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# TEACHING, DIVERSITY, AND OUTREACH

As a teacher and a mentor, my goal is to make science accessible and interesting for my students. In both the classroom and research lab, my aim is to both teach students core skills and challenge them to apply these skills to new problems. My teaching philosophy centers around collaborative and interacting learning, tailored to the unique needs of a diverse student body.

Outside of the classroom, mentoring and outreach play an important role as an educator. During my academic career, I have mentored students with a diverse set of backgrounds and skill levels. I am also an active participant in a variety of outreach activities, from STEM programs for K-12, to diversity initiatives targeting under-represented and underserved groups. As a professor, I look forward to teaching, outreach, and mentoring students to foster the future of robotics research.

## TEACHING GOALS

My philosophy on teaching focuses on collaborative and interactive learning. Within the classroom, this translates to a multitude of activities that meet the various learning styles of my students. I envision lectures as a combination of blackboard techniques and digital presentations mixed with hands-on learning and small-group discussions. This combination should meet the needs of a diverse classroom, such that we reduce the achievement gap. How we benchmark student understanding also depends on the course. For an entry-level core course, students will be graded on homework sets and tests, which assess their handle of fundamentals. At higher-level graduate courses, we should encourage creativity and critical thinking via projects, where students can launch research topics and collaborate with their peers. It is important to have a mix of individual projects, which test independence and analysis skills, as well as team projects, which allow students to support each other in complementary skills.

I believe interactive approaches to learning are perfect for robotics-related courses. For example, a course on algorithms should be more than just blackboard lectures. Tools like Jupyter notebooks allow us to make code interactive. Here, we can test the students' critical thinking skills by asking them to complete algorithms. In parallel, this sandbox provides an opportunity for exploring how the algorithm works. Similarly, for an upper-level robotics course, using experimental platforms bridges the theoretical concepts with real-world implementations.

## APPLICABLE AND POTENTIAL COURSES

My interdisciplinary background sits at the intersection of mechanical, systems, and controls engineering, and computer science. From this, I am qualified to teach courses related to dynamics, control, artificial intelligence, and robotics. Some examples of these courses include: Signals and Systems; Feedback and State Space Control (Linear Systems); Dynamics; Nonlinear Systems; Optimal and Robust Control; Adaptive Control; and Introduction to Robotics, to name a few.

In addition to contributing to the core education, I am excited to bring my unique expertise into developing new robotics courses. Two such courses I envision might be:

- *Decentralized Control:* This course will explore how to create robust algorithms for teams of robots in a decentralized fashion. Content will be a mix of fundamental design tools for decentralized algorithms, survey of state-of-the-art approaches, and projects. Topics include: planning algorithms, dynamics and control, geometric computation, experimental systems.

- *Methods of Cooperation in Multi-Agent Systems:* As robots interact with other humans and robots, advanced models of cooperation will enable greater functionality and robustness in performance. This course explores techniques in modeling and control of semi-cooperative systems, with models rooted in biological and psychological systems. Topics include: behavioral decision theory, game theory, and bio-inspired team models.

These graduate courses bring my specific research expertise to a classroom focus, and would be tailored to robotics-focused graduate students. I look forward to teaching a variety of classes and empowering students to succeed.

## Mentoring Experience

My experience as a mentor spans many different skill levels, from volunteering with middle school students to graduate-level research. As a graduate student at Boston University, I mentored two high school and three undergraduate students, as well as assisting the UAV club. At MIT, I help manage a team working on autonomous driving technologies. The team is approximately twelve graduate students and postdocs in total, and I directly supervise five students. I have also worked with five MIT undergraduate researchers. Working across different skill levels, it is important to tailor to the student needs. Projects should be suitable to their current experience, yet challenging enough to encourage growth and learning. In research labs, these projects should provide students at all levels an opportunity to contribute. Two of my undergraduates have been co-authors and key contributors on two conference papers and one journal paper. At MIT, I have co-authored three journal papers and six conference papers with the graduate students I mentor.

## Commitment to Diversity

As researchers, we strive for advancing science through cutting-edge ideas and technologies. Diversity is crucial to generating the highest possible quality of research and sustaining new ideas. A diverse community brings together new perspectives and experiences, which enables innovation. As researchers, our job is to encourage diversity, be inclusive of various backgrounds, and support all members of our community.

Creating an inclusive community stems from committing to a core of key values. First, we must remove barriers that inhibit diversity. In academia, these barriers may include: funding opportunities, scholarships, recruiting, or perceived support. Participating in outreach is crucial for inspiring and connecting with future scientists. Outreach is particularly important for under-served communities, which may lack the internal resources to support those students. We must also focus on sustained practices to retain and empower the current members of our community. Representation and visibility matters: when junior members see themselves in role models, they are more likely to see those roles as obtainable. Finally, we must commit to being agile and adaptable to our changing needs. We must work to close any achievement gap among our student body, through cultural competence, comprehensive support, and extended learning opportunities.

My commitment to diversity and inclusion extends beyond my personal experiences. As woman in STEM, I know first-hand how important these initiatives are to success. My experiences have shaped my understanding of barriers to diversity, and what it means to create an inclusive environment. At the same time, I know my experiences are just one data point. As a professor, I am committed to being a leader, a role model, and an advocate for all voices in our community, drawing upon my experiences and striving for continuous learning and improvement.

## Outreach

Throughout my career, I have been actively involved in promoting diversity and inclusion through outreach. At Boston University, I received the Clare Boothe Luce Fellowship, a competitive award for women in STEM. Additionally, I am a member of the IEEE Women in Engineering society, and participate in activities, luncheons, and meetings associated with this group. This past spring, I served as the co-chair of the MIT EECS Postdoctoral Affairs Committee. Our committee collected feedback and generated a report on understanding the diverse needs of the postdoctoral community, which was presented to the external EECS Visiting Committee.

Growing up in rural communities across Western Colorado and Wyoming, I understand how a single opportunity can be a catalyst for a young mind. For me, this was MathCounts. While my school districts often lacked funding for STEM education, MathCounts gave me an opportunity. These outreach programs are our chance to teach kids about science, a chance they may not otherwise get. Outreach has remained a staple in my volunteer work over the years, working with programs targeting elementary, middle school and high school students, from MathCounts, FIRST Lego League, to inviting students for tours of our robotics lab. By working with under-served schools, we can create opportunities and spark the inspiration of our future generations of scientists.

At each step in my career, I am cognizant of how my changing roles results in new responsibilities. As a postdoc and research scientist, I strive to be a role model to the younger students. An important part of being an effective role model is visibility within the community. This includes mentoring students, giving talks, participating in local events, and making yourself available as an ally on a daily basis.