Letter of Intent for the Summer School on Cognitive Robotics

Kyle Vedder

To whom it may concern,

I am excited to have the opportunity to apply to the Summer School on Cognitive Robotics, as it very closely aligns with my research. As a research assistant in the Autonomous Mobile Robotics Laboratory (AMRL) at the University of Massachusetts Amherst, my research area is realtime multiagent navigation planning, and my primary application domain is AMRL's RoboCup Small Size League (SSL) team, the UMass Minutebots. This domain is a particularly interesting research platform as it requires the development of autonomous multiagent systems that run in realtime and operate robustly in adversarial environments.

My past work in navigation planning includes work on an extension to roadmap based path planners and to the elastic roadmap framework that allows for finer planned paths near dynamic obstacles. Dubbed "Obstacle Scaffolds", this approach places structured graphs around dynamic obstacles and integrates them into the base roadmap, thus allowing searches of the base roadmap to leverage the structure provided by the scaffolds when planning near these obstacles. In the context of RoboCup SSL, this work allows us to place scaffolds around obstacles such as opponent robots, allowing us to plan smooth, tight paths through complex geometry without relying heavily on the local underlying density of the roadmap. This work was presented in part at the ICAPS 2017 PlanRob workshop, and the full work is currently in submission to IROS 2018.

My thesis focuses on solving the problem of collision resolution between individually planned agents in realtime systems. I have developed an anytime solution to this problem by planning for each robot in individual space, projecting that plan into joint space, and then performing successively larger local repairs on an embedding in joint space that, in the limit, converges to the globally optimal solution. In the context of RoboCup SSL, this work will allow us to resolve future collisions in individually planned robot paths without resorting to randomized obstacle avoidance techniques such as Dynamic Safety Search (Bruce, 2006), which provide no path optimality guarantees.

I believe that this summer school can provide me with the tools and understanding to better tackle the challenges faced in my current research as well as expose me to new directions of inquiry for the future, and I would love to have the opportunity to participate.

Thank you for your consideration,
Kyle Vedder