HOLOGRAPHIC RADAR

The use of radar in many real-world environments is made difficult by the presence of clutter. Clutter is the term used to describe the background and objects you don’t want to see which mask the objects you do want to see. For example, the clutter for an automotive radar trying to warn the driver about oncoming vehicles, is caused by the road, street signs, trees and traffic lights. For a radar trying to track a shell fired at an unmanned speedboat, the sea is an enormous clutter source. Unfortunately, it is often the clutter which produces the largest radar signals, making the radar’s job either difficult or impossible.

Holographic radar is especially good at seeing through clutter. It uses coherent (hence holographic) receiver arrays to map a 3D volume of space, and uses tracking algorithms to separate objects of interest from clutter, by recognising differences in behaviour that cannot be seen using conventional radar. Holographic radar collects much more information than conventional radar and this sets it apart, although it also presents a challenge. Creating large amounts of data from a large receiver array needs a powerful signal processor that can keep up. Holographic radar has now been made practical through the availability of low-cost, high-performance processor devices that can reach teraflop processing rates which were once only the realm of supercomputers.

This impressive signal processing performance means that a holographic radar can simultaneously detect and track tens of thousands of objects in real-time, recognising all of the unwanted clutter and extracting what may be only one object of interest. Our highly parallel radar sensor, combined with the latest in signal processing technology, has the sheer brute force to sift through such a high volume of data in real-time to extract the small fraction of detection points that we are trying to track.

The holographic approach has been recognised by the United States Navy, who want to instrument their target boats with a shell scoring system so that they can perform simulated swarm attacks against their ships and measure the accuracy of their self-protect systems. So far it has not been possible to install radar that can operate on high-speed manoeuvrable boats since the movement against the sea produces massive clutter. This swamps conventional radar scoring systems, making it impossible to detect a 5” shell at 1000 feet range. Cambridge Consultants is developing the Land and Surface Target Scoring (LSTS) system under funding from the United States Department of Defense to solve this problem. So far, in just 14 months, we have developed a proof-of-concept system which has been tested in firing trials at the Naval Surface Warfare Center, Dahlgren Virginia, demonstrating its ability to reliably track 5” shells over the sea surface. In the follow-on phase we will scale the system up to its full specification, and put it to test at full speed.

Holographic radar is not a new concept, but it has truly come of age now that the supporting technology has caught up, delivering the processing power that means the clutter you don’t want to see can be removed, not by reducing sensitivity but by spotting the distinguishing features of the targets you do want to see.

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