Intelligent Surveillance Could Aid Law Enforcement

By Pam Frost Gorder

A faculty and student team in the College of Engineering is developing a computerized surveillance system that, when completed, will attempt to recognize whether a person on the street is acting suspiciously or appears to be lost.

Intelligent video cameras, large video screens and geo-referencing software are among the technologies used in the system, which will soon be available to law enforcement and security agencies.

James W. Davis, associate professor; doctoral student Karthik Sankaranarayanan; and undergraduates Matthew Nedrich and Karl Salva, all in the Department of Computer Science and Engineering, are working on the project with funding from the National Science Foundation and the Air Force Research Laboratory.

They have completed the first three phases of the project: a software algorithm that creates a 360-degree, high-resolution video panorama of a street scene; another that maps the panorama onto a high-resolution aerial image of the scene; and a method for actively tracking a selected target among the view of different cameras.

The ultimate goal is a networked system of "smart" video cameras that will let surveillance officers observe a wide area quickly and efficiently. Computers will carry much of the workload.

The system isn't meant to gather specific information about individuals, he explains.

"In our research, we care what you do, not who you are," he says. "We aim to analyze and model the behavior patterns of people and vehicles moving through the scene, rather than attempting to determine the identity of people. We are trying to automatically learn what typical activity patterns exist in the monitored area and then have the system look for atypical patterns that may signal a person of interest — perhaps someone engaging in nefarious behavior or a person in need of help."

Davis and his team are now working on the next step in the research: determining who should be followed.

The system won't rely on traditional profiling methods, he says. A person's race or sex or general appearance won't matter. What will matter is where the person goes and what he or she does.

"If you're doing something strange, we want to be able to detect that and figure out what's going on," he says.

For example, law enforcement officers might consider as suspicious people who stop in an unusual spot or leave behind an object like a package or backpack.

To first determine what constitutes normal behavior, Davis and his team plan to follow the paths of many people who walk through a particular scene over a long period of time. A line tracing each person's trajectory will be saved to a database.

"You can imagine that over a few months, you're going to start to pick up where people tend to go at certain times of day — trends," he says. Any deviations from the general trend, then, might indicate to law enforcement a situation that merits closer attention.

Davis is looking into the possibility of deploying a large test system around the state of Ohio using the research. Here law enforcement could link video cameras around the major cities, map video panoramas to publicly available aerial maps and use the software to provide a higher level of "location awareness" for surveillance.

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On the Web: Watch Davis explain his research online at www.osu.edu/features/2009/surveillance. Read more about his work at researchnews.osu.edu/archive/surveillance.

Jim Davis and his students use six panoramic cameras with various views of campus in their research. Using software, they have developed a system that maps images from the cameras onto an aerial map of the scene to calculate where the viewspaces of all the security cameras in an area overlap. As a person walks across a scene, the computer can calculate exactly where the person is on the panorama and aerial map. That information can then be used to instruct a camera to follow him or her automatically using the camera's pan-and-tilt control. In the next version of the system, they plan to have the computer "hand-off" the tracking task between cameras as the person moves in and out of view of different cameras.