D76 Accuracy of Latent Print Identification Using AFIS

Keith B. Morris, PhD, West Virginia Univ, 208 Oglebay Hall, 1600 University Ave, PO Box 6121, Morgantown, WV 26506-6121; and Elizabeth C. Dearth, BS, 10093 Azalea Grove Dr, Manassas, VA 20110*

The goals of this presentation are to simplify the comparison process, determine a threshold for the adequate amount of minutiae points needed for an identification and determine the error rates that are made by latent print examiners.

This presentation will impact the forensic science community by providing necessary data for laboratories to evaluate the advantages and disadvantages of using a numerical standard.

Minutiae have been used in the past as a measure for effecting identifications of latent fingerprints. In 1973, the International Association for Identification issued a statement regarding using minutiae for identifying latent fingerprints. The consensus was that there is no basis for using minutiae as a guideline to make identifications. Since then, there have been fluctuating opinions regarding its use. The purpose of this study will be to define error rates in latent fingerprint identification using receiver operating characteristic (ROC) curves. The study proposes to simplify the comparison process by making two assumptions: firstly, only minutiae will be used in the identification process; and, secondly, only specific, clearly identifiable ridge endings and bifurcations will be used. In the baseline study, latents of varying size (and thus varying volumes of identifying features) will be used to gain estimates of error rates.

Preliminary studies, comparing latents with varying numbers of identifiable minutiae using an AFIS, have provided interesting results. Examiners were given a number of latents and a variety of known prints. The prints were then entered into an AFIS. Three specific areas of the latent prints were focused on: tip, core, and delta. For each print, a separate analysis was performed at each of the specified areas. The analysis included selecting from 3 – 50 identifiable minutiae around the designated areas. The frequencies of minutiae combinations were recorded by choosing from 3 – 5 minutiae in relative closeness to the area of concern. The results can be analyzed in a number of ways using signal detection theory and compared for model predictability. The ROC curves will also provide a measure of discrimination irrespective of the method which the examiner provided.

In the baseline study, the error rates were defined in latent fingerprint identification using AFIS. The effectiveness of identification using AFIS was evaluated using receiver operating characteristic curves. The prime objective was to be able to clearly define how the number of minutiae can be used to understand and be applied to error rates. All minutiae are not valued to the same degree, highlighting the need for different numerical standards for the three areas that have been chosen for analysis. These standards will be used to determine the threshold and how it changes based on how the latent occurred. One must also consider at what point this threshold will change based on the area (tip, core, or delta) chosen for analysis. Clear definitions of false positive and false negative rates and their implications for latent fingerprint examiners will be established.

The results of this study may provide the necessary data for laboratories to evaluate the advantages and disadvantages of using a numerical standard. According to the Inspector General's report into the Brandon Mayfield Case, a numerical standard is where a minimum number of points must be in adequate agreement for an identification.[1] The forensic community could benefit from this adoption because "the premise of establishing such a standard is that the probability of encountering two different fingers that share that number of minutiae in common is infinitesimal and can be disregarded" which was also stated in the Inspector General's report.[1]

Reference:

1. "A Review of the FBI's Handling of the Brandon Mayfield Case," Office of Inspector General, U.S. Department of Justice, March 2006, www.usdoj.gov/oig/special/s0601/final.pdf.

Latent, AFIS, ROC Curves

 ** Presenting Author*