A191 Strategic Research Directions in Forensic Science at the NIST Information Technology Laboratory

Martin Herman, PhD, 100 Bureau Drive, MS 2000, Gaithersburg, MD 20899*

After attending this presentation, attendees will understand how the National Institute of Standards and Technology (NIST) Information Technology Laboratory's (ITL's) unique mission and expertise in computer science, mathematics, and statistics can be applied to improving forensic science.

This presentation will impact the forensic science community by providing strategic research directions that will result in improving the scientific, measurement, and statistical foundations that underlie forensic methods, standards, practices, and technologies, resulting in greater reliability, accuracy, validity, and throughput of forensic analyses.

The following strategic forensic science research challenges may be addressed by ITL:

Scientific Underpinnings — The fundamental measurement science underpinnings of the pattern-based and digital forensic sciences must be solidified. Research is needed to address issues of accuracy, reliability, and validity in these disciplines.

Statistical Foundations — There is a need for development of quantifiable measures of uncertainty for forensic measurements and for the conclusions of forensic tests and analyses. Statistical tools and practices need to be formulated and integrated into tests and analyses performed by practitioners.

Validation Studies — Validation studies are needed that determine how well forensic methods, practices, and technologies in pattern-based and digital forensic disciplines, interoperability standards and technologies, and automated computing technologies perform under a variety of conditions of use.

Human Bias and Error — Much must be done to understand the sources of human bias in forensic science procedures and to develop mitigation strategies. Testing methodologies need to be developed to determine and evaluate human error, including the sources of error. Metrology needs to be developed that can be used to characterize and quantify the amounts of human error from the various sources.

Computing Technologies and Reference Data — Computing technologies and reference data sets in forensics can lead to greater accuracy, reliability, functionality, and throughput. New automated computing technologies and data sets relevant to forensics need to be developed, tested, and validated.

Usability — Forensic systems and methods with enhanced usability can lead to greater accuracy, reliability, and throughput, as well as greater satisfaction for forensic practitioners. Studies are needed to provide a better understanding of how to improve forensic usability, and where such improvement can enhance forensic practices. Standards, practices, and technology need to be developed or updated to achieve improved usability.

Interoperability — Enhanced interoperability of forensic systems and methods are potentially capable of providing greater reliability and throughput through improved collaboration and sharing of information. Standards, practices, protocols, and technology need to be developed or updated to achieve improved interoperability.

The forensic science research performed by NIST ITL focuses on four critical themes:

Image and Pattern Analysis — Many forensic disciplines are based on image, pattern, or impression evidence, including friction-ridge patterns, face imagery, voice, scars-marks-tattoos, bitemarks, tire marks, shoe prints, tool marks, and handwriting. Image and pattern analysis is also necessary for video and audio analytics, for comparison and identification of software files in digital forensics, and for 2D and 3D forensic shape metrology and analysis.

Measurement and Uncertainty — All the forensic science disciplines require a solid underpinning of statistical foundations, measurement science, and measurement uncertainty. This theme covers topics such as measurement errors, error rates, errors due to human bias, errors in forensic methods and technologies, statistics-based tools and practices, and assessing the statistical validity of forensic methods, standards and tools.

Interoperability of Forensic Data — Interoperability of forensic data provides the basis for improved collaboration and sharing of information among forensic laboratories, practitioners, and different forensic methods and systems, including automated systems. This theme covers topics such as scientific interoperability studies and tests; documentary interchange standards, practices and protocols; and conformance tests for documentary standards.

Automated Forensic Technologies — Automated technologies can greatly enhance forensic practices by providing greater accuracy, reliability, repeatability, functionality, and throughput. This

 ** Presenting Author*

theme covers topics such as measurement and evaluation approaches for automated technologies; technologies that perform forensic information extraction, representation, and analysis; software tools to measure forensic data quality; forensic database representation and search; digital forensic technologies that extract and analyze digital data; and usability of automated technologies.

Measurement Science, Statistical Foundations, Automated Technologies

 ** Presenting Author*