D84   Using Automated Digital Tools for Forensic Audio Examinations

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The goal of this presentation is to provide testing results and guidance regarding automated audio analysis tools for use in forensic digital audio examinations.

This presentation will impact the forensic science community by increasing awareness of the benefits and cautions when using automated digital tools for forensic audio examinations.

Current technology offers a continually changing array of tools for forensic audio examinations. There has been significant progress in the design and usefulness of the tools available to the audio examiner in recent years. Traditionally, the forensic audio examiner had limited choices for electronic filters and other tools for forensic use. However, today there is a wide array of systems and tools to use for audio enhancement, duplication, voice comparison, signal analysis, and authentication examinations. This analysis investigates a variety of those audio tools and functions that are in common use. Particular emphasis is placed on analysis tools that improve the efficiency and effectiveness of examinations for the audio examiner. Some of the functions evaluated are noise removal, phase detection, prior digitization, tone-detection, statistics and batch processing. Functions related to computer forensics, for example hashing and file comparison, are not covered in this analysis. The primary focus for this analysis is the testing and review of tools for use in audio enhancement, signal analysis and authenticity examinations. There is widespread use of digital audio analysis tools for these examinations, but there is very little measurable data for the examiner to judge the value of these tools. This analysis provides test results and recommendations concerning possible improvements in the speed and accuracy of audio examinations when using automated digital tools. Cautions are also provided to the examiner concerning certain technical limitations when using automated digital audio tools.

Some of the test results reveal inconsistent data and inappropriate application of technology. However, some of the systems performed well and clearly provide improved effectiveness and efficiency for certain forensic audio examinations. The function "phase detection" was tested and analyzed. Its test results show that inconsistent data occurs and can be misinterpreted. For example, a test recording with a minimum of ten stop/start recording events was tested with one of the phase detection systems. The goal of the system under test was to automatically detect possible alteration of recorded events, for example recording stop/start events. This automated analysis function would be used in an audio authenticity examination to determine among other details whether or not the recording was original, continuous and unaltered. The system under test concluded that "no phase changes nor alterations" were present on the test recording. Therefore, using that system for conducting an authenticity examination would be flawed. There are other alternative tools that provide effective results for detecting alterations in digital audio files. Another system was tested for its ability to conduct batch processing for the enhancement of an audio recording. The benefits of this function include improved efficiency and effectiveness, particularly for longer recordings exceeding an hour in length. This particular system depended on setting its filter parameters in the first few seconds of the recording. This meant that the enhanced version had no filtering effects for the first few seconds of the recording and the filtering was only effective after the parameters were 'learned' by the system. The system design for this type of batch processing would be considered not appropriate for forensic audio enhancement examinations.

Testing results indicate that the forensic audio examiner must be aware of the technical limitations of digital audio tools before using in actual examinations. In addition, all forensic tools should complete a series of validation tests to determine whether the tool is appropriate and whether the analysis results of the tool are accurate.

Audio Analysis, Digital Audio, Audio Authenticity