

ZKTECO COLLEGE- FUNDAMENTAL OF FINGERPRINT RECOGNITION



What are Fingerprints?

Fingerprints are the tiny ridges, whorls and valley patterns on the tip of each finger. They form from pressure on a baby's tiny, developing fingers in the womb. No two people have been found to have the same fingerprints -- they are totally unique. There's a one in 64 billion chance that your fingerprint will match up exactly with someone else's. Fingerprints are even more unique than DNA, the genetic material in each of our cells. Although identical twins can share the same DNA -- or at least most of it -- they can't have the same fingerprints.



What is Fingerprint Recognition?



Fingerprint identification is one of the most well-known and publicized biometrics. Because of their uniqueness and consistency over time, fingerprints have been used for identification for over a century, more recently becoming automated (i.e. a biometric) due to advancements in computing capabilities. Fingerprint identification is popular because of the inherent ease in acquisition, the numerous sources (ten fingers) available for collection, and their established use and collections by law enforcement and immigration.

History



There are records of fingerprints being taken many centuries ago, although they weren't nearly as sophisticated as they are today. The ancient Babylonians pressed the tips of their fingertips into clay to record business transactions. The Chinese used ink-on-paper finger impressions for business and to help identify their children.



However, fingerprints weren't used as a method for identifying criminals until the 19th century. In 1858, an Englishman named Sir William Herschel was working as the Chief Magistrate of the Hooghly district in Jungipoor, India. In order to reduce fraud, he had the residents record their fingerprints when signing business documents.

Today, digital scanners capture an image of the fingerprint. To create a digital fingerprint, a person places his or her finger on an optical or silicon reader surface and holds it there for a few seconds. The reader converts the information from the scan into digital data patterns. The computer then maps points on the fingerprints and uses those points to search for similar patterns in the database.

Technical Algorithm



Although hands and feet have many ridged areas that could be used for identification, fingerprints became a popular form of biometrics because they are easy to classify and sort. They're also accessible.

The foundation of fingerprint algorithm is based on the verification and matching by the features of fingerprint images and their related information. With year's effort of various enterprises and research organizations, different digital algorithms have been generated. Although algorithms differ, they are all categorized as the identification and matching of the features found in fingerprint images. There are two kinds of fingerprint features for verification and matching: General Features and Partial Features.

General Features

Refers to the visually identifiable features, including:

1. Fingerprint Patterns



Loop



Whorls



Arches

Other fingerprint patterns are based on these 3 basic patterns: Loop, Whorls and Arches. Only identifying fingerprints with fingerprint pattern is only a general categorization which is far from precise, a detailed classification enables quicker and more precise search of fingerprints in big-data database.

2. Mode Zone

It refers to the zone which covers the general features of fingerprint, in mode zone it is able to identify the type of fingerprint. Some fingerprint verification algorithms only uses data in mode zone.



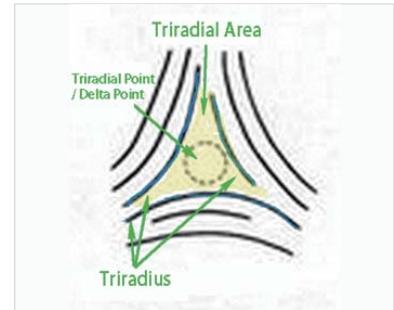
3. Core Point

The core point is located at the gradual center of the fingerprint line pattern, it is used as a reference point for reading and matching fingerprints. Many algorithms are based on core point, which can only process and verify fingerprints with core point.



4. Triradial Point

The triradial point is located at the first segregation point or breaking point from the core point, or the junction, isolation point, or turning point of two lines, or towards these singularity. The triangular point provides a starting point of calculation and traction of a fingerprint line pattern.



