SEMINAR NOTICE

Preston M. Green Department of Electrical and Systems Engineering

The 2013 John Zaborszky Distinguished Lecture Series: Lecture 2

Control Designs that Enhance Perception by Climbing Information Gradients

John Baillieul
Intelligent Mechatronics Lab
Boston University

Abstract: Motivated by problems arising in **automated perception of digital images**, the talk presents recent research on formal methods for describing the information content of spatially varying scalar fields defined on R^1, R^2, and R^3. The methods have been developed by combining analytical tools from **differential topology and information theory**. The concept of topological persistence is described, and a refined notion that we refer to as topological information utility is presented. The results will be shown to provide a theoretical framework for **robotic search strategies** that are capable of **rapid discovery of topological features** in a priori unknown differentiable random fields. In this context, the theory enables study of **efficient reconnaissance strategies** in which the tradeoff between speed and accuracy can be understood. The proposed approach to rapid discovery of topological features has led in a natural way to the creation of parsimonious reconnaissance routines that do not rely on any prior knowledge of the environment. The design of **topology-guided search protocols** uses a mathematical framework that quantifies the relationship between what has been discovered and what remains to be discovered. The quantification rests on an information theory inspired model whose properties allow us to treat search as a problem in optimal information acquisition. Human exploration experiments have been conducted to determine how actual behavior deviates from what is optimal.

Tuesday October 1, 2013

10:00 - 11:30 a.m.
Green Hall, room 0120

Host: Hiro Mukai

Short Bio: John Baillieul's research deals with robotics, the control of mechanical systems, and mathematical system theory. His PhD dissertation, completed at Harvard University under the direction of R.W. Brockett in 1975, was an early work dealing with connections between optimal control theory and what came to be called "sub-Riemannian geometry." His main controllability theorem applied the concept of finiteness embodied in the Hilbert basis theorem to develop a controllability condition that could be verified by checking the rank of an explicit finite dimensional operator. Baillieul's current research is aimed at understanding decision making and novel ways to communicate in mixed teams of humans and intelligent automata.

The Annual Zaborszky Lecture Series was created in 1990 to honor Professor John Zaborszky, the founder and first chairman of the Department of Systems Science and Mathematics (now the Preston M. Green Department of Electrical & Systems Engineering). Each year a distinguished scholar is invited to present a series of three lectures in his/her field of expertise.

Washington University in St. Louis
School of Engineering & Applied Science