

Review on Dactylography Interfacing with Computers

Sachin Wayase¹, Ganeshh Chaulang²

^{*1}Computer Engineering, Parikrama Polytechnic, Kashti, Maharashtra, India

²Department of Pharmacy, Waghire College of Pharmacy, Pune, Maharashtra, India

ABSTRACT

Like snowflakes, no two persons' fingerprints are exactly alike, not even those of identical twins. A fingerprint is the pattern on the inside of the finger in the area between the tip and the first joint and stays the same from the day of a person's birth to the day they die. These two facts make fingerprints very useful in identifying somebody beyond any doubt, and this is why police forces find them invaluable in tracking down a criminal. In more than 100 years of fingerprint record keeping, no two identical sets have ever been found, even on identical twins. The scientific study of fingerprints, known as dactylography, is used as a technique of crime detection by practically every modern law enforcement agency. Other government agencies and many private businesses also use fingerprints for identification purposes. The Federal Bureau of Investigation (FBI) in America holds the largest collection of fingerprints. Finger prints are easily classified, as there are four different basic shapes of pattern — arches, loops, whorls, and composites that are then subdivided according to things like the numbers of ridges between certain points in the pattern. To begin with, our skin consists of two layers of tissue. One is a thick, deep layer and over it is a delicate membrane called the "epidermis". In cold-blooded animals, the epidermis fits smoothly on the corium. There are no "ridges" to make "prints". When Police Department tries to match the fingerprint of the accused persons at that time the exact matching of fingerprints necessary to identify the exact accused. The science of Dactylography gives the exact matching of fingerprint.

Keywords : Arches, Loops, Whorls, and Composites.

I. INTRODUCTION

A fingerprint in its narrow sense is an impression left by the friction ridges of a human finger.^[1] The recovery of fingerprints from a crime scene is an important method of forensic science. Fingerprints are easily deposited on suitable surfaces (such as glass, metal, or polished stone) by the natural secretions of sweat from the eccrine glands that are present in epidermal ridges. These are sometimes referred to as "Chanced Impressions". Human fingerprints are detailed, nearly unique, difficult to alter, and durable over the life of an individual, making them suitable as long-term markers of human identity. They may

be employed by police or other authorities to identify individuals who wish to conceal their identity, or to identify people who are incapacitated or deceased and thus unable to identify themselves, as in the aftermath of a natural disaster. Fingerprints and, to a lesser extent, iris scans can be used to validate electronic registration, cashless catering, and library access.

Fingerprint reorganization

Fingerprint authentication refers to the automated method of verifying a match between two human fingerprints. Fingerprints are one of

many forms of biometrics used to identify individuals and verify their identity.

The analysis of fingerprints for matching purposes generally requires the comparison of several features of the print pattern. These include patterns, which are aggregate characteristics of ridges, and minutia points, which are unique features found within the patterns. It is also necessary to know the structure and properties of human skin in order to successfully employ some of the imaging technologies. Biometric machines are helpful for scanning storing and detecting the figure prints. These are never repeating pattern followed by the each human.

A. Types of Fingerprints

Over the past sixty years, television has always been a reflection of our society. The programs are an indication of the norms, values and interests that society holds dear at any given time. Crime shows, detective stories and police tales have historically been a staple of the country's television viewing habit, and the country has always had a fascination with these kinds of shows. Today's programs, such as the most popular TV program over the last five years, C.S.I., bring a level of sophistication to the viewing audience that producers of the early crime shows, such as "Peter Gunn" and "Seventy-Seven Sunset Strip," never dreamed was possible. America has always had a fascination with the solving of crimes, and fingerprints are one of the most common types of evidence that investigators search for at crime scenes.

One of the main tasks of the crime scene investigator is to recover fingerprint impressions in order that a positive identification can be ascertained. Since no two individuals have the same fingerprint pattern and these remain unaltered during the course of a person's lifetime, the main type of physical evidence that can be extracted from a crime scene are fingerprints.

There are three distinct types of fingerprint impressions that can be recovered from a crime scene

or a scene of interest for investigators looking for some clues as to a missing person, or for other identification purposes.

These categories are as follows:

PATENT PRINTS - are visible prints that occur when a foreign substance on the skin of a finger comes in contact with the smooth surface of another object. These prints leave a distinct ridge impression that is visible with the naked eye without technological enhancement of any kind. The tried and true "blood on his hands" evidence is an example of patent prints recovered from a crime scene or scene of interest to investigators. These foreign substances contain dust particles, which adhere to the ridges of the fingers and are easily identifiable when left on an object.

PLASTIC PRINTS - are visible, impressed prints that occur when a finger touches a soft, malleable surface resulting in an indentation. Some surfaces that may contain this type of fingerprint are those that are freshly painted or coated, or those that contain wax, gum, blood or any other substance that will soften when hand held and then retain the finger ridge impressions. These prints require no enhancement in order to be viewed, because they are impressed onto an object and are easily observable.

LATENT PRINTS - are fingerprint impressions secreted in a surface or an object and are usually invisible to the naked eye. These prints are the result of perspiration, which is derived from sweat pores found in the ridges of fingers. When fingers touch other body parts, moisture, oil and grease adhere to the ridges so that when the fingers touch an object, such as a lamp, a film of these substances may be transferred to that object. The impression left on the object leaves a distinct outline of the ridges of that finger. These fingerprints must be enhanced upon collection and, because they serve as a means of identifying the source of the print, they have proven to be extremely valuable over the years in the identification of its source.

