
Computer Science Colloquium

Robot Learning from Demonstration through the Capture and Analysis of Human Motion

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Wednesday, 19 October 2005

Olsen 311

Refreshments at 2:30, Talk from 3:00-4:00

Robots are becoming increasingly prevalent in a wide variety of applications, ranging from virtually embodied animated characters to physically embodied humanoid and mobile robots. Such robots will eventually act autonomously, interacting with humans through collaboration rather than explicit programming. Manually designing and implementing control mechanisms for autonomous robots, especially high degree-of-freedom humanoids, can be a complicated and time-consuming process that lacks scalability. Additionally, such development processes are typically not suitable for non-technical developers. The aim of my research is to address these problems by leveraging the performance capacities of humans to: 1) automatically design and implement modular semi-autonomous skills for humanoids and 2) learn control policies for coordinating these skills. In this talk, I describe my work in data-driven methods for unsupervised learning of humanoid robot skills from human motion, sensory structures underlying teleoperated grasping, and fusion properties of robot skills acting in parallel.

In general, my research attempts to address three primary issues for robot learning from demonstration: 1) Acquisition - how to capture data from the real world about how humans move and perform, 2) Learning - how to apply or extend methods from machine learning to uncover latent structure underlying human performance, 3) Control and Perception - how to utilize learned structures of human performance in the construction of autonomous control and perception mechanisms. In addressing the issues of acquisition and learning, we have applied and extended techniques for multidimensional scaling (MDS) to uncover structures underlying human motion in a model-free fashion.

One of the motivating principles of this work is that "natural" humanoid robot skills should come from motion data of humans behaving "naturally." Consequently, human motion capture should require little or no instrumentation such that a subject can move in an unrestricted manner while performing tasks. Towards this end, this talk will describe a method for Kinematic Model and Motion Capture (KMMC). The KMMC method is complimented by Performance-Derived Behavior Vocabularies (PDBV) for deriving "behavior vocabularies" from unlabelled motion data of a human performing multiple activities. This talk will demonstrate the utility of behavior vocabularies for humanoid motion synthesis, classification, and imitation.

Bio: Odest Chadwicke Jenkins is an Assistant Professor of Computer Science at Brown University. He began this position in July 2004 after serving as a postdoctoral researcher at the Center for Robotics and Embedded Systems at the University of Southern California. Prof. Jenkins earned his B.S. in Computer Science and Mathematics at Alma College (1996), M.S. in Computer Science at Georgia Tech (1998), and Ph.D. in Computer Science at the University of Southern California (2003). His research interests include humanoid robotics, human-robot interaction, machine learning, computer vision, computer animation, motion capture, and interactive entertainment.