



Criminalistics Section - 2012

A139 Testing AFIS Search Accuracy at the Limits of Minimal Minutiae

Gary H. Naisbitt, PhD, Aaron Hall*, and Dale Zinn, Utah Valley Forensic Science Program, Criminal Justice Department, Mailstop 286, 800 West University Parkway, Orem, UT 84058*

After attending this presentation, attendees will appreciate how low numbers of minutiae affect the search accuracy of AFIS software.

This presentation will impact the forensic science community by presenting an example of validating AFIS performance prior to conducting searches to establish that the system is performing within its designed specifications and quality control boundaries and the limits of minimal numbers of minutiae will be investigated by taking latent print images from the AFIS database, manually reducing the number of minutiae to between fifteen and eight minutiae points, then searching a known set of print images of the same finger. A probability of success can be determined by comparing realized search results against the number of known true candidates.

The goal of this project is to test the probability that a fingerprint can be unambiguously identified from as few as eight minutiae points. An AFIS validation protocol was used at the beginning and end of each experimental session to verify the software was working as designed.

Previously, latent print screening results of commercially available AFIS software was found to be only seventy percent accurate when compared to known theoretical outcomes (Robert E Ryberg, AAFS Proceedings 2010). The problem was traced not to rotational orientation, rather to how the print's image was cropped. Cropping near the edge of the image, even without eliminating minutia, caused a different set of minutiae to be extracted than when the same image was centered in the field (Aaron Hall, AAFS Proceedings 2011). To overcome this source of error, a standardized AFIS image presentation protocol based on centralizing the print image was developed to maximize latent print database enrollment accuracy. This image presentation protocol tests AFIS performance with a set of standard latent print images with known outcomes to assure the AFIS system was performing to its designed specification and within quality control boundaries. Performing this validation protocol before and after a session searching unknown latent prints enables individual fingerprint examiners to validate the performance of their own AFIS system each time they use it.

This validation protocol was used to assure best possible performance in the following study that measured search accuracy when the unknown latent had low numbers of minutiae.

The AFIS database contained thirty rolled and thirty slapped latent print images of the same finger and the AFIS system was validated according to the protocols referenced above. A duplicate latent print image was taken from AFIS database to be the unknown latent print and the search accuracy of each latent print image was determined to be 100% when compared to its known duplicate in the AFIS database. The AFIS minutiae editing tool was used to reduce the number of minutiae to sixteen and the resulting image was searched to produce a list of matching candidate prints that were judged against the known print as either a True or False result. In subsequent trials, the number of the minutiae were reduced incrementally to a minimum of eight and searched as before.

An example candidate list for a single print in which the database contained thirty different prints of the same finger is (minutiae: true candidates): 15:22, 14:18, 13:16, 12:10, 11:4, 10:2, 9:1, 8:0. Several prints of different patterns will be presented.

AFIS Search Accuracy, Minimal Minutiae, Validation