Teaching Statement

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I plan to use teaching to achieve three goals: (1) get students interested in and excited about computer science and electrical engineering and provide them with solid fundamental knowledge for their future careers; (2) interact with students to improve their programming capabilities, communication skills, and presentation skills through projects and presentations; and (3) inspire and involve students with original research ideas through reading and discussions. To prepare myself as a good instructor, I am deeply involved in teaching and mentoring activities, including lecturing lab sessions on microprocessor design, presenting demos to government officials, and mentoring undergraduate and graduate students on research projects. These experiences are preparing me to teach a wide variety of courses at different levels in areas including cyber security, computer systems, and networks, and to mentor students' research in these areas.

1 Teaching Philosophy

I believe that courses at the undergraduate and graduate levels should be taught differently.

For undergraduate courses, I believe two things are key. The first is to help students clearly understand fundamental concepts. At the University of Illinois at Urbana-Champaign, Ph.D. qualifying exams are conducted as oral presentations. Through my own preparation for the qualifying exam, I realized how the capability to understand and explain fundamental knowledge can help a student grasp the essence of a complex research idea and deliver it in an understandable manner. I therefore believe that an emphasis on fundamental concepts in undergraduate courses can help students in their future work. To help students grasp such fundamental concepts, I prefer to use traditional "writing-on-blackboards" presentations in certain courses. Instead of reading lecture materials, students can be more engaged in processing and understanding the materials while taking notes. For example, when I took a course on power system analysis (even with research experiences in computer engineering/science), I gained a better understanding of many details of power flow equations while I wrote them repeatedly. The second important thing in undergraduate teaching is to involve students in projects or machine problems that allow them to apply knowledge from the lectures to real problems. Instead of merely remembering abstract concepts, students can become more capable of using the knowledge to design, implement, and optimize concrete things. Meanwhile, students can learn how to collaborate and communicate with each other through such projects.

For graduate courses, I believe that teaching and research are two sides of the same coin. As a result, I plan to present current research trends and challenge students to extend the research they are pursuing. When I took graduate courses, I have published work based on materials that were taught in the courses; that collaboration can benefit both the instructor and the students. Also, I will assess graduate students on their originality and effort in developing projects or research ideas, instead of concentrating solely on research results. I believe this teaching style can encourage students to try out original ideas, even if the ideas may appear impractical at the initial stage.

2 Teaching/Mentoring Experience

Class/Lab Teaching. At the University of Illinois at Chicago, I was involved in teaching ECE 225 (Circuit Analysis) and ECE 367 (Microprocessor-Based Design), with lecturer Robert Becker, for two semesters. I gave lectures in all laboratory sessions, guided students to perform experiments, and answered questions related to course projects. Specifically, teaching the lab sessions of ECE 367 was a very challenging experience, because I taught and graded coding, which can be very different from student to student. To help students grasp the fundamental knowledge presented in the lectures, I spent a long time interacting with them. In doing so, I asked them to explain their designs and how they applied the knowledge from the lectures in their coding. At the very beginning, students progressed slowly. By the end of the semesters, however, I could clearly see their improvements; in particular, their coding efficiency was significantly improved. Also, I got to understand their designs before I dug deep into their codes. This approach helped me to identify possible mistakes in their projects and thus, shortened the debugging time. Furthermore, in interacting with students, I was surprised to see many original designs. This experience helped me realize what rich resources are in eager young minds.

Lecturing. The TCIPG (Trustworthy Cyber Infrastructure for the Power Grid) center was a major multi-university collaborative effort between academia and industry; it provided me with numerous types of teaching experiences. I participated in all five TCIPG Industry workshops, in which I presented demos and posters of my research project. At the November 2012 workshop, I was selected as one of five students to give demos to TCIPG vendors. (A recording of my demo is available on YouTube[1].) At the October 2014 workshop, I was again selected as one of four students to present their research projects to all attendees. (Again, a recording of the presentation is available on YouTube[2].) I believe that a research demo is an effective and challenging way to deliver a research idea. Because I was facing a diverse audience, it required me to highlight the essence of a complex research idea and present it in an understandable and appealing manner. I felt excited and delighted when my demo drew interest from senior researchers. More importantly, presenting demos has helped me obtain the experience to encapsulate knowledge into vivid presentations that can get audiences, such as students, interested in what they're hearing. My demos and the associated posters were among the most popular (as measured by the number of stickers indicating interest that were added to posters by audience members).

One special lecture experience I had was in a seminar course related to TCIPG. In the course, participants with computer engineering backgrounds gave lectures related to power engineering, and vice versa. Such teaching experience is very beneficial for interdisciplinary research. I am a researcher with more background in computer systems and network security; that background helped me understand the challenge of learning concepts related to power system analysis. To help clarify the difficult material, I used analogies to explain power system concepts during my lectures. For example, to explain the concept of reactive power, I used the analogy of a person's work/recreation balance. Similar to recreation in a person's life, reactive power does not directly introduce concrete outputs, but provides critical support for generating and maintaining real power.

Mentoring. I have applied my teaching philosophies to both undergraduate and graduate students when I have mentored them. In the Spring of 2016, for example, I mentored an undergraduate student as part of an effort to implement a communication network. To ensure that he understood all related basic concepts, I worked closely with him. I asked him to give presentations on his progress every week and challenged him with fundamental knowledge on computer networks during the presentations. In addition, I encouraged him to present how he applied those concepts to projects that he was working on. I really enjoyed supporting him and seeing him gain new knowledge and make improvements in the project.

During the Summer of 2016, I mentored a first-year Ph.D. student from Tennessee State University who was working as a graduate intern. Through this experience, I learned how to interact with a student from a different background and merge her knowledge with mine in an interdisciplinary project. Before the internship, this student was working in the area of control theory. In her internship application, she proposed a theoretical idea that used a distributed feedback control system to detect cyber attacks. Through our discussions, I worked with her to successfully apply the theory to a specific problem in power systems. During this mentoring experience, I could see the value of interdisciplinary collaborations. I cannot wait to build my research group of students with a variety of backgrounds and thus, create an exciting research environment.

3 Teaching Interests

I am interested in teaching courses in the areas of network security, secure/reliable computer systems, operating systems, and computer networks at all levels. In these courses, I plan to design solid projects that can simulate what happens in real computing environments. For example, I can use the Geni testbed, a nationwide network experiment platform, as the environment for students to design and implement their course projects. Doing so allows the students to experience working with real network devices.

Furthermore, I hope to develop an advanced course that can specifically focus on interdisciplinary research related to cyber-physical systems and the Internet of things, such as smart grids. The research can include different areas (e.g., computer system design, network security, power system analysis, and control system analysis). Although students can take separate courses in those areas, there is a lack of courses that describe how different research areas are merged in this unique area. Consequently, I am interested in developing this course by collaborating with professors from other related areas, to help students who are interested in this interdisciplinary research area.

[1] https://www.youtube.com/watch?v=unb7b8myNvA
[2] https://www.youtu.be/J9OMzhbgNjA