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Night Vision
By Lindsay Ferg

An Ohio State professor is developing a video surveillance system that uses body heat to track and identify basic human movement.

The research has broad implications for national security as well as search and rescue, border patrol, law enforcement and many other types of military applications.

James Davis, assistant professor of computer and information science, is using computers to simulate human activities, such as walking, running or riding a bike. Video cameras are linked with this computer, so when the camera records a person walking, the computer recognizes the activity.

"We use thermal cameras to locate the people and use statistical methods to classify the activity of the person into different categories such as walking, running, standing and throwing," Davis said. "We are also interested in more qualitative aspects of the action, like determining if the person is a child or adult, moving leisurely or in a hurry or carrying light or heavy packages."

The system uses a thermal camera to measure the amount of heat in a scene. Thermal cameras are already widely used by law enforcement and military agencies, especially to locate people in the dark when the difference between the air's heat and person's heat is greatest.

"Thermal images provide a unique signature of humans so they stand out as a bright white image against a dark background," Davis said.

Eventually Davis said he wants the system to identify a person's intent by mapping such behaviors as breaking into a building or car.

"This is the hardest part because it takes a lot of knowledge," Davis said. "There are so many ways to break into a building, it's almost impossible to map them all."

The first version of the thermal surveillance system will be available in two or three years, but will not identify human intent because it is such a new area of research, Davis said.

The system will have advantages over traditional video surveillance and that used by the military.

Traditional video surveillance systems can fail because there is often one or two security guards watching 20 different television screens at once, Davis said. The new surveillance system can identify and catalog what it recorded and alert security guards of behaviors it cannot identify.

"The system can summarize what happened throughout an entire night. If anything out of the ordinary happened, it will note the deviation," Davis said.

With traditional surveillance systems, a security guard would have to watch hours of video to look for strange activity. With the advanced system, any strange activity would be identified with a specific date and time.

The military will also benefit from the system's ability to identify odd behavior, Davis said.

"An army in the field could use these cameras by having some behind them to look for enemy movement. So if someone turns to point and shoot you, the system would alert you," Davis said.

The military agrees that it can benefit from this new technology. The U.S. Army Night Vision Lab and the National Science Foundation are funding the project.

"We're happy with the progress Professor Davis is making at Ohio State," said George Strawn, spokesman for the National Science Foundation. "We saw the potential in this project and expect positive results."

However, purchasing one of these "positive results" will not be cheap.

The price of a camera ranges from $12,000 to $60,000. Part of the reason for its hefty price tag is the nearly foolproof surveillance it provides.

Even the most devilish criminals would have a hard time fooling the thermal surveillance system, Davis said. A person's body temperature would have to be the same temperature as the air to remain undetected, which is nearly impossible.

Davis' work in investigating computer vision methods was recognized last month by the National Science Foundation with the prestigious NSF Faculty Early Career Development Program award. The awards, which are highly competitive, are given only to the nation's more outstanding junior researchers. Davis will receive $500,000 over the next five years to continue his research in this area.