HUMANITY CENTERED ROBOTICS INITIATIVE

BROWN

Tech Talk: Scott Niekum
Carnegie Mellon Robotics Institute

"Online Bayesian Changepoint Detection for Articulated Motion Models"

Friday, October 24, 2014
12-1pm in CIT 477 Lubrano Conference Room

Learning from demonstration techniques often directly learn policies from human demonstration data. By contrast, the aim of our work is to learn and exploit physically-interpretable models of the robot's dynamic environment from demonstrations. These models can then be leveraged by well-understood planning and control algorithms to generate robust behavior in a wide variety of situations.

One type of physically-grounded structure is the set of articulation relationships that characterize object behavior in many manipulation tasks — rigid, prismatic, and revolute motion. Several recent methods have been proposed to identify articulation relationships from visual observations but have assumed that these relationships remain static over time. However, many articulation relationships are of a changing nature, requiring analysis from a time-series perspective.

We introduce CHAMP, a new state of the art algorithm for online Bayesian changepoint detection. CHAMP is then used in combination with several articulation models to detect changes in the articulated motion of objects in the world. We focus on three settings where a changepoint model is appropriate: objects with intrinsic articulation relationships that can change over time, quasi-static articulated motion of grasped objects, and assembly tasks in which each step changes articulation relationships. Experiments show how this system can be used to infer task-relevant information from demonstration data including causal manipulation models, human-robot correspondences, and skill verification tests.

Scott Niekum is a postdoctoral fellow at the Carnegie Mellon Robotics Institute, working with Chris Atkeson. He received his Ph.D. in Computer Science from the University of Massachusetts Amherst in 2013 under the supervision of Andrew Barto, and his B.S from Carnegie Mellon University in 2005. His research interests include learning from demonstration, robotic manipulation, time-series analysis, and reinforcement learning.

This tech talk is part of the HCRI's multidisciplinary speaking program that showcases diverse and groundbreaking research undertaken by leaders in science, technology, design, and impact of robotics on society.

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