

Maximal Information Systems

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Abstract

Information provides a quantitative metric for describing the value of individual systems components in autonomous systems tasks such as tracking, mapping and navigation, search and exploration; tasks in which the objective is information gain in some form. An information model is an abstraction of system capabilities in an anonymous form which allows *a priori* reasoning on the system itself. By construction, information measures have properties of composability and additivity and thus provides a natural means of modeling and describing large scale systems of systems.

This talk will begin by describing how information measures arise naturally in autonomous tracking, mapping and navigation, search and exploration tasks. It is then demonstrated that the performance of individual sensors and platforms can be modeled using these information measures and that system-level performance metrics can be computed. These ideas are illustrated in a series of tasks involving mixed air and ground autonomous systems. These include flight-tests of cooperative UAVs engaged in tracking and navigation tasks, mixed UAV, ground vehicles and human operatives, engaged in mapping and picture compilation operations, and operations involving multi-platform search in constrained environments. In each, it is shown how information provides both a performance metric and design objective underpinning large-scale systems of systems operation.