The Role of Submodularity and Greedy Algorithms in Sensor Scheduling Problems

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Abstract: The sensor scheduling problem is one of using an energy constrained sensor network to estimate the state of an uncertain process. When the process is modelled by a linear system, a Kalman filter can be used to fuse the measurements of each active sensor and to compute a state estimate. The goal is to choose a subset of sensors at each time step so as to minimize the covariance of the state estimate error.

Over a finite time horizon, prior work suggested that the commonly-used error covariance cost functions are submodular, implying that a near optimal sensor schedule can be computed with a simple greedy algorithm. This talk will show that this is, in general not true, and will give a restrictive set conditions for submodularity to hold. The second half of the talk will then look at how the greedy algorithm can be modified to obtain performance guarantees in sensor scheduling problems.