Teaching Statement

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My strong conviction for pursuing an academic career stems in part from my passion for teaching. I have extensive experience in teaching to date; I have taught, on my own, two undergraduate and one graduate course, and I have served as a teaching assistant for numerous courses in computer science and electrical engineering. In my teaching, I have always strived to help my students understand the fundamental principles by providing relevant examples, with integration of real-world applications whenever possible. I also cultivate collaboration and creative problem-solving skills in my students and aim to persuade talented undergraduates to continue towards graduate studies in STEM, especially underrepresented minorities and women. Beyond classroom teaching, I have been a research supervisor to a diverse group of graduate and undergraduate students, all of whom have achieved fruitful research progress under my direction, with some of our joint work published in top-tier conferences and journals in my research area. As a research supervisor, I strive to have a diverse research group that embraces critical and independent thinking and fosters collaboration and creativity. I will further discuss my teaching experience, philosophy, and interests in more detail.

Previous Experience

I have served as a teaching assistant for various courses in electrical engineering and computer science throughout my Masters and Ph.D. program. These courses have ranged from an introductory undergraduate course (e.g., Introduction to Computer Science I) to a graduate level course (e.g., Mobile Communication). Most courses that I taught have had dedicated lab sessions, where I was the lab instructor. Typically, the number of students in the lab ranged from 10 to 30 students, where they designed and implemented software and hardware solutions to a set of problems and projects. One of the main benefits of teaching in a laboratory setting is the ability to acknowledge and address student's strengths and weaknesses at a greater depth than a lecture setting. In the complementary lab sessions, students often raised similar questions, which has enabled me to pinpoint concepts that students find challenging in various courses. This has allowed me to better identify areas where students need more help and tailor my teaching to clarify those concepts.

I was privileged to teach Signals and Random Processes course twice in the fall of 2011 and 2012, where I was a Lecturer for a medium-sized class of 50 students. This is a third-year undergraduate course in the Faculty of Business and Information Technology, where students do not have a strong foundation in mathematics. The mismatch between the course requirements and the students' lack of pre-requisite knowledge had made this course notorious for being one of the most challenging to teach. Acknowledging the students' lack of interest in pure mathematics, I redesigned the course. I introduced more practical examples and problem sets to enhance students' engagement. For example, in one of the assignments, I gave the students an amplitude-modulated audio file and asked them to demodulate the signal to find the hidden message. I also provided students with more assignment questions with detailed solutions for practice material. This approach provided the students with many practical and interesting examples to learn from. The students appreciated this method of teaching as well. At the end of the term, students rated the overall teaching of the class as 86% compared to the departments average of 67% and the university average of 71%.

After improving teaching outcomes in this challenging course, I was selected by the university's Faculty Committee to teach a graduate level course, Advanced Communication Networks in Winter of 2015. This course had students from departments of Electrical Engineering, Computer Science, and Business and Information Technology, with diverse backgrounds. For this course, I used a main project and an area survey presentation to complement the existing assignment and quiz components traditionally used within the department. This addressed the diverse interest of students in the class and motivated them to work on a project that was related to their research interests.

Besides teaching classes, I had several rewarding supervisory experiences: I helped co-supervise three Master of Applied Science students, three undergraduate researchers, and one visiting Ph.D. student. I mentored the M.A.Sc. students by actively supervising their first-year projects, which were required to be on a different topic than their Master's thesis. These projects culminated in two papers accepted and presented in prestigious conferences in my field of research. The work with the three undergraduate students that I supervised at Stanford resulted in a conference publication and the one with the visiting Ph.D. student resulted in two conference publications and one journal paper. I am currently co-advising two visiting Ph.D. students from Germany and South Korea and one Ph.D. student at MIT.

Teaching Philosophy

At a fundamental level, teaching is about sparking students' curiosities in a subject and inspire them to think independently. To achieve this, it is imperative to concentrate on simple yet intrinsic ideas tailored to the students' knowledge levels and diverse backgrounds, rather than emphasizing mathematical sophistication. Especially when teaching an introductory level course, one often forgets that the concepts that we find natural and obvious could be new and challenging to some of the students. My objective is to strike the right balance between simple intuitions and mathematical depth in my teaching. Another point that has often been under-emphasized is the importance of collaboration. Based on my own experience, many of the research ideas are stimulated during communication with peers. I intend to introduce homework parties or project bootcamps to each course, which set up a regular time for the students to convene and discuss assignments or projects, while the instructor and teaching assistants are also present to provide

further guidance. This way we are able to help students build up an effective and collaborative environment, and to improve their abilities to communicate ideas to a diverse audience.

