Shared Autonomy for Aging in Place

Problem Statement for Robotic Caregivers, Fall 2021

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Researchers have demonstrated that teleoperated robots can provide meaningful physical assistance to people with disabilities. However, the time to complete tasks and error rates can be high, reducing effectiveness. One approach to overcoming these challenges is to incorporate task-specific autonomy in the system, so that the robot takes on more responsibility for the task and selectively relieves the human operator from task details. Since neither the human operator nor the robot are wholly responsible for performing the task, this is a form of shared autonomy.

You are part of a research and development (R&D) team investigating the potential for robotic caregivers to provide physical assistance to older adults with disabilities. Your goal is to enable older adults to live independently at home with a higher quality of life (i.e., age in place). In the interest of fielding solutions in the nearer term, your team is creating a shared autonomy system. The system will enable a remotely-located human caregiver and a home robot to work together to provide assistance to older adults. The human caregiver could be across the world from the older adult's home where the robot resides.

Your team is expected to design a task-specific shared autonomy system. Along with a proof-of-concept implementation, you should provide a complete picture of how your system would function in everyday life, including identifying which parts of the task are well suited for automation versus human control. You should also clarify the roles of the remote caregiver, the care recipient, and the home robot. Your implementation should provide evidence for the feasibility of your approach and you should use it to perform both quantitative and qualitative evaluations. You should also justify your approach using the scientific literature and interactions with members of the population you expect to benefit from your robotic caregiver.

To take advantage of the benefits of iteration, you will create two projects, a midterm project and a final project. Each project will require a proposal presentation and a project presentation. Your final project can either build on your midterm project or be distinct. During your presentations, you will answer questions from panels of experts who will provide feedback and evaluate your projects using rubrics.

An example of a plausible progression in a project follows:

- Define the population, task, and robot
- Perform a literature review of related work
- Teleoperate the robot to perform the task
- Define a shared autonomy approach
- Define evaluation methods

Present project proposal

- Implement an interface for human control
- Implement autonomous capabilities
- Implement a shared autonomy system
- Iteratively improve your system
- Evaluate your system

Present completed project