University of Colorado Denver

National Center for Media Forensics
College of Arts & Media

Campus Box 154
P.O. Box 173364 | Denver, CO 80217-3364
artsandmedia.ucdenver.edu/ncmf

Forensic Analysis and Authentication of Digital Images

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, and more will be discussed. Students are strongly encouraged to bring images from their own cases as well as their own digital cameras.

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 auathentication.
    - 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