Research in simulation of fingerprint damages

My research is focused on creation of methods that intentionally damages quality of synthetic fingerprint. These damages represent various effects of phenomena that influence real fingerprint when is being acquired by fingerprint scanner.

Generation of synthetic fingerprints

Synthetic fingerprint can be generated from various input data. From ISO template which is in essence reconstruction of existing fingerprint to a few random points which creates completely new fingerprint. As examples there are pictures from SFinGe generator which uses random points and some information about fingerprint e.g. fingerprint class, density of papillary lines, etc. to create an artificial fingerprint and there are pictures of Chaloupka's generator which uses mainly minutia to create an artificial fingerprint.

Damage Simulation

As we can see on the left side generated fingerprint is too perfect. To create believable fingerprint some damage simulation is needed. It is because process of fingerprint acquirement is influenced by many phenomena. They can be divided into 3 categories:
1. Effects of the user – physical damage of the finger, diseases, wrinkles, pressure, moisture
2. Effects of the sensor – dirt on the sensor, physical damage, latent fingerprint, sensor technology
3. Effects of the environment – surrounding light, vibration, electromagnetic radiation

SFinGe	Chaloupka's generator

SFinGe	My damage simulation

Fingerprint diseases

Fingerprint diseases are often neglected factor of fingerprint recognition. Despite of that they can cause skin discoloration, changes in ultrastructure and changes of epidermis and dermis.

a) CRD   b) CRD   a) CRD   b) CRD
c) E500   d) EII   c) E500   d) EII
e) MSO   f) DIN   e) MSO   f) DIN
Psoriasis – a partial seizure.   Verruca vulgaris.

Fingerprint spoofs

Biometric systems can always be attacked by spoofed biometric feature. While mold is usually from PCB, fingerprint fakes itself can be created from various materials.

Sweeping sensors

Interesting in conjunction with damage simulation are swipe sensors. They are the most used fingerprint sensors nowadays.

Compared to touch based sensors they are also have some special kind of damages that needs to be simulated to create convicing synthetic fingerprint.

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