

Getting In Focus

New software is now available that can enhance crime scene video and produce print-friendly images for law enforcement and forensic applications

By Kara Gray

It is a common scenario in small towns and big cities across the country – a local convenience store has been robbed at gunpoint and the only evidence police have available is the grainy surveillance video shot from the cameras overtop the cash register. The images are barely distinguishable, despite the fact that one of the suspects practically looks directly into the camera. The evening news airs the footage, along with the police captain's plea for the public's help in identifying the robbers, but the images are so poor that the suspects' own mothers might not recognize them. If the police had better surveillance images to work with, the suspects might be easier to identify.

Surveillance cameras are everywhere – in banks, drug stores, shopping malls and convenience stores – and, despite the myriad of technological advances in recent years, the images captured from these systems remains poor in most cases. "Video is inherently low quality," said Laura Teodosio, founder and president of Salient Stills, a Boston-based software development firm that has pioneered the art of video enhancement for forensic purposes.

Analog video quality captured by a surveillance camera is typically even lower than a consumer handheld camcorder. Plus, people may not maintain their cameras properly, may not change the tapes, or tape over them numerous times – all of which work against good-quality images. Because video takes up so much digital space when it is converted to a form that works on a computer, digital surveillance video is often compressed, either by throwing out frames or shrinking images down. So you're starting at a detriment with the quality of images you can capture.

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Teodosio and her team at Salient Stills have developed VideoFOCUS, an easy to use, effective and powerful software tool that can enhance video and produce print-friendly still images from video for use in law enforcement and forensics applications. It is user-friendly, portable and compatible with any form of video. It offers a full suite of enhancement capabilities that can produce insightful, useful video evidence supported by a solid evidentiary trail that holds up in court.

It is based on technology that Teodosio first discovered as a graduate student at Massachusetts Institute of Technology (MIT). In 1997, her former MIT adviser suggested that they look into a business venture based upon the video enhancement technology they had discovered. The duo licensed the technology from MIT and began presenting it to mass-market newspapers as a tool for deriving printable still images from video. Their first customer was The New York Times.

"Some major events had taken place – the Rodney King incident in Los Angeles and the Challenger shuttle explosion – for which there was not a still image, only video," Teodosio said. "The newspapers needed good, clear images for their stories, and didn't really have a way to get them. The New York Times helped us think through some of the technology, helped us figure out what fit with their workflow and processes. Since then, The Boston Globe, Sports Illustrated, USA Today and Time magazine have all become customers."

"We always knew there was a market in law enforcement, security, military, surveillance, industrial security and retail security, and it just made sense," Teodosio said. "Both the media and law enforcement markets are driven by time – the media deal with



deadlines, and law enforcement wants to identify a suspect very quickly. In the commercial market, time is money, but, in law enforcement, time saved could mean a life saved."

The OLETC Connection

Shortly after Salient Stills made the move toward serving the law enforcement market, Teodosio learned about the Office of Law Enforcement Technology Commercialization (OLETC), and attended one of their Commercialization Planning Workshops (CPW®). OLETC's mission is to assist in the commercialization of technologies for use in the public safety industries and partners with Mohawk Research Corp. to provide the workshops.

In 2001, the Boston Police Department became their first law enforcement customer. During a rash of Oxycontin drugstore robberies, the Boston PD would bring surveillance tapes to Salient Stills for enhancements.

When the events of Sept. 11, 2001, unfolded, Salient Stills deposited a system with the FBI office in Boston, and later the FBI headquarters at Quantico, Va., purchased a system.

Now, Salient Stills focuses most of its energy in two markets – government contracting and law enforcement – although they still serve the media market to some degree. Through its advanced R&D work with the federal government, and organizations, such as The Advanced Research & Development Agency, Salient Stills is able to make considerable advances in VideoFOCUS that make their way down into the law enforcement product.

