



E3 Automated Fingerprint Identification System (AFIS) -Based Likelihood Ratios for Latent Fingerprint Comparisons

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After attending this presentation, attendees will understand the different variables, such as match score, match minutiae, and minutiae matched, that influence match results obtained during an AFIS database search.

This presentation will impact the forensic science community by providing attendees with a possible explanation regarding the workings of the AFIS system by analyzing the inter-dependency of features in determining a true match/non-match and the accuracy of the system.

Latent fingerprints are one of the most common pieces of evidence found on a crime scene that represent accidental or unintentional prints collected as part of a criminal investigation. They are caused by the friction ridge skin deposition on a surface, hence requiring the use of chemical processing to be visualized with the naked eye. While fingerprint evidence itself is very reliable, the comparison and identification of fingerprints depends on various factors, such as the substrate quality, surface, duration, environmental factors, and examiner experience. These factors can result in reduced clarity, content, and even distortions as compared to a fingerprint taken under controlled conditions. Since the release of the National Academy of Sciences (NAS) Report in 2009, the field of fingerprint analysis has come under much scrutiny.¹ Specifically, the need for more research into the determination of the accuracy and reliability of the identifications made by fingerprint examiners has been raised.

One method used for the comparison of latent fingerprints to known prints is through an AFIS. The performance of the AFIS was measured using the AFIX Tracker[®] software where the variability of the data produced was analyzed using the match score, minutia marked, fingers matched, and matching minutiae. The Biocop database was used which contained 962 ten-print cards and latents developed through ninhydrin, cyanoacrylate fuming, and black powder. The quality of the prints was assessed using the National Institute of Standards and Technology (NIST) Fingerprint Image Quality (NFIQ) score in which each latent was scored from one-five to determine its quality. A 70-30 approach was then used in which 70% of the (known) prints were used to test the accuracy of the system and 30% of the prints were unknown prints. A Bayesian network was constructed to perform statistical analysis of the matches obtained while comparing a latent print to a known (ten-print) card where the match score, match minutiae, match status, fingers matched and NIST scores were the nodes analyzed. A preliminary analysis of the results revealed that true matches were only found when more than 25 minutiae were marked on the latent, yielding a match score of 6×10^5 or higher while 90% of the match scores for the non-matches ranged from 55,000- 1×10^5 . This research project may help explain different fingerprint results obtained based on the match score, database size, and number of minutiae marked.

Reference(s):

1. The National Research Council: Committee on Science, Technology, and Law. (2009). *Strengthening Forensic Science in the United States: A Path Forward*. Washington, DC: The National Academies of Science.

Latent Fingerprints, AFIS, Accuracy

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