Long-term Real-World Autonomy for Assistive Robots

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ABSTRACT

For long-term deployment in real-world environments, robots need to continually learn new concepts to adapt to their ever-changing environments. However, continual learning in real-world environments poses various challenges. First, machine learning (ML) models for continual learning can forget previously learned knowledge when learning new information, a problem called catastrophic forgetting. Second, the only source of supervision for the robots in everyday environments is their non-expert users, who might provide limited and imperfect information to the robot. In this talk, I will discuss how we can draw inspiration from theories of learning in cognitive science to develop ML models that can continually learn from limited data while mitigating catastrophic forgetting. I will then present how these models can be integrated into complete systems that can allow robots to continually adapt while performing assistive tasks in a household-type environment. Finally, I will present how continual learning robots can interact with and learn from non-expert human users. Specifically, I will discuss some of the key factors observed in a long-term HRI study that should be considered when developing continual learning robots for real-world applications.

BIOGRAPHY

Dr. Ali Ayub is a Postdoctoral fellow at the University of Waterloo in the Department of Electrical and Computer Engineering, advised by Professor Kerstin Datuenhahn and Professor Chrystopher Nehaniv. He studies long-term autonomy for assistive robots that continually learn personalized knowledge from people to assist them in their daily environments. His research combines methods from machine learning and human-robot interaction to develop theoretical frameworks that are integrated into practical systems for human-robot interaction in domains like assistive robotic arms, mobile manipulators, and socially assistive robots. Prior to his postdoc, he earned his Ph.D. and MS from The Pennsylvania State University in Electrical Engineering in 2021 and 2017, respectively. He is a recipient of Penn State's Robert W. Graham Fellowship, the United States Educational Foundation's Global UGRAD Fellowship, and Google's diversity, equity, and inclusion (DEI) award. He has also