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Teaching Statement

The greatest benefit of an academic career is the privilege to instruct and mentor future generations of computer scientists and professionals. I strongly believe that a professor’s most important role is that of a teacher and mentor in all educational settings: from classroom teaching to mentoring students and community outreach.

Teaching Philosophy and Experience

Computer science is unlike many other classroom-taught disciplines in that there is little substitute for concrete experience. I believe that the most effective courses, specifically in cyber security and systems, should guide students through materializing the taught theories into practical implementations. For undergraduate courses, this couples the instruction of fundamental design principles and abstractions with implementation projects which solve realistic, relatable problems and utilize cutting-edge technologies. For graduate students, this translates to the critical analysis and understanding of state-of-the-art research and innovation. Particularly in cyber security, a graduate-level course must provide the technical foundation students will need in developing their own hypotheses and solutions to open research problems.

During my graduate study, I have acted as a guest lecturer for several graduate and undergraduate courses covering security and operating systems. My goal is to engage students by constructing interactive lectures which lead toward open discussions. I achieve this by periodically introducing concrete exercises to challenge students to think critically about the topic at hand (e.g., walking through the operations of a stack-smashing exploit). By stepping through these examples on the board, I can encourage students to propose solutions and gauge their understanding of the concepts. Most importantly, this feedback allows me to modify my discussion and ensure they have grasped the concept before moving on. In my experience, this approach gave students the confidence to ask their own questions, which often evolved into guided group conversations around the topic. In these cases, I have found success in transforming some of my more topical research (e.g., memory forensics \[1, 2, 3\] after discussing kernel memory management) into thought exercises to provoke more critical consideration of the lecture’s real-world applicability. This approach appears to be effective as I am often approached after the class or online (via Piazza) by students interested in more in-depth conversations or help on other topics.

I am excited and prepared to teach graduate and undergraduate courses related to software and systems security, operating systems, privacy, and networking. In addition to this, it has long been an ambition of mine to develop a cyber forensics curriculum. As an undergraduate, I was fortunate to enroll in three newly constructed courses focusing on hands-on digital forensics techniques (cyber investigation methodologies, binary program reverse engineering, and even legal proceedings). These courses offer students an increasingly in-demand skill set, for both graduate research or employment with private and government forensics labs, not currently covered by existing security curricula. For example, students should learn to utilize commercial cyber forensics toolkits in solving mock investigations but also identify where those techniques break down and propose new models for evidence acquisition. Beyond this, I would also welcome the opportunity to teach undergraduate courses on a broad range of topics in computer science, as it would give me a chance to further my own breadth of knowledge.

Finally, I am a firm believer in the complementary relationship between coursework and research. This begins with undergraduate involvement in research projects. As an undergraduate researcher, I worked with two different research groups in my junior and senior years, culminating in one publication and my undergraduate thesis. These experiences expanded my analytical thinking and creative problem solving skills which have advanced my research ever since. Similarly, I have been privileged to see this same progression sparked within an undergraduate that I have mentored over the last two years. For graduate students, coursework often serves as an essential foundation of knowledge to be utilized in later research. I hope that by teaching courses which instill these foundations I can inspire students that are as passionate about the field as I am.

Community Outreach

Education must also go beyond the classroom. I have enjoyed serving on a number of community outreach efforts focusing on cyber security awareness. As a professor, I plan to continue building programs to introduce computer science and cyber security to the broader public.

During the summer of 2015, I was invited to moderate a full day of the GenCyber workshop \[4\], an

https://www.cs.purdue.edu/~bsaltafo
NSA/NSF funded two week intensive training program in cyber security for high school teachers. The GenCyber initiative aims to give teachers (many of whom are not trained computer scientists) the confidence to incorporate cyber security topics into their curricula, in hopes of increasing awareness among younger students of the importance of cyber security and its many career opportunities. In addition to organizing the program’s volunteers, I prepared materials covering memory forensics background, practical applications, and research (including my own contributions [1, 5]) as well as moderated guest lectures by a cyber forensics investigator from the Jefferson Parish Sheriff’s Office and a retired Texas District Attorney. In addition to serving as the moderator, I extended my stay to help administer and guide several in-class lab assignments on network security and cyber forensics for the entire second week of the program.

Building on the success and excitement of that workshop, I brought all that I had learned back to Purdue, where the following summer we hosted a similar half-day summer camp to introduce local elementary school students to cyber security and digital forensics. This camp was conducted as one of the outreach activities planned into an important Broader Impacts component of my advisors’ NSF SaTC Medium grant on cyber forensics. We featured a number of my smartphone cyber forensics techniques [3, 5] through a very popular “show and tell” demo format. This program was equally well-received, with even the parents of attendees asking questions and seeking additional information on smartphone privacy and forensics. Based on this success, we plan to expand the camp to a larger program this coming summer. Helping non-technical professionals and young students alike become fascinated by cyber security and forensics is one of my most rewarding teaching experience to date. I eagerly await organizing similar outreach activities in the future.

Mentoring

During my time at Purdue University, I have been fortunate to serve in an advisory role for two exceptionally talented students. Praseem Banzal (MS, 2014) conducted his thesis work, a cloud-hosted provenance tracking system for advanced cyber attacks, under my guidance. Praseem also presented several demos of the system as part of our tech-transfer to industry partners. Since graduating, he has continued to utilize his system programming skills as a member of Google’s infrastructure team. Qi Zhang (BS, expected 2016) has served as an undergraduate research assistant on two of my cyber forensics projects. Under my direction, she has excelled as a low-level systems researcher, now capable of instrumenting and debugging the Android framework on her own. Her work has contributed to two papers (one published and one under submission), which she cowrote. After her graduation, Qi will join Facebook’s New York City office.

Through helping them design and execute their respective research projects, I have grown significantly in my abilities as an advisor. In addition to providing technical guidance on their projects, I am most proud of assisting them in developing their technical writing and oration skills and for being consulted by both for advice on their future careers. Working with them has taught me how to effectively communicate low-level technical details and their corresponding high-level theories in a concise and digestible way. Most importantly, I learned to identify a student’s strengths and encourage them to use these to find creative solutions to problems.

In addition to advising students, for the last two years I have been invited to speak at the incoming graduate student orientation to cover good cyber security research practices and research opportunities at Purdue. I have thoroughly enjoyed these presentations, as I am honored to give new students any advice that I can to make their careers more successful, the same goal I have for advising my own research group.

References