



MMAE SEMINAR

Monday, March 26, 2007
E-1 BUILDING – CRAWFORD AUDITORIUM
3:30 – 4:30 PM

Collective Perception and Control in Large Scale Dynamic Systems

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Abstract

The increasing demand for autonomy, flexibility, efficiency, and ability to handle complicated tasks has made the modern control systems inherently complex. This presentation talks about the techniques that exploit learning, optimization, active perception, biologically inspired mechanisms, and abstraction methods to deal with the complexity, uncertainty, and non-linearity of such systems. These complex dynamic systems need to have advanced perceptive ability which necessitates the development of enhanced algorithms that can gather and process information from multiple sensors to obtain accurate estimate of the dynamic states of the environment. The presentation first discusses some of the critical issues in multiple sensor data fusion such as sensor modeling, uncertainty handling, elimination of spurious data, and knowledge generation from ambiguous and missing information. An innovative unified strategy to fuse multi-sensor data is presented that utilizes statistical and intelligent learning, and information theory in a Bayesian framework to deal with some of these crucial issues. The proposed technique is verified via extensive simulations and an experiment that makes use of multiple vision sensors and laser proximity sensor to obtain three-dimensional profile of a robotic workspace in an occupancy grid framework. The presentation also deals with the control of large scale interconnected system in the context of swarm robotics. An example of a swarming behavior is presented in which heterogeneous mobile agents achieve aggregation or segregation based on differential profiles of attractive/repulsive potential. An analysis of the aggregation/segregation behavior is presented, and the strategy is verified using extensive simulations.