C21   Using Reverse Projection and File Metadata Analysis to Calculate Speed in Recorded Digital Video

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Learning Overview: After attending this presentation, attendees will understand a novel approach for determining vehicle speed in a fatal motor vehicle accident using frame timing metadata.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by introducing a new approach to determining time difference between frames of digitally recorded video. This directly relates to how practitioners, the judiciary, and the public analyze video footage in critical incidents, such as police officer use of force and motor vehicle accidents.

On July 25, 2016, a fatal motor vehicle accident occurred in Edison Township, NJ. The accident was captured on a nearby restaurant's exterior video security camera system. At the time, no accident reconstruction was conducted. However, data was acquired from one vehicle's onboard Event Data Recorder (EDR). With no accident reconstruction completed, the data from the EDR could not be validated; an attempt was then made to determine the speed of that vehicle using the recorded security camera footage.

An initial review of the video footage was conducted and seven frames of video prior to impact contained enough newly encoded data to utilize in the examination. A reverse projection was conducted with those seven frames in order to place the vehicle at specific locations on the roadway to determine distances prior to impact. The digital video file metadata was then analyzed to determine specific intervals between each displayed frame. This metadata differs from information displayed in the recording system's settings (30 Frames Per Second (FPS)) and the originally reported frame rate of the video file (25 FPS). Additionally, the metadata may account for minute differences in time that each video frame is intended to be displayed at. The metadata also differs greatly from a common misconception that all recorded video is intended to be viewed at 30 FPS.

Using the identified distances and frame time difference, speed was calculated for the vehicle. A margin of error was also calculated based on an examiner's ability to accurately identify the location of a recorded image on the roadway. Comparison with the calculated speed as well as the margin of error was conducted against the EDR reported speed data. It was found that the speed calculated from the recorded video was validated by corresponding EDR data speeds.

This approach to calculating speed from recorded video can be applied to other fatal accident investigations as well as any video footage where object speed is in question. With the prevalence of police body-worn cameras and bystander video in police use-of-force incidents, these questions are certain to become more popular. It would greatly benefit the forensic science community and the public to have a scientific basis for determining exact timing and speed of actions within digitally recorded video.

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