. Patent fingerprint are also known as visible print or direct print.

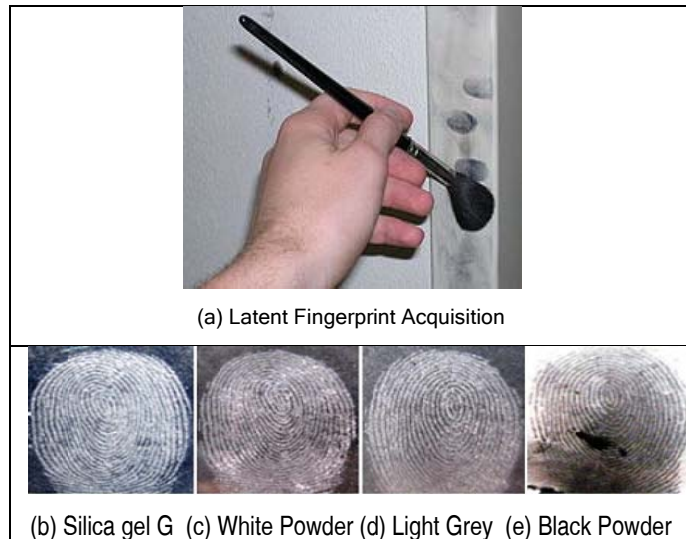


Figure.5. Showing Latent Fingerprint acquisition and comparative visualization on glass surface with different powers [9]

Some special forensic techniques are used, such as the different colored powder (iodine, ninhydrine) and magnetic brush are used

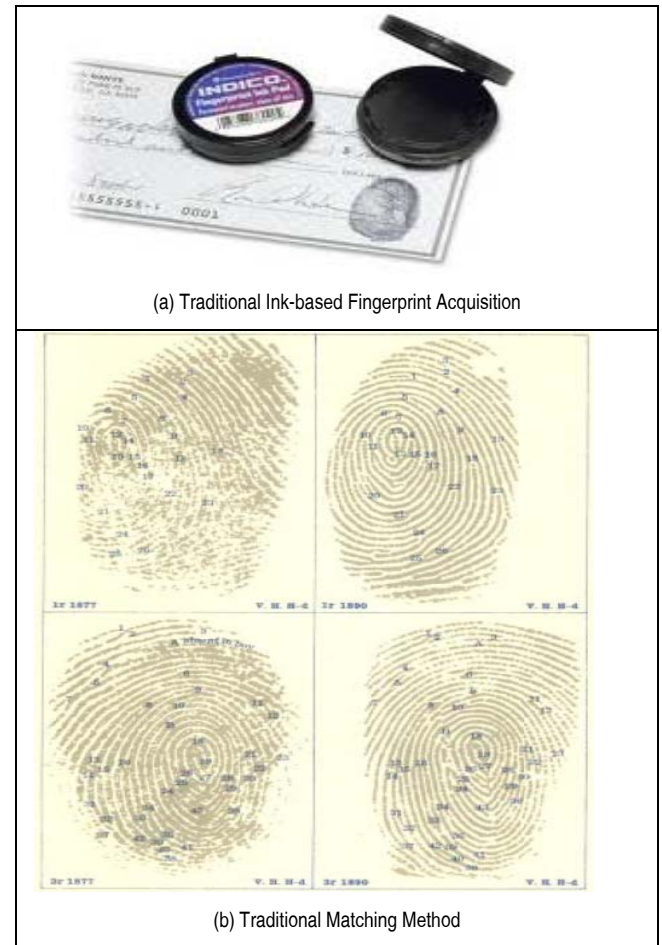


Figure.6. Patent Fingerprint [10]

Patent Fingerprints are the fingertip impressions which are visible to human eye. But Latent Fingerprint requires enhancement techniques to view by human.

Conclusion

After analyzing the entire fundamental related to the fingerprint and different kinds of fingerprint, it is clear that fingerprints are really important and easy way to uniquely find the person. This work is based on to find various application and techniques to match fingerprint. The fingerprints based on their types of acquisition can

be classified into three categories as Live Scan, Latent and Patent. Live Scan is the latest kinds of fingerprint which allow multiple researchers from both Computer Information Technology and Medical Sciences to develop new concepts with theory. Due advancement in Chemical Powder and Digital Camera computing the digital image of Latent Fingerprint Image can easily be extract.

The Patent Fingerprint is an old concept while people apply their thumb impression by using ink onto the paper. But Patent Fingerprint has no scope in near future, because everything is going digital whereas fingerprint readers are available to create digital images of fingerprint.

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