“Information-driven Robot Planning and Control for Active and Mobile Sensing”

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Refreshments at 3:30, Upson Hall Lounge

Abstract

Unmanned ground, aerial, and underwater vehicles or robots equipped with on-board wireless sensors are becoming crucial to both civilian and military applications because of their ability to replace or assist humans in carrying out dangerous yet vital missions. In many cases, these robots are deployed for the primary purpose of gathering information from unstructured and uncertain environments and, therefore, must decide future actions intelligently based on the sensor measurements and environmental information. Recent work on information-driven sensor path planning has shown that the performance of these sensors can be significantly improved by planning their paths based on probabilistic sensor models, and on the geometric characteristics of the workspace and of the sensor field-of-view or visibility region. This talk discusses a general framework by which the expected information value of sensor measurements can be described by information theoretic functions in closed form, and, consequently, used to derive path planning and control laws for active sensing and information gathering. Although this framework has been shown highly effective in a variety of active and mobile sensing applications, the ability of engineered systems to solve sensorimotor tasks remains far removed from that exhibited by biological brains. Therefore, this talk also presents research on emerging spiking neural network training techniques aimed at reverse engineering the brain, and, in particular, at modeling sensorimotor learning and control strategies used by biological organisms, such as the Drosophila fly.

Biographical sketch

Silvia Ferrari is Professor of Engineering and Computer Science at Duke University, and Director of the Laboratory for Intelligent Systems and Controls (LISC) and of the NSF IGERT Training Program on Wireless Intelligent Sensor Networks (WISeNet). She is a member of the Duke Institute for Brain Sciences (DIBS) and of the information Initiative at Duke (iID). Her principal research interests include information-driven planning and control, learning and approximate dynamic programming, and distributed optimal control. She received the B.S. degree from Embry-Riddle Aeronautical University and the M.A. and Ph.D. degrees from Princeton University. She is a senior member of the IEEE, and a member of ASME, SPIE, and AIAA. She is the recipient of the ONR young investigator award (2004), the NSF CAREER award (2005), and the Presidential Early Career Award for Scientists and Engineers (PECASE) award (2006).