ECE 590 GRADUATE SEMINAR

ALL ARE WELCOME!

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UNIVERSITY OF COLORADO BOULDER

Blending Human-Robot Intelligence for Collaborative Autonomous Systems

Fri, Dec 7 at 3pm

Woodward Hall, Room 147

Nisar Ahmed is an assistant professor of aerospace engineering sciences at the University of Colorado Boulder. He is a member of the Research and Engineering Center for Unmanned Vehicles (RECUV) and directs the Cooperative Human-Robot Intelligence (COHRINT) Lab. His research interests are in the modeling and estimation for intelligent control of dynamical systems, especially for applications involving human-robot interaction, distributed sensor networks, and information fusion. He received his B.S. in Engineering from Cooper Union, and Ph.D. in Mechanical Engineering from Cornell University in 2012.

He was a postdoctoral research associate in the Cornell Autonomous Systems Lab from 2012 to 2014. He was awarded the 2011 AIAA Guidance, Navigation, and Control Conference Best Paper Award; an ASEE Air Force Summer Faculty Fellowship in 2014; and recently received the 2018 ACGSC Dave Ward Memorial Lecture Award. His work is supported by the Army, Air Force, Navy, NASA, and industry, and he has also organized several workshops and symposia on autonomous robotics, sensor fusion, and human-autonomy interaction. He is a Member of the IEEE and the AIAA Intelligent Systems Technical Committee.

The age of autonomous machines has arrived. Yet, as products of imperfect human engineering designed to make decisions in an uncertain world, the promise of "set-it-and-forget-it" autonomy is still quite far off: autonomous systems will never operate out of the box "exactly right". For sufficiently rich tasks that constantly push the technological cutting edge, they will encounter unexpected situations that require reasoning beyond their designed/immediate capabilities. As such, an intelligent autonomous system must be able to independently gather, process, and act on imperfect information – and be cognizant of what it can and cannot accomplish, and know when and how to seek help.

Human-machine interaction is thus a key component of autonomous system design, and must naturally connect to existing perception, planning, learning, and reasoning algorithms that enable autonomy. An autonomous robot, for instance, should ideally enable human stakeholders and users to fluidly delegate tasks, assess available information, and contribute meaningful operational improvements -- without having to "babysit", act as "band aids" (when all else fails), or think too hard about what the system is trying to do. As teammates, intelligent autonomous robots should also be able to communicate with human users to leverage their complementary abilities and improve decision making under uncertainty.

This talk will present novel Bayesian approaches to collaborative human-robot reasoning under uncertainty that can be exploited from the outset in autonomous system design. The talk will focus on probabilistic modeling, inference, and optimization techniques for augmenting autonomous optimal state estimation and planning algorithms with "plug-and-play human sensors", connected via user-friendly semantic natural language chat and free-form map sketching interfaces. Results from collaborative human-robot teaming applications for target search and tracking applications show that these techniques allow human-machine teams to gracefully "cut knots and fill in gaps" for challenging problems– without undermining individual agent roles or ignoring their limitations.

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