

A KASSPER Real-Time Signal Processor Testbed

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The Knowledge Aided Sensor Signal Processing and Expert Reasoning (KASSPER) Program is a Defense Advanced Research Projects Agency (DARPA) program which has the goal of improving the performance of Ground Moving Target Indicator (GMTI) radar systems by incorporating external sources of knowledge into the signal processing chain. The KASSPER Real-Time Signal Processor Testbed and its associated Signal Processing Architecture is a prototype radar system scheduling and signal processing framework that has been developed at Massachusetts Institute of Technology Lincoln Laboratory (MIT LL).

A typical scenario in which KASSPER processing could be useful is depicted in Fig. 1. Note that the GMTI clutter environment is heterogeneous (trees, open areas, an urban area, etc). By taking advantage of prior knowledge about this environment (i.e. locations of roads, terrain contours, types of ground cover, etc.), processing algorithms can have an opportunity to improve their performance by avoiding invalid assumptions about the environment.

A top level diagram of the KASSPER architecture is shown in Fig. 2. The components of this architecture that are different from a conventional radar signal processor are the knowledge database, knowledge cache, and the look-ahead scheduler.



Fig. 1. A representative KASSPER problem.

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The knowledge database stores the 'knowledge' that both the signal processing chain and the scheduler need to perform 'intelligent' processing. The knowledge database reformats the knowledge data into a form that is usable by the processing chain during a pre-mission data load. During system operation, the knowledge cache holds the portion of the knowledge store that is within the radar's field of view. The knowledge pre-processing step performs real-time operations such as transformations between geographic coordinates and radar system coordinates.

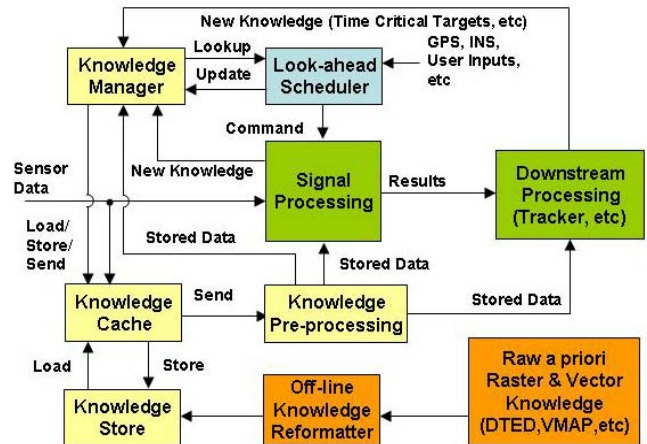


Fig. 2 KASSPER Architecture Block Diagram

An important factor in the performance of knowledge aided signal processing algorithms is that the application of knowledge must be performed locally. This tends to cause the signal processing to be done at a finer grain than is comfortable for achieving good computational efficiency. As an aid to making processor scaling choices for knowledge aided algorithms, signal processing and knowledge database benchmarks have been developed in order to quantify the efficiencies that will actually be achievable.

This talk will discuss the design of the testbed, its architecture; the testbed's software to hardware mapping, knowledge aided processing algorithms, as well as computational performance data that have been collected for important knowledge-aided processing kernels.

A number of topics (such as the look-ahead scheduler) are currently areas of ongoing research. An overview of the potential benefits as well as a vision of how the architecture will incorporate knowledge aided scheduling will be presented.