

Title: Multi-Robot Communication-aware Cooperative Belief Space Planning with Inconsistent Beliefs

Speaker: Tanmoy Kundu, a Postdoctoral Researcher at Technion - Israel Institute of Technology

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Abstract:

Multi-robot belief space planning (MR-BSP) is essential for reliable and safe autonomy. While planning, each robot maintains a belief over the state of the environment and reasons how the belief would evolve in the future for different candidate actions. Existing MR-BSP works have a common assumption that the beliefs of different robots are consistent at planning time. Such an assumption is often highly unrealistic, as it requires prohibitively extensive and frequent communication capabilities. In practice, each robot may have a different belief about the state of the environment. Crucially, when the beliefs of different robots are inconsistent, state-of-the-art MR-BSP approaches could result in a lack of coordination between the robots and, in general, could yield dangerous, unsafe, and sub-optimal decisions. In this talk, I will discuss how we tackle this crucial gap. I will present a novel decentralized algorithm developed by us, which is guaranteed to find a consistent joint action. For a given robot, our algorithm reasons for action preferences about 1) its local information, 2) what it perceives about the reasoning of the other robots, and 3) what it perceives about the reasoning of itself perceived by the other robot. This algorithm finds a consistent joint action whenever these steps yield the same best joint action obtained by reasoning about action preferences; otherwise, it self-triggers communication between the robots. To further reduce the number of communications, we propose a relaxed version of the action selection policy. I will present some experimental results showing the efficacy of our algorithm in comparison with two baseline algorithms.

Bio:

Tanmoy Kundu has been a Postdoctoral Researcher at Technion - Israel Institute of Technology since November 2022, where he is a member of the Autonomous Navigation and Perception Laboratory led by Prof. Vadim Indelman. Tanmoy obtained his Ph.D. degree from the Department of Computer Science and Engineering, IIT Kanpur, in 2022. Prior to joining the Ph.D., he earned his M.Tech degree from NIT Tiruchirappalli and B.Tech. degree from West Bengal University of Technology in Computer Science and Engineering. He has three years of work experience in software companies such as SAP Labs and Cognizant. His research interest lies in the task and path planning for mobile robots under uncertainty using formal method techniques. His research led to several publications in top-tier robotics conferences like ICRA and IROS.