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Week 5

Tamura: "Is an Entertainment Robot Useful in the Care of Elderly People With Severe Dementia?"

The authors set out to evaluate the effectiveness of entertainment robots in the care of elderly patients who have dementia. In order to do this, they conducted two experiments using both AIBO and a non interactive toy electric dog. In one of the experiments the patients were exposed to one dog, then the other. In another experiment, the patients were exposed to AIBO with and without "clothes" (I believe that they dressed him in some kind of fur?). They measured the effectiveness of these dogs by recording the number of various activities performed by the patients, including talking, watching, clapping, etc.

They found in their results that the furry electric dog elicited more response from the patients than the AIBO. They also noticed that clothing the AIBO did not improve the patients reaction to the robot. They concluded from this data, and from watching the patients behavior, that the patients identified the electric toy dog as a dog and thus engaged some dog related behaviors. They also determined that the patients did not think of AIBO as a dog, even when it was furry, unless the therapist specifically pointed it out to them.

I found the data presented here to be hard to interpret. We are presented with the difference in responses between AIBO and the regular toy dog, but without any baseline. We have no idea whether both dogs increased these behaviors, but the simple toy dog was better, or if these behaviors are exhibited at the AIBO level normally. Another graph, one that had baseline levels, and also levels when interacting with a real dog, would really help out.

I also would like to know more about what makes the furry dog seem dog-like, and AIBO not seem dog-like. Is it simply the fur, and the "clothes" they provided AIBO were inadequate? The patients also had seen AIBO furless before they say him furred, so they might remember that he is not really furry. It would be interesting to vary the differences between the two dogs and try to pinpoint what cues the patients are using to determine which is more dog-like.

Pineau: "Towards robotic assistants in nursing homes: Challenges and results"

The authors developed a robotic platform to assess the effectiveness at integrating robots into nursing homes. They wanted both to improve the quality of life for the patients as well as assist the nurses. To this end, the robot needed not only to be able navigate a real world environment, but also interact with people. To that end, they equipped the robot with a number of environmental sensors.

They describe some of the core work they have done in featureless person tracking. The robot gets the initial identity of a human (in this case based on their room of origin), then keeps track of their identity. The humans are tracked by noting the differences between the current environment and the robot's static model of the environment when empty. They developed a number of probabilistic models for human and robot movement to accurately track their target human even when they are briefly occluded by other people.

Another area they have worked on is the system for how best to assist as a memory aid to patients. They designed their system with the goals of making sure the patients were aware of commitments, attempting to get them to perform those commitments, trying not to annoy the patients, and trying to avoid causing the patients to become overly reliant on the robot.

Finally they bring the system together with a POMDP planning process. Apparently a straight POMDP with the number of states they require is not feasible, so they used a hierarchical system to break the planning into high level and low level plans, reducing the complexity.

The robot seemed to perform well at the tasks it was assigned, verbally communicating effectively with minimally trained users to remind them to take medications and guide them to appointments, as well as provide additional information (such as weather reports). This seems like a pretty good demonstration of the system, because these types of tasks are so open ended that many systems would frustrate the user or be too difficult to be helpful. It remains to be seen how the patients would feel about this robot reminding them to do things after the novelty wore off, but even so they demonstrated that it could function somewhat in the open domain of the nursing home.

I was interested to see how they have incorporated their uncertainty handling throughout the system. Instead of forcing subsystems to call go/no-go on sensor data, then acting on that information, they have each system report what it has, then they deal with the uncertainty at the highest level of the system in the POMDP, seemingly pretty effectively. This allows the robot to incorporate top-down information in with its noisy sensor information, so for example even a really uncertain and noisy utterance might be sufficient if the robot is already sure of the context of the utterance, and thus can predict largely what is being said. This seems like a promising way to go, one might even want to go further and instead of getting the best guess from the speech recognition system, get the full probabilistic output (60% chance they said "hello", 10% chance they said "help", etc.) if the system can produce that kind of data, then use that as input to the POMDP. This seems like it also could be consistent with a top level "simulator" approach to action recognition, where the simulators are being differentially activated by this probabilistic sensory input instead of forcing the sensors to make discrete judgments on exactly what they are perceiving.

Yanco: "Wheelesley: A Robotic Wheelchair System: Indoor Navigation and User Interface"

The author presents an improvement to powered wheelchairs, a reactive navigation system that is intended to remove the need to provide low level navigation input to the wheelchair. This system relies on sonar, IR sensors, and hall effect sensors to determine obstacles around the wheelchair. The idea is that a user must only indicate their higher level intentions (go straight) and the chair will automatically avoid static obstacles and even people. Similarly, to turn through a doorway, the user must just indicate "right" and the wheelchair will perform all the high accuracy movements needed to pass through the doorway.

The interface to the chair is presented on a laptop screen, and can be customized based on the needs of the user. They have adapted it both to the scanning single-switch systems used by people who can only press a single switch, and to an eye tracking system. It could also be customized to other input devices.

This sounds like a good application of robotic technology - the problems of low level control and obstacle avoidance can be readily addressed through sensor technologies and reactive control, while the high level control is provided by the user. If the system ever gets confused about where it is going, the user can simply correct it. Using available intelligence is a good way to make robust robotic systems right now.

It seems like a next step they might consider is improving the interface options of the chair. Forward, left, etc., are good for buildings arranged in a grid, but often buildings are more complicated. Perhaps if the chair detected the possible ways to go and displayed a pictorial representation in a simplified form (like a line drawing map of the immediate area) and then the user selected one of the possible ways to go it could be easier to drive. Then the chair can also be more sure what they mean: selecting "follow the corridor" provides a more clear goal than selecting "forward".

I was surprised to read about the way they measured eye position. They seemed to be able to measure the gaze angle using electrodes mounted around the eye, which I was not aware was possible - it sounds not much more intrusive than some of the IR based technologies that must mount on glasses right near the eye, though I wonder which systems provide better accuracy.

Wada: "Effects of Robot Assisted Activity to Elderly People who Stay at a Health Service Facility for the Aged"

The authors here set out to investigate the effectiveness of robots for entertaining elderly by introducing them to Paro, a robotic seal. They were hoping to find a measurable decrease in physiological measures of stress and an increase in psychological and social well-being. They measured the presence of a particular chemical linked to stress in the urine of the subjects, and measured certain psychological factors with a questionnaire. As well as measuring the effect of introducing Paro, they also introduced a limited version of Paro with less rich behavior and compared the reactions people had to the two Paros.

They found that the both Paros held the interest of the subjects for the 3 weeks of the test (1 hour each day). They also found that subjects exposed to the simpler Paro showed less decrease in stress (although still some) than those exposed to the real Paro. The subjects also seemed to enjoy interacting with both Paros.

It sounded as if they were only able to get a few responses for each of the groups that interacted with Paro, between 3 and 4 people per group. I would have liked to see a bit more of the 11 or so people per group respond on the survey and urine test, because it might help show whether there is any difference between the two groups. If there is a significant difference between the two groups, that is pretty interesting, it indicates that the behavior they have embedded in Paro makes it a more useful robot for these situations. If there is no significant difference, it could be attributed to a number of things. First, it seems likely that simply gathering these people together for any excuse for an hour a day will improve the social interaction and quality of life - that could be part of the effect we are seeing here. Also, the advantages that real Paro have over placebo Paro are not best observed in a group setting. One on one, something like well implemented reinforcement learning could make the interaction more pleasurable, but it would be hard to even notice in a group setting.