A60 Combined Chemical and Biometric Field Analysis of Human Fingerprints

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After attending this presentation, the attendees will learn of a novel approach to combine quick field-deployable chemical trace detection analysis and a unique latent fingerprint collection method in a single sample.

This presentation will impact the forensic science community by offering a unique latent fingerprint collection method that is compatible with field-deployable chemical analysis techniques that are currently in use around the globe.

There are currently several existing methods to collect and analyze latent fingerprints for human identification with forensic applications. There are also numerous techniques to collect and detect trace levels of contraband materials from various surfaces within a few seconds. However, there is not yet a field deployable technique to collect a latent fingerprint and investigate that print for trace explosives or narcotics contamination in the field within a single sample. This presentation will describe a method to collect latent fingerprints and analyze them with a common trace contraband detection technique, ion mobility
spectrometry (IMS).

IMS is a rapid screening technique commonly used in airports, prisons, and border control checkpoints to examine various surfaces for trace levels of explosives or narcotics. Surfaces are typically swiped with a collection material to collect microscopic particles, and the swab is then heated to temperatures exceeding 200°C for analysis. Adding a heat-sensitive and low out-gassing silicone adhesive to the collection swabs has been shown to improve the particle collection efficiency by a factor of 12.[1] This adhesive can also be applied to a surface for collecting a latent print, and, due to its heat resistance, is compatible with trace detection techniques such as IMS.

Collection swabs for lifting fingerprints were made by applying a heat-resistant silicone adhesive to opaque smooth Teflon swabs. Latent fingerprints containing trace levels of C-4 explosive were created by a volunteer on glass slides, and forensic magnetic fingerprint dust was brushed over the fingerprint for development. The adhesive swab was used to pull the latent fingerprint off the glass surface, similar to collection of a forensic tape pull. In addition to the latent fingerprint, a full set of ink-rolled exemplar fingerprints were also captured from the same volunteer. The latent print on the adhesive swab was analyzed directly with IMS. All fingerprints including both the exemplar and the latent were then scanned to digital form using an FBI Appendix-F certified scanning station. All images were cropped of most white-space, and the latent fingerprints were inverted across the vertical axis to correct for inversion resulting from the lift-capture. The digital fingerprints were measured for relative quality using the NFIQ algorithm[2], processed through the MINDTCT minutiae detector[3] and the resulting minutiae templates matched using the BOZORTH matcher[3] to verify that a match can be made between the latent and the matching exemplar finger. Preliminary results show that the fingerprint swabs were capable of producing an IMS response for the explosive, and the lifted prints had enough fingerprint detail to make a positive match using the algorithm, even after thermal desorption.

This presentation will introduce this novel approach of combining trace contraband detection with biometrics for field applications. Having the ability to collect a latent print and heat it for chemical analysis while keeping the print intact could be extremely useful for law enforcement and military operations. It could potentially reduce the cost and delay of sending fingerprint samples to a lab for chemical analysis. Chemical analysis in the laboratory may also affect the ability to analyze the fingerprint for biometric purposes. This work is beneficial to the forensic community by offering a unique latent fingerprint collection method that is compatible with quick field-deployable chemical analysis techniques that are currently in use around the globe.

References:

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Latent Fingerprint, IMS, Trace Detection

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