Reading 5 - Bayesian Inference for HRI

Toward real-collaborative interaction between humans and robots

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- Discussion on Probabilistic Inference for HRI

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Toward real-collaborative interaction between humans and robots

by Jeeeun Kim - Wednesday, February 22, 2017, 12:16 PM

The paper "Approaching the symbol grounding problem with probabilistic graphical models" reminded me of Prof. Laura Devendorf's seminar talk. She mentioned the properties of the material and 'uncertainty' associated with it-- as input into the computational system. The question is why we need to pay attention to uncertainty, inferring utilizing material means users should take care of it, and this is a nonlinear practice. A possible solution could be setting semantics of rules and constraints for parameterization.

Authors of this paper say that the level of autonomy should be based on the amount of uncertainty; even if the concept of uncertainty here comes from the robot side manipulation— i.e. sensor inaccuracies, action failure, white noises. Yet, more uncertainty comes out from humans, because they lack precision, think the intention in an abstracted manner, etc. The point of rethinking 'uncertainty' should not only be lying under to appreciate how robot perceives human commands, but also to bridge such uncertain commands (of human) as an input, AND to interpolate the gap between them and the parameter signatures.

Authors presented a basic philosophy about the human-robot dialogue semantics— the perception loop is closed when queries are posed. In the same way, I guess the perception loop should start again when there was another human intervention as input. To realize “collaborative human-robot decision making", my belief is that humans should be considered not only information sources, but also as an “information consumer”; so the communication between the two can be much bidirectional. If robots can instruct, guide, and inform humans as a collaborator, requiring a physical action as part of dialogue to complete given tasks, there will be a chance that the system can limit the range and degree of uncertainty-- without strictly defining the parameter type and form.

+) For those who want to remind of Bayesian theory, I found this material easy to follow: Bayesian Statistics (a very brief introduction)

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Re: Toward real-collaborative interaction between humans and robots
by Bo Cao - Wednesday, February 22, 2017, 11:35 PM

Thanks Jeeeun for sharing the Bayesian Statistics, I was looking for materials to learn the fundamental concepts :)

I liked the way you thought of communication between human and robot as bidirectional. In terms of thinking humans as "consumer", if robot thinks that the input from human is still uncertain, that might involve 1) the probabilistic inferring for robot to ask what kind of information human need, 2) how much the information is likely human needs?

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Re: Toward real-collaborative interaction between humans and robots
by Jeeeun Kim - Thursday, February 23, 2017, 10:13 AM

Thanks for sharing your thought.

Your 2nd question is specifically my interest, how should we open/limit information the robot should/can give humans. It will be dependent on the context where humans and robots are collaborating. There must be the work categories robots can do better, of course supporting humans' tasks, but humans are not aware of mechanical specifics-- physical dynamics, mathematical simulations forecasting possible outcomes. Given such probabilistic projection provided by robots, human will be less likely do some arbitrary action that affects the quality of final outcome.