J31 Generating and Harnessing Objective Data for Trash Mark Examinations

Linda Eisenhart, Federal Bureau of Investigation, Quantico, VA 22135; Joseph C. Stephens, MSFS*, Quantico, VA 22135; Jocelyn Abonamah, MFS, Washington, DC 20002; Colbey Ryman, Arlington, VA 22206; Paige Riley, Fairfax, VA 22030; Nirmeen Salah, Woodbridge, VA 22191; Brian Eckenrode, PhD, Quantico, VA 22135*

Learning Overview: The goal of this presentation is to demonstrate the foundational validity of trash mark comparison methods through empirical, objective data. By harnessing this objective data, forensic scientists can define and apply mathematical calculations and statistical approaches to make the analysis more transparent and reproducible.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by outlining a method to move trash mark examinations toward pre-defined decision criteria and data analyses. This presentation will discuss an on-going effort to digitize documents and accurately record trash mark data using a reproducible method. This method also provides an improvement in efficiency, especially when numerous known machines with multiple functions are being compared to one or more questioned documents.

Forensic scientists periodically face challenges regarding the lack of foundational research and the subjectivity of their methods. Pattern recognition methodologies, in particular, require application of significant training and experience to make subjective decisions. One such pattern recognition method is the use of printed or photocopied defect marks, commonly referred to as trash marks, from office machines to associate a questioned document to a source. This method may assess whether documents share a common source (document to document comparison) or whether a document may have been produced using a specific machine (document to machine comparison). This type of examination has been in use in forensic laboratories for decades, yet it remains qualitative and subjective in nature.

An evaluation of different approaches to digitization (e.g., scanning versus photography) of questioned documents and exemplars will be presented, along with the variables to consider for each approach, the pros and cons of each, and a recommended procedure to follow based on how the images will be used. Next, the development of a custom software that serves as an objective, reproducible tool for examiners to utilize as part of trash mark examinations will be presented. This software includes core functionality such as finding the trash marks in a digital image and recording the location and size as well as capturing an image of each trash mark. This enables comparison of morphology across multiple exemplars and with questioned documents. In addition, the software performs comparison of trash mark constellations between two or more pages. A demonstration of the software will be provided, followed by a discussion to gather feedback for important parts of the software design.

Trash Marks, Macro Development, Foundational Research