Researchers investigate tracking, sensors to assist Air Force

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Two Louisiana Tech faculty members, Dr. Sumeet Dua, an assistant professor of computer science, and Dr. Rastko Selmic, an assistant professor of electrical engineering, are using their skills and technical knowledge to help the U.S. Air Force and Department of Defense with sensor networks and tracking capabilities.

Dua's project, called Automated Target Detection and Tracking, or ATR, involves the development of fast and accurate computer algorithms for the automated recognition, identification, classification and tracking of targets of interest.

"Algorithms can be applied to national defense in a variety of ways, including missions involving air-to-ground, ground-to-ground, surface-to-surface and air-to-air scenarios," Dua said. "The algorithm is unique in its ability to use a system-level approach to define both a target's signatures and movement. It uses sophisticated data-mining techniques, a class of computer science algorithms used to discover embedded, hidden patterns and anomalies in data which are previously unknown but very useful."

The targets are received using remote sensors such as cameras and radars. Software then determines their positions and features with rotational and translational variations. Dua said the algorithm uses patterns to get a unique target's signature information.

"The algorithm is novel in its ability to take a system-level approach to

achieve reinforced concurrent learning of both the target's signatures and movement in a single run of the software program," he said.

The algorithms can be used in metropolitan areas to identify humans in irregular terrains and to identify and log the suspicious movement of vehicles of interest, Dua said.

"We give monthly reporting to the Air Force, which is different from regular projects," he said. "We usually report to them once every six weeks. It's very good feedback we get back from them."

Selmic's group study deals with research of deployment and control of wireless sensor networks. Supported by the Air Force Research Laboratory, Selmic and his group are trying to discover how to perfectly position and deploy a large number of sensors to cover one particular area while still providing extensive coverage of a specific target.

"The technology will help the Air Force to solve sensor network deployment problem – where and how to deploy thousands of small wireless sensor nodes in order to cover the area of interest, and still being able to efficiently track targets of interest," Selmic said.

The results of the research will affect many applications such as chemical agent monitoring, weather and hurricanes tracking and monitoring and explosive detection at the battlefield, Selmic said. The project also aims to develop unmanned air vehicle sensor nodes and a wireless sensor network test bed for the Air Force.

"The sensor network test bed idea stems from an application in chemical agent monitoring," Selmic said. "Louisiana Tech's sensor network test bed currently includes static chemical sensor nodes and several mobile nodes flying on blimps. Blimp control will be implemented at the sensor network base station which will provide a feedback to the network based

on a real-time simulation."

As part of this effort with the Air Force, Selmic and his undergraduate student, Thomas Goodwin, an electrical engineering student from Mexica, Texas, have been invited for a fellowship with the Air Force Research Lab in Dayton, Ohio, to work on computational fluid dynamic simulations and related sensor placements.

"In order to maximize detection of explosive, for instance, it is necessary to consider air flow in closed environment," Selmic said. "Small UAVs can provide additional air flow, thus increasing the chance of explosive or pollutant detection. The technology will be considered for future improvised explosive devices detection methods, but is also applicable to civilian application such as anthrax detection in indoor environments and others."

Source: Louisiana Tech University

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