B. Patterns of figure prints

Mainly fingerprints patterns are three types as follows

1. Arches- These patterns are found in about 5% people in the world. This pattern is ridges moves from one side to another side. It has no backward turn. Here no delta in arch pattern present. Mainly arches are classified in to following two categories.

- a. Plain Arch
- b. Tented Arch

2. Loops- These can be seen in almost 60 to 70% of the fingerprints that are encountered. The ridges make a backward turn in loops but they do not twist. This backward turn or loop is distinguished by how the loop flows on the hand and not by how the loop flows on the card where the imprint is taken. This imprint on the fingerprint is similar to the reverse image that we see when we look at ourselves in the mirror. A loop pattern has only one delta.

There are three types of loops

- a. Radial
- b. Ulnar
- c. Double

3. Whorls- These can be found in about 25 to 35% of the fingerprints that are encountered. Some of the ridges in a whorl make a turn through at least one circuit. Therefore any pattern that contains two or more deltas will be a whorl.

- a. Plain whorl
- b. Central Pocket loop whorl
- c. Accidental whorl

C. Storage of Biometric Data

There are four major locations in which biometric data can be stored – a token or smart card, a central database on a server, on a workstation or directly on the sensor device. Storing the template on a token provides the advantage that the data is not centrally stored and hence does not traverse the network. The users carry the information from location to location which gives them the feeling that they control their personal identification data. The drawback includes higher implementation costs. When templates are

stored in a central repository on a server, it overcomes the problem of users authenticating from multiple locations. This data however needs to be encrypted to avoid any potential intruders from sniffing this data off the network and replaying the authentication session.

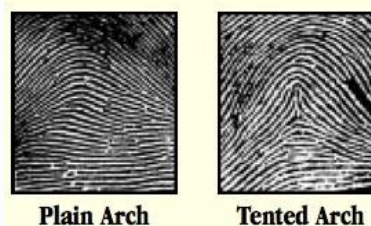
Storing the templates on individual workstations seems to be a reasonable middle ground between storing on a central database and storing on a sensing device. First, a workstation is more difficult to steal physically as compared to a small sensing device. Moreover, storing the data in a distributive manner creates less privacy concerns and prevents a focal point of attack for intruders. The drawback however is that users cannot authenticate from multiple locations. One of the main advantages of storing the templates on the sensing device itself is that it provides quick responses during future authentication.

D. Biometric template security, challenges and solutions

Just after the creation of the template and includes both the enrollment and the verification templates .The database where the templates are actually stored. In a client-server topology, hacking can occur during the transmission of the templates from the biometric system to the central server. In a hosted environment where the templates database resides with a third party. These security challenges can be overcome with the help of template protection schemes.

E. Diagrams and Tables

Samples for fingerprints





Ulnar Loop



Radial Loop



Plain Whorl



Central Pocket Loop



Double Loop Whorl



Accidental Whorl

F. Processing fingerprints

1. Enrolment, searching and verification is most important part of the processing the fingerprints.
2. In the process of enrollment, the aim is to capture the fingerprint using the sensor or any other device.
3. The perfection in the processing provides more accuracy for the detection.
4. Verification is nothing but matching the enrolled data with other document.
5. There are different techniques to match the fingerprints are nothing but correlation based matching, minutiae-based matching, ridge feature-based matching and minutiae-based algorithm.

6. If we classified the above fingerprints into the sub categories mentioned above it will be more easy to identify the pattern of the fingerprint.

II. DETECTION THROUGH COMPUTERS

Introduced Fingerprint Identification System consists of two processes

- 1) The enrollment process: This process consists of capturing a person's fingerprint using a fingerprint capturing device. During the enrollment process, the system saves the person's fingerprint into a database.
- 2) The authentication process: It is used to authenticate the claimed person. This process consists of comparing a captured fingerprint to an enrolled fingerprint in order to determine whether they match. If the two fingerprints match, then the computer will be unlocked, otherwise, an alert will be sent.

III. METHODS AND MATERIAL

Fingerprints were recorded on a plain white paper with a stamp pad by plain and rolled method and each fingerprint was assigned by their serial numbers and roll no. of student. The Name and general information of the students like Age, Sex and Blood groups were recorded on the Proforma. All the subjects were in the age range of 19-25 years consisting of 30 male and 70 female students.. The study design was cross sectional study. The students suffering from any chronic skin disease e.g. eczema, leprosy and chronic dermatitis having scars, congenital or acquired anomalies due to trauma on fingers were excluded from this study. A proforma was designed in which data including name, age, gender, ethnicity, and ABO blood groups were entered. Impression of all fingers and thumbs of both hands were taken. The impressions were taken by simple plain and rolled method. Screening of fingerprints were done by using magnifying lens and scanner.

IV.RESULTS

Out of hundred participants majority were showed the trend and most common pattern belonging to Loop pattern 50%, followed by whorl pattern, which was 42%, a very small proportion belonging to Arch pattern which was only 8%.

V. CONCLUSION

1. Each fingerprint is unique hence it can be very effectively used as an evidence for identification in the court of law.
2. Loops are the most commonly occurring fingerprint pattern and Arches are the least common.
3. Differentiating the whorls, arch, loop are easy by dividing them in sub pattern.
4. Biometric machines can be easily connected to the computers and using this machines authentication is possible.
5. Monitoring attendance is also possible using this Dactylography.

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