



W16 Forensic Multimedia Authentication: Real-Life Challenges

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Learning Overview: After attending this workshop, attendees will: (1) become familiar with the latest developments in forensic video and audio authentication, enhancement, and restoration; (2) understand criteria used for media authentication; (3) understand how to conduct analysis within a forensic framework; and (4) explore the latest technologies in the generation of synthetic imagery, including deepfakes, face2face, and others.

Impact on the Forensic Science Community: This workshop will impact the forensic science community by: (1) explaining the scientific approach in forensic media authentication, enhancement, and restoration; (2) demonstrating an authentication investigation framework; and (3) discussing tools used to create and combat multimedia forgery.

Digital multimedia authentication seeks to determine the validity of digital multimedia containers and contents by investigating their format, structure, time, frequency, and pixel and/or sample level features. This workshop will discuss the multimedia authentication process, providing the user with methods of authenticating both video and audio, including deepfakes and deepvoices. This workshop will also demonstrate the incorporation of multiple tools and techniques into unified frameworks appropriate in forensic examinations where reducing examiner bias and error is crucial.

This half-day workshop will cover video and audio authentication analyses. The goal of this workshop is to provide an overall view of conducting comprehensive examinations that rely on the results of multiple analyses to inform an ultimate finding or opinion. First covered will be a video authentication framework, focusing on camera verification/identification and image and video attack detection. This includes a quick overview of the digital video file creation chain for contextual information of the artifacts that influence the final digital media streams based upon a general description of camera sensor noises for both complementary metal-oxide-semiconductor and charge couple device type sensors. Photo Response Non-Uniformity (PRNU) are small artifacts of the sensor and can be used as a sort of fingerprint for the sensor. For video and images, it can be determined with a high likelihood that a certain image or video has been made with a specific camera. PRNU can also be used for detecting deepfakes. Splicing, copy-move, and removal artifacts are also investigated in a complex video authentication process and will be discussed and exemplified with original and manipulated videos.

The use of articulated 3D face models is a double-edged sword: it can be used to make deepfakes, but it also can be used to recover true image/video details. A theory and the method for video resolution enhancement restoration with data adaptive 3D facial models will be presented. This method starts with a generic facial 3D model, then simultaneously recovers the finer facial feature details in the video frames and also adapts the 3D model to fit the observed face in the video.

In the second section of the workshop, real-life audio challenges and solutions will be presented. The proposed audio authentication framework combines both container and content analysis to determine authenticity of the recording as well as the purported source. Audio container analysis will exploit characteristics of the multimedia file format and structure while content analysis will cover time and frequency domain techniques, including quantization level, power, direct current offset, butt splice, spectral and Multidetector Computed Tomography (MDCT) analysis.

Multimedia Forensics, Authentication, Deepfake