SEMINAR NOTICE

Preston M. Green Department of Electrical and Systems Engineering

The 2013 John Zaborszky Distinguished Lecture Series: Lecture 1

Perception-Enabled Control---A new paradigm for biomimetics and machine autonomy

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Abstract: Ever accelerating advances in sensor technologies and their integration into real-time control systems have enabled an unprecedented expansion in the use of so-called **autonomous and semi-autonomous systems** in a wide range of applications. Nevertheless, these systems are rarely capable of levels of autonomy that would enable robotic agents to function as equal partners in **mixed human and robot teams**. The most significant limiting factors in imparting true autonomy to robots have been the lack of a formal structure for assimilating very large amounts information about prior experiences in typical operating environments coupled with a limited understanding of how to interpret prior experience in light of real-time data-streams from sets of heterogeneous sensors.

My recent research has focused on understanding how "perception" should be formally incorporated into feedback control in such a way that control signals are determined by a single unified awareness derived from a **combination of sensory processes together with past experience**. This talk will be focused on two aspects of **perception-enabled control**. First, I shall describe the inverse perception problem for controlling agile movements of robotic vehicles. This begins with the analysis of large data sets of bat trajectories and our work to interpret and design feedback control laws that synthetically replicate the motions of Myotis velifer bats around trees and other natural obstacles in rural Texas. There is evidence that agile animal flyers use optical flow to guides their motions, and because of this they are attracted to locations where the visual environment is rich with features. I shall present results on optical flow based control and also speak briefly about a mathematical framework that quantifies the information content in a visual scene and suggest the use of an information theory inspired model that is the basis of controlled motions aimed at rapid location of visual settings that are rich in information content.

Monday September 30, 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.

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