Information Theory Approach to Redundant Robotic Systems

Dejan Milutinović, UC Santa Cruz (UCSC), Applied Mathematics and Statistics Department

Abstract

The common ground for the design of redundant robot manipulators and multi-robot/agent systems is that redundant degrees of freedom improve the operation robustness of these robotic systems in the presence of uncertainty, which is due to possible failures of their subsystems, or unpredictable environment. However, once introduced in the robotic system, these redundant degrees create a challenge in the formulation of control algorithms. One way to deal with them is through a formulation of a constrained optimization problem. Along this idea, we can formulate a minimum effort controller for the control of redundant robotic systems, including robot manipulators. Classically considered, the measures of effort are: time, speed, energy, torque, as well as measures that take into account uncertainty. While the maximization of information measure for the control of multi-robot systems has been considered, the minimization of the amount of controller-generated information necessary to achieve the robotic system control, to the best of our knowledge, has not been considered so far. This talk is illustrated with our results in airport taxiway control and our research on redundant manipulators.