D12 Empirical Elimination of a Digital Enhancement

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After attending this presentation, attendees will understand the necessity to empirically validate photography enhancement algorithms.

This presentation will impact the forensic community and/or humanity by serving to caution those working with photography enhancement that subjective observations coupled with enhancement may present an erroneous implication.

The importance of empirical validation of photo enhancement algorithms was demonstrated by a case in which a photograph was enhanced, appeared to show an object in a particular location and, upon investigation, was demonstrated not to be present.

The case involved a boating accident in which two individuals overturned a small rowboat at night in extremely cold water. One victim was found floating next to the shore the next morning but the second was never found. Extensive searches were immediately conducted including an air search, shore search, and cadaver dogs, and an underwater search with divers. Although the victims were thought to be relatively close to the shore, the bottom of the lake dropped precipitously. Subsequent underwater searches over the next two years were conducted using sidescan sonar, and drop cameras. On the last day of one of the searches, an interesting photograph was acquired on the video recording of a drop camera but the battery was almost discharged and the photograph quality was extremely poor. The photo appeared to show a boot and a portion of a leg. The "rest of the body" would have been outside the frame of the photograph. The location of the camera at the time of the picture was initially calculated to be around 200 feet but later measurement of the cable determined it to be closer to 170 feet.

Standard contrast enhancement by Adobe Photoshop was performed and the features of a boot and trousers leg seemed to be even more apparent. Based on the photograph, another search was set up. This search was jointly conducted by four agencies and employed a newer model of side-scan sonar, two models of remotely operated vehicles (ROV) with video, another drop camera, and divers. The GPS coordinates of the photograph were extrapolated from the data supplied by the operators of the drop camera on the previous search.

The search protocol was to conduct a side-scan sweep of the area surrounding the GPS coordinates, download the data, identify potential targets, determine their precise GPS coordinates from the software, then deploy the ROVs and drop camera to verify or exclude the target. Using this strategy all targets in the primary search area were excluded. The search protocol was then repeated on the areas immediately next to the primary area. All targets in the secondary area were also excluded. Due to the persuasive nature of the photograph, it was decided to perform a redundant exclusion in the primary area. Two divers used a circle search to clear the area and eliminated all targets.

Because the enhanced photograph had generated such high expectations by everyone involved, especially the family of the missing victim, it was decided to demonstrate the source of the photograph. The target closest to the GPS coordinates was an uprooted tree trunk with roots attached. There were several in the primary area searched but this one was the closest to the expected target. One of the roots on this tree contained a bend in it similar to that seen in the "boot & leg" photo. A frame of the video of the root was selected and then dis-enhanced, i.e., made more fuzzy, so that it looked similar to the original photograph. Although it did not appear to be a portion of a victim as closely as the original photograph, it demonstrated enough similar features to explain the features seen in the original photograph and thus, not finding the victim in the area.

Digital Evidence, Photography Enhancement, Underwater

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