B16 Building a Database of Electric Network Frequency Variations for Use in Digital Media Authenticity

Jeffrey M. Smith, MSc, National Center for Media Forensics, 1800 Grant Street, Suite 230, Denver, CO 80210*

After attending this presentation, attendees will become familiar with the fundamental principles behind utilizing the variations in the Electric Network Frequency to authenticate digital recordings and the approach the National Center for Media Forensics has taken to create a database of ENF variations for the Western United States.

This presentation will impact the forensic science community by providing an overview of a new technique in authenticating digital audio and discussing the current research on this subject underway at the National Center for Media Forensics.

There is great need for research in the area of forensic media authentication with regards to digital audio. Tools used in authenticating analog tapes do not apply in the digital domain where sophisticated criminals are capable of seamlessly editing evidence. One proposed tool that is currently undergoing a fair amount of research and has been presented in European courts is the extraction of the Electric Network Frequency (ENF) component of a digital recording in order to authenticate it and perhaps even obtain a time-stamp. When this tool is successful, a forensic investigator is capable of locating edits, identifying the broad geographical area in which a recording was made, accurately assessing the date and time a recording was made, whether the recording is an original or copy, or if it is the result of two audio files being combined or mixed together.

However, for this application to reach its potential, a database of Electric Network Frequency variations for each grid must be available. For the United States, these grids include one for the Western United States, one for the Eastern United States, and one for Texas. It is possible for one to obtain this information from the local power company but for this data to be readily available and easily analyzed, a custom database must be recording ENF variations twenty four hours a day, seven days a week, three hundred and sixty five days a year. The National Center for Media Forensics is currently maintaining a database covering ENF variations for the Western United States and has plans to implement databases in other parts of the country as well. The analysis of this database involves generating a low sample rate waveform from data collected directly from a power outlet. This waveform can then be spectrally analyzed for pseudo-random variations and compared to field recordings exhibiting a strong ENF component.

In this presentation examples will be shown to demonstrate the application as well as proposed methods regarding its use. Following this brief introduction, elaboration on current research trends including those at the National Center for Media Forensics where a database of the distributed power grid covering the western United States is collecting data twenty four hours a day for potential use in media authentication and time stamping recordings of unknown origin. A review of relevant literature that relates to this topic will be given in addition to proposed areas in need of research. A scenario in which recordings originating in either the continental United States or Canada can be authenticated and/or time stamped for use in forensic applications will be described. This involves at least one database in each of the three grids covering these countries. In addition to establishing these databases, refinement in techniques regarding ENF extraction, analysis, and comparison must be undertaken in order for this tool to reach its full potential.

Audio Forensics, Digital Media Authentication, Electric Network Frequency

 ** Presenting Author*