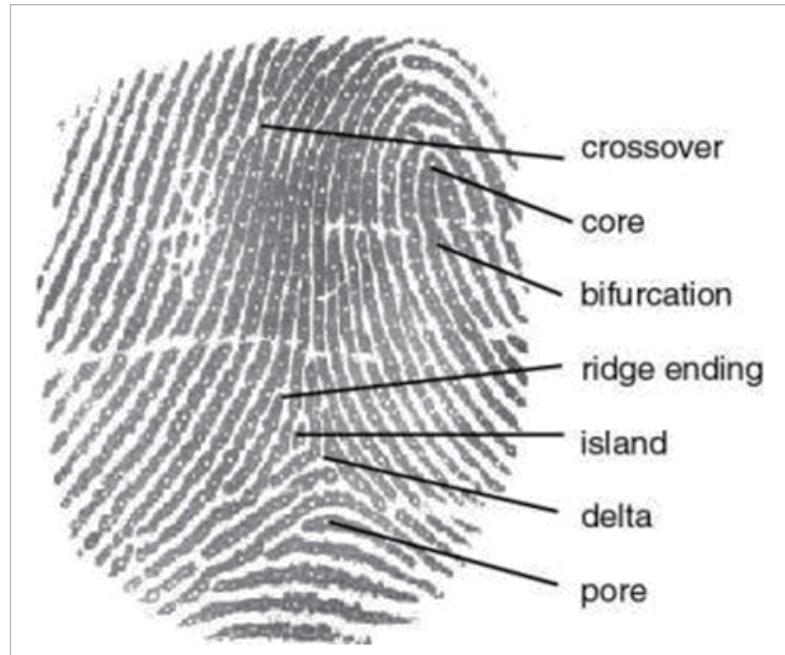
5. Number of Lines

Refers to the number of lines in mode zone. Before calculation of the number of fingerprint lines, it joins the core point and triangular point first. The number of intersection of this joint line and fingerprint line pattern can be seen as the number of lines.



Specific Features

It refers to the features of the node points of a fingerprint. These node points with some kinds of specific features are named feature points. Two fingerprints could often have the same general feature, but it is impossible to have the completely same specific features – feature points. A fingerprint line pattern is not consequential, smooth and straight, but is often interrupted, braided or folded. These breaking points segregation points and turning points are named “feature points”. These feature points provide the only confirmed information of fingerprint. The node points include the below 4 characteristics:



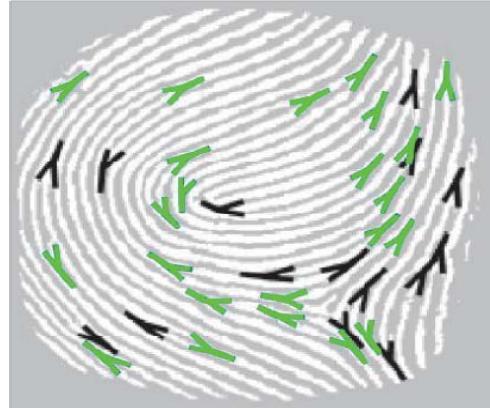
1. Types of feature points

Generally ending points and segregation points.



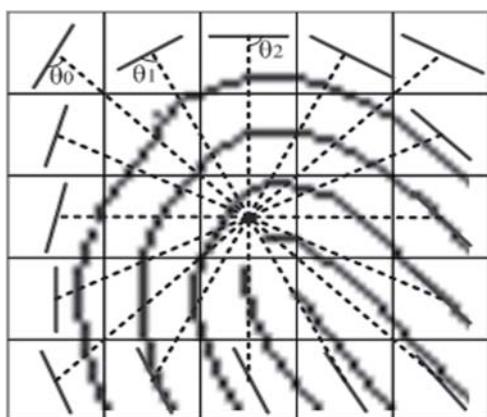
2. Orientation

Node points may point towards the same direction.



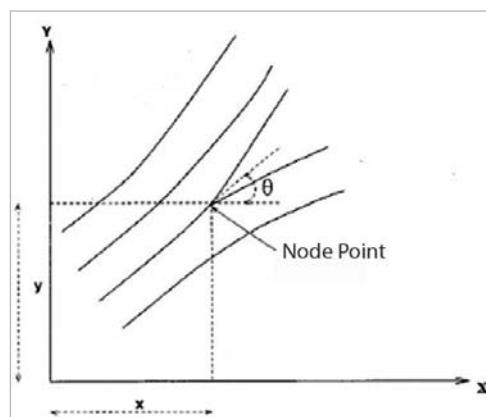
3. Curvature

The speed of the change of the direction of a fingerprint line pattern.



4. Location

The location of node points may be described by (x, y) coordinates, it may be an absolute rate or relative to the triradial point or feature point.



Obviously, based on different digital algorithm, there are no possibilities of different 3rd parties to obtain user identities reversely.

ZKTeco offers own intelligent property rights based algorithms, in the meantime our templates are privately owned, ZKTeco never releases algorithms and template formats to any 3rd party, the reliability of ZKTeco algorithms is based on our 20-year algorithm development experience and the database with integration of up to 10 million fingerprint images, in every year up to a million time & attendance and access control devices have presented our international standard quality of matching passing rate, matching consistency and algorithm precision.

