Special MIE Seminar
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******MEC 224******

Decision Sciences based Approaches for Robotics

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Abstract

Decision Sciences integrates principles and tools from Systems and Controls, Linear and Nonlinear Optimization, Machine Learning, and Statistical Data Fusion. Due to the current advances in computational capabilities, it has become possible to apply these principles and tools to real-time robotics systems.
In this talk, I will demonstrate the use of Decision Sciences principles and tools for problems in three (3) areas of robotics:

1. Autonomous Multi-Vehicle Systems using Mixed-Integer Non-Linear Optimization with Stochastic Physical Layer Communication Constraints: Ground, Aerial, and Underwater Vehicles
2. Wearable Robotics for Biomedical Actuations using Resistance Feedback Mechanisms for Shape Memory Alloy (SMA) Control
3. Thermal and Fluid Control Systems for US Naval Vessels using Shapelets and Gaussian Conditional Random Fields (GCRF)

Underpinning all three areas is the implementation of analytical techniques using fast and efficient numerical methods that are implemented on cloud platforms such as the Amazon Web Services (AWS). As Decision Sciences based algorithms and associated numerical methods continue to develop, it is anticipated that the aforementioned techniques will be applied to an increasing number of robotics problems, and the framework and formulations presented in this talk may serve as a guide for future research.

Bio

Pramod Abichandani received his Bachelors of Engineering (B.E.) in Instrumentation and Controls degree in 2005 from Nirma Institute of Technology, Gujarat University, India, and his M.S. and Ph.D. degrees in Electrical and Computer Engineering from Drexel University in 2007 and 2011 respectively.
His research interests are centered around optimal, multi-dimensional, data-driven decision-making, through the use of techniques from systems and controls theory, linear and nonlinear optimization, statistics data fusion, and machine learning. Areas of research include optimal control of robotics systems, data-driven decision making using probability models, embedded systems design for data acquisition and control, and online engineering education. Sponsors of his research include the National Science Foundation (NSF), National Institute of Health (NIH), Office of Naval Research (ONR), National Eating Disorder Association (NEDA), Wills Eye Hospital Department of Research, Weight Watchers, and Mathworks.

On the education front, he works on bringing innovation to the classroom by introducing novel course content, pedagogical methodologies, and evaluation techniques. He is leading research efforts that explore credentialing in engineering education, the scalability of engineering education innovations and technology, and engineering-specific learning theories for robotics and data analytics education. He has won several awards for his teaching, including the Continuing Excellence in Teaching (2010) award at Drexel University. In 2013, he was selected to participate in the National Academy of Engineering's fifth Frontiers of Engineering Education symposium in Irvine, California where he presented his Robotics and Data Science education initiatives.