The Chinese University of Hong Kong
Shun Hing Institute of Advanced Engineering

Distinguished Lecture Series 2010

Reverse Engineering of Electronic Devices: An Information Forensic Paradigm

by

Professor K. J. Ray Liu

Department of Electrical and Computer Engineering
University of Maryland, College Park, USA

Date: 22 September 2010 (Wednesday)
Time: 11:30 a.m. – 12:30 p.m.
Venue: Lecture Theatre, 9/F, William M.W. Mong Engineering Building, CUHK

Abstracts

Information forensics is an emerging new interdisciplinary field concerning about framework, algorithms, and methodology for traitor tracing, content protection, tampering detection, component analysis for intellectual rights protection/infringement, and behavior modeling and analysis for multimedia social networks.

Information forensics is to reconstruct what have happened to the content and to answer who has done what, when and how. To perform forensic analysis, there got to be some traces of evidences. There are invisible traces of evidences left on the content when going through some operations and devices. These "intrinsic fingerprints" can provide powerful forensic evidences regarding the history and provenance of digital content.

In this talk, we will present state-of-the-art advances to identify components inside a electronic device solely from its output by inferring what algorithms/processing are employed and estimating their parameter settings. We will, as an example, discuss a new methodology for forensic analysis of digital camera images based on the observation that color interpolation leaves distinct intrinsic traces on digital images, and these *intrinsic fingerprints* can then be identified and employed to verify the authenticity of digital data. Using a detailed imaging model and applying component analysis techniques, we can determine which interpolation algorithm is being used, estimate the parameter settings, and thus determine the brand and model of the camera that take this picture.

It can be used for tampering detection as well. Any change or inconsistencies among the estimated in-camera fingerprints, or the presence of new postcamera fingerprints suggests that the image has undergone some kind of processing after the initial capture, such as tampering or steganographic embedding. Building upon such component forensics knowledge, we can extend such a "non-intrusive" forensic methodology to address a number of larger forensic issues in discovering technology infringement and protecting intellectual property rights (*infringement forensics*), identifying the type and model of acquisition device (*acquisition forensics*), detecting a variety of content tampering and verifying integrity (*tampering forensics*), and building universal detector capable of detecting unseen and challenging steganography schemes (*steganography forensics*), just to name a few.

Biography of the Speaker

Dr. K. J. Ray Liu was named a Distinguished Scholar-Teacher of University of Maryland in 2007. He leads the Maryland Signals and Information Group conducting research encompassing broad aspects of wireless communications and networking, information forensics and security, multimedia signal processing, and biomedical engineering.

Dr. Liu is the recipient of numerous honors and awards including 2009 IEEE Signal Processing Society Technical Achievement Award, IEEE Signal Processing Society 2004 Distinguished Lecturer, and best paper awards from IEEE and EURASIP. A Fellow of the IEEE and AAAS, he is recognized by Thomson Reuters as an ISI Highly Cited Researcher. Dr. Liu is President-Elect of IEEE Signal Processing Society. He was the Editor-in-Chief of IEEE Signal Processing Magazine and the founding Editor-in-Chief of EURASIP Journal on Advances in Signal Processing.

Dr. Liu also received various research and teaching recognitions from the University of Maryland, including Poole and Kent Senior Faculty Teaching Award and Outstanding Faculty Research Award, both from A. James Clark School of Engineering; and Invention of the Year Award from Office of Technology Commercialization.

His recent books include *Behavior Dynamics in Media-Sharing Social Networks*, Cambridge University Press (to appear); *Cognitive Radio Networking and Security: A Game Theoretical View, Cambridge University Press, 2010; Handbook on Array Processing and Sensor Networks,* IEEE-Wiley, 2009; *Cooperative Communications and Networking*, Cambridge University Press, 2008; *Resource Allocation for Wireless Networks: Basics, Techniques, and Applications*, Cambridge University Press, 2008; *Ultra-Wideband Communication Systems: The Multiband OFDM Approach*, IEEE-Wiley, 2007; *Network-Aware Security for Group Communications*, Springer, 2007; *Multimedia Fingerprinting Forensics for Traitor Tracing*, Hindawi, 2005.

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**** Light refreshment will be served at 11:15 a.m. before the lecture ****