Teaching Statement

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I have been fortunate to learn from many great mentors and professors, whose enthusiasm for teaching and patience with students have a deep influence on me. My own teaching experience comes from being a guest lecturer, teaching assistant, and lab demonstrator for 8 courses at the University of Oxford and the University of Pennsylvania (see the full list of courses in my CV). I have also been a research mentor for 2 MSc students and 5 PhD candidates. These experiences have shaped my teaching philosophy and mentoring style as follows.

Teaching Philosophy

*Bringing passions to the classroom.* I believe that students learn the most when they are passionately engaged in their learning. Therefore, I try to share my passions in computer science with students while teaching. For example, when I guest lectured “Intro to Formal Methods” in the class of Embedded Software for Life-Critical Applications at Penn, I told students stories about various software failures documented in news and their societal impact. Students seemed to be motivated by these real-world examples, and became more engaged in the discussions of how to better prevent software failures.

*Helping students develop insights of fundamental concepts.* Computer technologies may change quickly, but the fundamental concepts remain the same. It is essential to teach students these concepts, which will enable them to master new technologies and solve new problems in their future career. One strategy that I find useful is to elucidate concepts with concrete examples. For instance, I used examples of robots navigating a road map to guide students discuss the advantages and disadvantages of various AI search techniques, when I was a teaching assistant of Intelligent Systems at Oxford. Students liked these concrete examples.

*Emphasizing hands-on experience.* I advocate learning by doing, and connecting theory with practice. For example, I helped students study homework assignments of Probabilistic Model Checking by guiding them work through a proof or an algorithm step by step. I encouraged them to not simply focus on getting the correct answers, but instead pay more attention to the problem solving process. To help students understand how a model checker works in practice, I asked them to use the PRISM model checker to build models and analyze properties for a few case studies (e.g., Randomized Dining Philosophers). Students found it a fun experience of playing with PRISM, which helped them gain intuitive understanding of probabilistic models and temporal logics.

*Creating an inclusive learning environment.* The more teaching experience I accumulate, the more I realize that students come from different backgrounds with various educational goals and learning styles. To become an effective teacher, I should cater to these differences and integrate diverse perspectives in my teaching. When I demonstrated the Object Oriented Programming lab sessions at Oxford, I observed that some students had no prior experience in Java programming, while some had a strong technical background. I adjusted my pace for different students accordingly. I spent more one-to-one time with less experienced students (e.g., helping them learn how to debug programs), while challenging advanced students with optional, harder problems.

Mentoring

Research mentoring is similar to apprenticeship in some sense. I have been benefited from the mentoring of my PhD and postdoc advisors who guided me on how to conduct high-quality research and encouraged me to pursue my own research ideas. I want to convey the same excitement to my students. I will cultivate a collaborative group culture. I will help students identify research projects that they are passionate about and can excel at. When students are in their early years, I will get more involved in their work. For example, I will lead students to start with well-scoped, manageable tasks, help them with low-level technical details, and give them instructive feedback on their writings. As students grow with stronger research ability and gain more confidence, I will encourage them to be more independent and ask their own research questions.

In addition to research mentoring experience, I was a Junior Dean of Trinity College at Oxford for two years as a graduate student. My responsibility was to assist the Dean in maintaining students discipline and welfare in College. I worked with both undergraduate and graduate students, offering them support when they were in difficulties (e.g., helping them cope with anxiety when they took examinations). This experience made me aware of the variety of students and sympathetic to students with various constraints.
Teaching Interests and Plans

Based on my teaching experience and research interests, I would be enthusiastic and qualified to teach courses in formal methods (e.g., probabilistic model checking, computer-aided verification), cyber-physical systems (or embedded systems), software engineering, programming languages, compilers, concurrency, intelligent systems, and machine learning. I would also be happy to teach introductory computer science courses, such as computer systems, data structures, algorithms, automata theory, and discrete mathematics.

I would enjoy teaching discussion-based seminars or reading groups to graduate students. One potential topic is on the intersection of formal methods and machine learning, which is a research frontier and has been attracting increasing attention in the past few years. My own research is also related to this topic. I would lead discussions on exciting new ideas and techniques, such as the integration of advanced, adaptive model learning techniques from data, with successful model-based approaches for verification, synthesis and planning.

The emerging field of cyber-physical systems (CPS), where my work is situated, calls for new, interdisciplinary educational efforts. I would like to develop several new courses related to my expertise, such as:

Medical Devices and Applications. This course will prepare students to create innovative technologies that address critical healthcare challenges. It will not only teach students engineering skills for designing medical devices and/or mobile health applications, but also introduce them to topics ranging from regulatory issues, marketing, innovation management, reimbursement and clinical strategy. It will be intended primarily for engineering students who want to become entrepreneurs or professions in the future technology-driven healthcare industry, but will also be suitable for MBA and/or medical students who seek engineering skills.

Human Factors in CPS Design. Many CPS interact with human operators. For example, medical devices interact with caregivers, and autonomous cars interact with drivers. Correct operation of these systems depends crucially on human-automation interaction. This course will place emphasis on human factors issues for CPS design, and will cover topics such as modeling and verification of human interaction, usability of human-automation interfaces, and human-in-the-loop control strategies. I also plan to create course projects involving industrial partners.

Massive open online course (MOOC). While computer science MOOCs have been popular on platforms such as Coursera and edX in recent years, there exist very few CPS-related MOOCs. I would be interested in developing a MOOC for both outreach and to create materials which could be used to support “flipped” classes on campus.

Outreach and Diversity

I have been involved in various activities for women in computer science and engineering. I mentored undergraduate women students at Cambridge University, connected with women applicants to attract them to computer science at Oxford, and participated monthly women networking events at Penn Engineering. I also attended the Grace Hopper Conference, and organized a networking luncheon for women researchers at the CPS Week 2015. In the future, as a faculty member, I plan to continue encouraging more women students to study computer science and engineering, and providing mentoring to help them succeed. I will also support other outreach programs, such as incorporating CPS and computer science into K-12 education, leveraging my previous experience of engaging in the Cambridge University STIMULUS (Maths, Science, Computing, Technology) Outreach Program as a student volunteer.