Case Study: Real-Time Demonstration of a Knowledge-Aided STAP Algorithm Using PVL

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Paper Abstract

Under the Defense Advanced Research Projects Agencies' (DARPA) Knowledge-Aided Sensor Signal Processing and Expert Reasoning (KASSPER) program [1] Information System Laboratories (ISL) has developed a general knowledge-aided signal processing technique, referred to as colored loading [2], for improving the performance of space-time adaptive processing (STAP) for ground moving target indicator (GMTI) radar. Colored loading is a technique for incorporating knowledge sources such as terrain and land cover databases in the front-end of radar beamformers. The technique blends traditional adaptive clutter filtering with deterministic filtering based on *a priori* knowledge in a manner that typically leads to beamformers with faster convergence and thus improved minimum detectable velocity (MDV) in heterogeneous clutter environment (e.g., mountains, man-made discretes, etc.). The performance of the technique has been analyzed extensively in a Matlab environment using both simulated and experimental radar data [e.g., 2].

ISL is developing an implementation of the colored loading technique using the Lincoln Laboratory-developed parallel vector library (PVL). The software, which is currently being developed and tested on ISL's Linux cluster, will be ported to run on the Mercury-based KASSPER test bed system at MIT Lincoln Laboratory later this year. A major objective of this effort is to demonstrate that the performance potential of advanced knowledge-aided STAP techniques can be achieved in real-time. A key aspect of the work is to demonstrate that the processing and communications required to process *a priori* information can be managed in real-time without significantly impacting the throughput and latency of the radar signal processor.

The proposed paper will provide a status of the project including an overview of the issues associated with exploiting *a priori* information in a real-time system. Additionally, it will report on our experiences using middleware (i.e., PVL) to facilitate the

development and subsequent porting of a real-time application to a high performance parallel computing platform. Finally, the paper will provide a roadmap for migrating the application from PVL to parallel VSIPL++ when it becomes available.

References

[1] http://www.darpa.mil/spo/programs/kassper.htm

[2] J.S. Bergin, C. M. Teixeira, P.M. Techau, and J.R. Guerci, "STAP with knowledge-aided data pre-whitening," *Proceedings of the 2004 IEEE Radar Conference*, Philadelphia, PA, 26-28 April, 2003.