J10 A Comparison Between Biometric and Forensic Handwriting Individuality

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The goal of this presentation is to describe one approach to linking validation of the concept of handwriting uniqueness to empirical studies of measurable features extracted from handwriting samples.

This presentation will impact the forensic community by assisting in the validation of the premise of the uniqueness of handwriting profiles using empirical studies. This research will provide sound statistical support for handwriting individualizations in light of the *Daubert* standard.

Forensic handwriting individuality refers to the proposition that each individual in a population has a unique handwriting style. An empirical study cannot validate this proposition due to the impossibility of observing sample documents written by each person in a relevant population. However, the proposition that handwriting is unique is one of the key premises on which the Forensic Document Examiner (FDE) relies in making a positive identi- fication (i.e., individualization) of the writer of a given handwriting exemplar.

One proposed measure of the quality of a biometric identifier for indi- vidualization is the chance of observing two individuals in a relevant source population that are indistinguishable with respect to that biometric, a so- called random match probability (RMP). The “smaller” the RMP, the “better” is the biometric identifier. The RMP can be investigated empiri- cally by applying the biometric identifier to a representative sample of indi- viduals from the population. Furthermore, the RMP provides an upper bound on the chance of observing two individuals who are truly indistinguishable regardless of how microscopically they are compared. Therefore, although an empirical study cannot “prove” uniqueness of handwriting, it potentially can be used to show that the chance of observing two individuals with the same handwriting profile is very small. In a practical sense, the chance of such an observation is so small that it can be said that a handwriting profile is unique. This approach to individualization is similar to that used in the reporting of forensic DNA-analysis.

The empirical estimation of a small probability, such as a random match probability in a population where individuals tend to be different (if not ultimately unique), is a difficult problem. The estimation problem is further complicated in the current scenario by the inherent variability in handwriting samples. Some classical methods for estimating small probabilities related to random matching, focusing on construction of upper confidence bounds will be reviewed. Some new methods that more efficiently utilize the infor- mation from all pairwise comparisons of samples by modeling the dependency structure between individual comparisons will also be proposed. These new methods can also be used when all samples are distinguishable, a situation where many of the classical methods fail.

The newly proposed analysis techniques are applicable to any biometric identifier that can be used to compare two handwriting samples. Also, they have broad applicability to other forensic identification fields where pairwise comparisons can be used to estimate properties of biometric identifiers.

The classical and proposed estimation methods and the associated conclusions concerning handwriting uniqueness will be illustrated and compared using the handwriting biometric identifiers developed by Gannon Technologies Group and the George Mason Document Forensics Laboratory as applied to a FBI database of 500 writers with approximately 10 writing samples per writer.

Handwriting, Individualization, Statistics

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