"Because we're a small company, we can't do a lot of the R&D that we would like to do," Teodosio said. "But we get these very strategic contracts, which are great because the technologies we generate at the federal level actually wind up in commercial products that are made available to the local law enforcement organizations. The R&D is certainly driven by what the feds need, but there's often a lot of overlap in what ends up in the commercial product available to all."

Focus on the User

One of the many challenges in enhancing video evidence is getting access to the video data especially with the new digital video recording (DVR) technology used in surveillance systems. DVRs are often recorded in a proprietary format that can only be played on the specific equipment for which it was designed or in a proprietary digital movie player.

VideoFOCUS overcomes this challenge by importing video recorded in any format and making it editable and useful. A recent upgrade to the software even includes a digital screen-capture feature, which allows the user to import any video clip that is viewable on the PC, such as Flash video commonly used in Web applications.

One of the greatest video challenges law enforcement officials often encounter is multiplexing. This technique, commonly used in large spaces where multiple cameras are required to capture every area, employs a multiplexer box that receives the signal from each camera and routes each signal to a field of video. This results in a convoluted video stream that flips through each camera view in succession.

To use this video, investigators would need to have the same multiplexer box to de-multiplex the video in order to view it. With VideoFOCUS, the user can take the tape, digitize it and, with the click of a mouse, de-multiplex the footage automatically. This one feature saves hours of time and labor with one easy step. The user can adjust the system's sensitivity to lightness, darkness and noise in order to optimize the assimilation.

Motion tracking is another feature that VideoFOCUS has rendered with point and click ease. Typical resolution enhancement techniques use information from surrounding frames to reduce the noise associated with low-quality video, but, when this is done without consideration for motion, the result is one big blur.

"With our motion tracking, we have the actual pixel value garnered from a neighboring sample, and when we blow it up, we have a real pixel value, not just an assumption of what it contained. Frame averaging that doesn't allow for motion tracking is really useless, and our masking feature allows us to track specific motion in the field of view when multiple motions are taking place – a focus on one individual in a clip where there are two, for example."

Easy to Learn = Rapid Deployment

VideoFOCUS performs essentially all of the standard forensics operations as that of the industry standards with some added features, including super resolution and a more robust object tracking algorithm. Where it really rises above is in the accessibility and ease of use of such advanced features. Teodosio points out that law enforcement agencies cannot afford the man hours for a system that takes two weeks to train on, requires personnel to go away for three or four weeks and then come back with no idea of how to get it running in their own office, or a system where the trainee gets redeployed to another unit and someone new must be trained. The time involved to train users is minimal. Within hours of receiving his system on high-powered laptops, Detective Scott Slavin of the Seminole County (Fla.) Sheriff's Department had read the manual and used the tutorial to digitize a piece of video evidence that resulted in the elimination of one suspect in an arson case.

Detective Brian Marvin with the Reynoldsburg, Ohio, Police Department said that VideoFOCUS has essentially replaced an entire array of various VCRs, multiplexers and other equipment that he once used to attempt to extract images or video for evidentiary use, and has saved him a great deal of time.

"I use VideoFOCUS almost daily to pull images of vehicles, individuals, crime footage and other data that might aid in an investigation," Marvin said. "It has aided in hundreds of investigations over the past few years and is a very valuable tool we use to produce evidence that will aid in putting the puzzle together."

The system is currently used by law enforcement agencies, prosecutors and district attorneys in more than 30 U.S. states and 12 foreign countries, including Italy, Australia, Japan, Singapore and Korea.

The Office of Law Enforcement Technology Commercialization (OLETC) is a program of the National Institute of Justice (NIJ), Office of Justice Programs and an initiative of the West Virginia High Technology Consortium Foundation. OLETC assists in the commercialization of innovative technology for use in law enforcement and corrections.

Kara Gray is a consultant with New Horizon Consulting and works with the Office of Law Enforcement Technology Commercialization. OLETC is a program of the National Institute of Justice (NIJ), Office of Justice Programs and an initiative of the West Virginia High Technology Consortium Foundation. OLETC assists in the commercialization of innovative technology for use in law enforcement and corrections.



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