There is no better way to learn a concept than by direct implementation or experimentation. One of my goals in undergraduate teaching is to involve students in building and experimenting with real systems early on. An important aspect of this approach is to employ projects with interesting and meaningful results. To this end, I plan to use some of the experimental platforms I have developed in the past for labs and projects. For example, I have helped Dr. Matthieu Bloch at Georgia Institute of Technology to adopt one of my experimental platforms as a design project for senior undergrads. These platforms can also be used in labs to teach various concepts ranging from simple mathematics and electronics to more advanced topics in probability, embedded systems, signal processing, and communication theory.

In graduate courses, instead of emphasis on knowledge transfer, I believe the focus should be on facilitating self-directed learning. Students should be encouraged to find interesting problems related to the field and be provided with the tools necessary to explore answers to those problems. It is also important that students learn and practice how to pose research questions, test their hypothesis, and formally communicate their findings through research articles and presentations. I plan to facilitate this by incorporating area survey presentations and projects, with report and presentation components, into my graduate courses. Although self-directed learning is important, few students can learn in a vacuum. This is particularly true at the graduate level, where the best research is often done in collaboration. Group projects encourages overlap between related research areas, as students with different interests contribute jointly to the research effort. This is especially important in the modern research environment where collaboration and interdisciplinary research have become the norm rather than an exception.

Research Group Supervision

As a Ph.D. advisor, I intend to have a diverse research group with students working on theory, system design, experimentation, and devices. Beside skills in one or more of these areas, another important criterion I use for selecting Ph.D. students is communication and collaborative skills, which are central to multidisciplinary research. To further motivate collaboration and exchange of ideas within the group, I plan to hold regular group meetings where everyone reports on their progress and their challenges. In my opinion, the most important role of a Ph.D. advisor is not to impart knowledge but to guide the students through the pitfalls of graduate studies, engage them in critical and independent thinking, and provide a friendly environment that fosters collaboration and creativity. Therefore, besides the group meetings, I plan to have regular one-on-one meetings with my Ph.D. students as soon as they join my group, work with them to discover challenging yet practically important problems, and help steer them onto a path which would eventually lead to a solution to this problem. Early on, I would encourage them to start by re-working or replicating several well-known classical results in order to deepen their understanding of the field and to help them develop an intuition in their research problem. Later on, I would encourage them to find new problems on their own and become completely independent researchers. To help talented undergraduate students gain valuable research experience and persuade them to continue their graduate studies in STEM, I am committed to involve them in my research, especially underrepresented minorities and women.

Teaching Interests

Undergraduate level. My teaching experience to date and the topics associated with my research provide me with the basis to teach a broad range of undergraduate courses in computer science and electrical engineering. I would be enthusiastic to teach courses in *signals and systems*, *machine learning*, *deep learning*, *artificial intelligence*, *computer networks*, *introduction to programming*, *digital communication*, *wireless communications*, *embedded systems*, and *information theory*. Beside teaching courses, I plan to develop an online laboratory platform, based on my experimental setups which can be used for teaching concepts ranging from simple mathematics and electronics to more advanced topics in probability, embedded systems, machine learning, signal processing, and communication theory. This online learning tool can be adopted by interested faculty members in various courses to measure and improve student learning and as an educational outreach tool in STEM subjects.

Graduate level. At the graduate level, I am interested in teaching courses in *stochastic signal processing*, *machine learning*, *deep learning*, *communication networks*, *bioinformatics*, *information theory*, and *wireless communication systems*. I am also very interested in incorporating some of my research and expertise into new graduate level courses. I plan to offer two new courses: one on *machine learning for communication system design*, and another on *molecular and biological communication*. The first course covers the basics of machine learning, communication system design and signal processing as well as how to combine these areas for the design of future communication networks. The second course will cover the basic biological, chemical, and physical properties of chemical signaling, the theoretical foundations of molecular communication, system design and optimization, and the applications of molecular communication. These courses will offer a project component where the students could work on any aspects of these systems ranging from development of new techniques and algorithms to implementing of their own system prototype.

In conclusion, my passion for teaching and the numerus opportunities that I have had teaching and supervising students have prepared me for pursuing an academic career. My successful track record in implementing engaging and stimulating methods is evident from my students' results. I am excited to be able to implement these methods to encourage the spark of independent thinking in my students. As a life-long learner myself, I also enjoy contemplating ways to enhance student learning going forward.