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Statistics, Mathematics, and the Fair Evaluation of Evidence

In the last two decades, the validity and reliability of many forensic disciplines have come into question. A 2009 landmark report by the National Research Council of the United States was strongly critical of many forensic practices, but specially of what are known as pattern comparison disciplines. These include fingerprint and shoeprint analysis, ballistics, handwriting analysis and others. At present, pattern forensic examiners rely on subjective assessment of the similarity between two pieces of evidence and not at all on more objective, quantitative methods. In the pattern disciplines, evidence typically takes the form of images, and a common forensic question is whether two impressions could have been made by the same object. For example, was the crime scene footwear impression made by the suspect's shoe? Today, I discuss new methods that have been developed to quantify the similarity between two images and enable forensic practitioners to make probabilistic statements as they analyze and interpret pattern evidence. For illustration I will talk about two specific application areas, firearms and footwear, where novel methods have the potential to change the practice of forensics everywhere.