Georgia Tech

Research News

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SENSOR FUSION SIMULATOR OFFERS   **For Immediate Release**

PILOT'S VIEW OF MULTI-SENSOR DATA;   **May 16, 1990**

BOOSTS TARGET RECOGNITION SYSTEMS   **Photography Available**

If pilots could combine information from infrared sensors, millimeter wave radars, multi-spectral satellites and other sources, they could do a better job of spotting hostile targets amid the jumble of background clutter.

Researchers at the Georgia Institute of Technology have produced a multi-sensor simulation tool that could help visualize how pilots might use multi-sensor, multi-platform information for spotting targets -- while assisting in the development of automatic target detection algorithms and new sensors.

"If you have radar images, infrared images and other data, you can use that joint information to help determine whether or not you have a target," explained Dr. Nickolas L. Faust, principal research scientist at Georgia Tech. "What we are trying to do is provide a tool that would show people what it would be like if you could merge that information."

Real-time sensor fusion would require airborne computing power that may not be available for five or ten years, Faust noted. But the Georgia Tech simulator, known as GTSPECS, allows engineers and scientists to work on other portions of the sensor fusion problem while they wait for computing power to catch up.

The simulator includes a database of infrared, satellite, and synthetic aperture radar (SAR) images merged to show data from each source in a different color. It was developed by combining infrared scene and target simulations, simulations of radar cross section returns, and landscape information provided by LANDSAT satellites.

In real life, the data could come from three different platforms: a low-flying aircraft carrying a forward-looking infrared sensor (FLIR), a synthetic aperture radar on another aircraft, and a satellite high in space.

The combination was difficult because each sensor requires different inputs and produces data in different forms. Infrared, for instance, measures the thermal output of targets, making information about the target's exhaust and cooling systems important. Radar measures returns and backscattering from sharp edges and corners of targets. In addition, the infrared images change according to time of day and the season.

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Aside from the simulated targets, the GTSPECS designers also had to consider the background behind the target, using LANDSAT data to correct scene distortions produced by radar. Finally, the data also had to be converted to a format that the pilot can readily interpret.

"The pilot will see the infrared in blue, the near-infrared in green and the radar return in red," Faust explained. "You are mapping everything back to the perspective view, which is the most normal view for a human. The pilot can be perceiving all three sensors from all three platforms at the same time."

Information from different sensors is now displayed to pilots on different screens and in different formats, making it difficult to analyze.

The database represents a different approach toward the difficult problems of simulating sensor fusion. Instead of taking actual sensor data and trying to generalize it to broader scenes (the semi-empirical method), the Georgia Tech researchers began with simulated images and are attempting to apply this "first principles" understanding to model a wide range of real conditions.

"If you really have good understanding of the thermal physics, you can come up with an infrared model of what it ought to look like under all conditions," he said. "We are trying to check this model against measured data, rather than driving the model from measured data."

The simulator relies on the ability of the human eye to understand spatial correlations in complex images -- even when computers might have difficulty with them.

"Your eye is able to take these red, green and blue images and merge them to make some sense out of the information," he explained. "What you are looking for with your eye is the spatial correlation."

Target recognition algorithms being developed from GTSPECS will rely on the pilot to help the computers focus on most likely targets.

The Georgia Tech researchers are currently validating their database against measured target and scene information to determine how well it would describe real combat situations. If its information correctly represents the results of sensor fusion, the database could be used to develop and test automatic target detection algorithms.

"What we have is a synthetic scene generator system that allows you to exercise these kinds of algorithms," Faust added.

The work was sponsored by Georgia Tech's Senior Technology Guidance Council, using several software programs developed under military contracts. The research team included Bill Holm, Margaret M. Horst, Albert D. Sheffer, Keith Vaughn, and M.S. West.

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