

Forensic Image Authentication and Analysis of AI-Generated Images (IA1)

Course Description: Students explore authentication of digital images with regard to evidence admissibility and counterfeit detection. Structure analysis, EXIF data analysis, recompression analysis, DCT, PRNU, AI-generated image analysis, and more will be discussed. Students are strongly encouraged to bring images from their own cases as well as their own digital cameras. Students will complete hands-on exercises using real image examples and forensic casework.

Previous experience/formal training with digital evidence is recommended.

*Please note that some of the methods and software discussed and presented may only be available for demonstration purposes and/or to law enforcement agencies.

Course Outcomes:

KNOWLEDGE

Students will:

- Gain new perspectives to understand:
 - The latest forensic image authentication techniques.
 - Advanced principles of forensic image authentication.
 - Forensic techniques, emerging science, and limitations of the forensic expert.
 - Digital evidence seizure and acquisition.
- Acquire knowledge which either enhances or is not covered in scientific literature.

SKILLS

Students will:

- Take entrance and exit exams to gauge course's effectiveness while informing student regarding the advancement of their knowledge.
- Understand the questions that they shall be able to answer as a forensic expert.
- Know how to manipulate digital evidence.
- Know how to apply advanced techniques for forensic image authentication.
- Demonstrate a familiarity with general topics related to forensic imaging.

DISPOSITIONS

Students will:

- Gain an appreciation for advanced issues in forensic imaging.
- Be able to critically evaluate different forensic image equipment, software, and methods.
- Enhance awareness of needs and opportunities in the field of digital imaging.

Course Schedule:

1. Foundations for Forensic Image Authentication
 - 1.1. Forensic Principles
 - 1.2. Digital Evidence Seizure and Acquisition
 - 1.3. Digital Photo Algorithms (JPEG)
2. Demonstration and Practice
 - 2.1. Data Analysis
 - 2.1.1. Structure Analysis
 - 2.1.2. EXIF Analysis
 - 2.1.3. Quantization Table Analysis
 - 2.2. Pixel Level Analysis
 - 2.2.1. Global Analysis
 - 2.2.1.1. Compression Level Analysis
 - 2.2.1.2. Color Filter Array
 - 2.2.1.3. DCT Analysis
 - 2.2.2. Local Analysis
 - 2.2.2.1. DCT Map
 - 2.2.2.2. ELA Map
 - 2.2.2.3. Correlation Map
 - 2.2.2.4. Probability Map
 - 2.2.2.5. PRNU Map
 - 2.2.2.6. Blocking Artifacts Analysis
 - 2.2.2.7. Aligned Double JPEG Analysis
 - 2.2.2.8. Non-Aligned Double JPEG Analysis
 - 2.2.2.9. Clone Detection
 - 2.3. PRNU Analysis for Camera Identification
3. Introduction to AI-Generated Image Analysis
 - 3.1. Examples of AI-Generated Images and Tools
 - 3.2. Examples of AI-Generated Image Analysis