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Recognize the Face

Recording serious crime on surveillance video is a common occurrence today. Unfortunately, the quality and resolution of a single frame of these video recordings is usually insufficient to recognize the faces of the perpetrators. Through a program sponsored by the Office of Justice Programs' National Institute of Justice (NIJ), however, researchers in the Visualization and Computer Vision Lab at GE Global Research and Pittsburgh Pattern Recognition (PPR) have teamed up to help resolve this frustrating problem with new technology.

Under an NIJ-sponsored program, GE Global Research and PPR are developing computer vision and image processing technology that will improve the quality of facial images taken from video. The underlying video processing technology is composed of face detection, active shape and appearance models, and super-resolution image processing. Initially, face detection algorithms locate the faces of persons in video. Secondly, active shape and appearance models lock on to the individual three-dimensional shape of the face in each video frame, allowing it to be rotated to a frontal view. This enables a frame-to-frame registration of the face so that all of the images can be combined. Super-resolution processing then reconstructs a higher resolution image of the face from several lower resolution video frames. About 10 to 20 video frames are needed to produce a single, higher quality image of the face.

With the core technology now developed, GE is currently building a prototype interactive video application for forensic video analysis. This forensic tool will allow the user to first select a face from a surveillance video clip. The system will then accurately lock on the face in each frame in 1 to 2 seconds. The resulting image will have higher quality and greater clarity that can be used for automatic identification using face recognition software or distributed on bulletins and wanted posters.

Plans call for NIJ to beta test the face enhancer prototype tool. After testing, the prototype will be handed off to development teams at GE Security.

Moving from forensic analysis to real-time surveillance, GE Global Research and PPR are soon to begin another NIJ-sponsored project titled "Active 3D Face Capture." Setting up a video surveillance system for a large area such as a schoolyard or a parking lot requires many cameras and associated wiring, and this still leaves acquiring high-quality face images of people onsite as a challenge. This project aims to solve this problem with computer vision technology and automatically controlled pan-tilt-zoom (PTZ) cameras.

Active 3D Face Capture will include development of algorithms and a prototype surveillance system that uses multiple fixed and PTZ cameras to automatically monitor a wide region. Computer vision software will detect people in the far field; the camera control system will then point multiple PTZ cameras toward the subject and capture zoomed-in video. Because PTZ cameras can zoom in quite far, the coverage region of one camera is much larger than that of a typical fixed camera.

To be cost effective, however, PTZ control must be automated and reliable. Automatically capturing multiple simultaneous PTZ videos of a face will allow for accurate stereo reconstruction of the face shape, which will in turn improve face registration and super-resolution. Active 3D Face Capture gains an extra edge from use of the facial quality enhancement system from the face enhancer program.

Both NIJ-funded, the face enhancer program and Active 3D Face Capture are linked by a common goal: the enabling of biometric identification at a distance and bringing biometric sensing into the open.

GE Global Research is the centralized research organization for the General Electric Company, and PPR is a recent spinoff of Carnegie Mellon University specializing in object recognition software for photographs and video.

For more information about this facial recognition project, contact Stan Erickson at the National Institute of Justice, 202–305–4686 or stanley.erickson@usdoj.gov.

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