B107 A Novel Software-Based Toolset for Latent Print Examination

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After attending this presentation, participants will better understand the features and benefits of using a novel automated system to augment their existing tools for latent print searching and matching.

This presentation will impact the forensic science community by reporting on the development and testing of a novel toolset for latent print examination. The toolset provides a larger candidate list with latent features mapped onto the reference print, thereby potentially increasing the likelihood of identification if the database contains the reference print. The use of this toolset has potential cost-saving benefits in reducing examiner time and increasing the efficiency of expert examiners.

This presentation will introduce innovative toolsets for latent fingerprint examination that significantly reduce the labor intensity of examination and make possible the detailed comparison of a latent print to large databases of reference prints. The toolsets result from an innovative technology that captures ridge and furrow information in a fingerprint via a concept of Ridge-Specific Markers (RSMs).[1] RSMs are exploited to produce invertible overlays between a latent and a reference print that removes the local non-linear distortion between the prints. Each overlay is scored at the pixel level by an algorithm that evaluates the accuracy of the overlay at the pixel level within ridges and furrows. The overlay technology and scoring algorithms were previously presented and the performance of the RSM technology using the National Institute of Standards and Technology (NIST) Special Database 27 latent print data set was demonstrated; this presentation reports on new results of testing the current toolset by latent print examiners within various organizations.[1-3]

Latent prints often offer the best possibility for identification of suspects in criminal and terrorist cases; however, latent prints are also the most difficult to analyze by conventional automated methods due to poor image quality and limitations of the number of minutiae available for identification. The challenge in matching latent prints becomes one of establishing identity within the constraints of the limited information provided.

The presented toolset incorporates a unique method that establishes how well one fingerprint will overlay onto another. The overlay leads to a score that provides a quantitative assessment of the fit between prints with the objective of determining whether two fingerprints potentially came from the same finger. This method permits fingerprint matching using the rich feature set provided by the ridge structure enabling matching to take place without reliance on traditional minutiae (i.e., ridge edgings and bifurcations).

The toolset runs a latent against a reference print database, such as the prints returned from an Automated Fingerprint Identification System (AFIS) search or a set of prints of interest in a specific case. The toolset performs totally automated processing of the latent and reference images to include: (1) quality masking of the images; (2) binarization of ridges and furrows; (3) invertible non-linear overlays of the latent on each reference image; (4) pixel-based scoring of overlays to reference images based on the accuracy of the overlays; (5) automated locating and minutiae markup in the latent and all reference images; (6) visual assessment of level-3 features (when level-3 feature information is available in the images); and, (7) interactive image overlays supporting comparisons of latent and reference images that allow real-time visual assessment of corresponding locations in the latent and each reference print.

The magnitude of the score indicates the degree of similarity between the latent and the reference image. Scores are pixel-based for pixels along the one-pixel-wide centerline of both ridges and furrows; that is, scoring is an aggregate of the similarity of a latent and a reference print on the totality of ridges and furrows within an examiner's region of interest as marked on the latent print.

This presentation will also showcase the listed functionalities through a live demonstration of the toolset, specific to latents and reference print databases. Through this presentation, latent print examiners will become aware of enhancements to latent print examination through the RSM technology that potentially reduce examiners' labor and permit a broader quality range of latent prints to be exploited.

References:

1. D.T. Gantz, et al. (2012). "Ridge Specific Markers for Latent Fingerprint Identification," *EAFS2012*. The Hague, Netherlands.
2. D.T. Gantz, et al. (2012). "Automated Statistically Ranked Latent-to-Reference Print Overlays" *Impression and Pattern Evidence Symposium*. Clearwater Beach, FL.
3. D.T. Gantz, et al. (2013). "A Similarity Score for Fingerprint Images," The Joint Statistical Meetings. Montreal, Canada.

Fingerprints, Minutiae, Ridge Flow