Learning and Anticipating Human Motions for Collaborative Path Planning in Human-Robot Teams

Abstract –

An integral part of human-robot collaboration is the ability of the robot to understand and predict human motion. Predicting what the human collaborator will do next can be very useful in planning the robot's response in many collaborative manufacturing and assembly applications. In this talk, we will show our work in the area of early prediction of human intentions. We will present an overview of algorithms based on machine learning to learn multiple models of human motion, and sensor fusion that fuses motion and gaze data to predict the motion of the humans in reaching operations. We will show that the fusion of gaze and motion features result in fast and accurate prediction of the human actions. We will also show that embedding a reaching property in the model learning of human motion, e.g., in a hand reaching motion, result in faster and more accurate prediction algorithms. We will present some results that were obtained on two-person assembly task. Next, we will show results of sequential model learning using LSTM-RNN for learning a sequential assembly task and embedding the early motion and gaze-based anticipation to the sequence prediction. These anticipation and sequence prediction algorithms can be coupled with a high-level task planner for efficient and close-proximity collaborative tasks using human-robot teams.

Bio –

Ashwin Dani received M.S. and Ph.D. degrees from the University of Florida (UF), Gainesville. He is currently an Assistant Professor in the Department of Electrical and Computer Engineering, University of Connecticut, Storrs. He was a post-doctoral research associate at the University of Illinois at Urbana-Champaign. His research interests are in the area of estimation, learning and control for human-robot collaboration, learning from demonstration of flexible object manipulation, physics-informed machine learning, and vision-based tracking for autonomous navigation. His research in the area of passive vision-based range estimation has been transitioned to industry for range estimation for ships. He is actively engaged with the aerospace and robotics industry on various research fronts that include collaborative robotics in aerospace and manufacturing applications, and model learning with embedded physics for aerospace industry applications. He is a member of the Conference Editorial Board for IEEE Control System Society. He is a co-recipient of the 2016 FUSION student paper award - 2nd runner up, 2015 ASME Dynamics, Systems and Controls Conference Robotics paper award and the 2012 Technology Innovator Award from the UF for technology transition to industry.