Teaching Statement

Chao Chen, *Amazon Science – chao.chen@gatech.edu*

Teaching, as one of the most important activities of academia, is a process of collective improvement for both the students and the instructor. I want to become a professor because I am enthusiastic to engage in this exciting process with the best young talents. As a growing and ever-changing area, I believe teaching in computer science is not only to train skilled programmers, but also to inspire students and cultivate prospective computer scientists who can come up with creative and bold ideas when faced with unprecedented challenges.

Teaching Experience

Since entering the School of Computer Science at the Georgia Tech, I have served as a TA for various courses at both the undergraduate and graduate level, including "Operating System Design" (CS3210), "High-performance Computer Architecture" (CS6290), "Embedded Software" (CS8803), and "Compilers: Theory and Practice" (CS6241/CS8803). In these courses, I taught several lectures, graded homework and exam papers, managed course projects, and held office hours. Through these experiences, I learned common features of great courses and developed teaching skills to meet needs of students with different academic backgrounds.

I believe that teaching requires the ability to explain profound concepts with an easy-to-understand approach. When I worked as a TA for CS3210, some students had difficulty in understanding several basic concepts, e.g., "virtual" vs "physical" addresses. And I found that most of the time, a metaphor was an efficient way to explain such profound principles. For example, I utilized "store-goods-factory" to illustrate the relationship between the "virtual" and "physical" addresses (spaces) in that we could get goods (data) from a shelf (a virtual address) in the store (virtual address space), which was actually provided by a factory (a physical address, all factories form the physical address space). The goods provider for a shelf was changeable, in which case, the shelf (the virtual address) was mapped to a different factory (physical address). I was always ready to help when they met challenges in their projects. These experiences were quite helpful for preparing me to teach undergraduate courses.

I also believe that projects are always the best way for students to close the gap between theory and practice. When I worked as the TA for the compiler course, students were required implement a compiler for a toy language in their projects. Many students told me that they learned more from finishing the project than from listening to the lectures, but that they sometimes struggled with the scope of the work. I find that to ensure the success of a large project assignment we need to break the project into many small and doable tasks so students can accomplish the whole project step-by-step; and further, we also need to carefully design the project by providing a necessary framework for students so that they can focus on the implementation of the main ideas that are supposed to be delivered in the course. Following the experience I learned from CS3210, I implemented a toy LLVM-like framework for students, such that they could focus on developing and testing core ideas about liveness analysis, register allocation and instruction selection. It was very effective in encouraging students to learn, implement, and master the core concepts, and I believe it improved their project significantly.

Courses I can teach

My past teaching and research experience has covered a wide range of topics in computer science, including computer architecture, compilers and operating systems. Given the need, I am qualified and ready to teach undergraduate courses in these subjects. I am also qualified to teach introductory courses in data structures and algorithms, networking, and programming.

I am also interested in creating a special topic course related to my research. Over the past decades, CS as a discipline has grown in terms of diversity of areas, but our curriculum has pretty much followed the traditional model of offering isolated courses in respective areas (e.g., Algorithms, Architecture, OS, Compilers, Databases, Networking, etc.). Moreover, the "distance" between the advanced topics for these areas has increased due to the natural evolution of the discipline. Therefore, in order to inculcate our graduate students, who are at the forefront of the research that we do, with the possibilities of research, these silos must be abolished and holistic views of some cross-cutting topics must be incorporated into our curriculum urgently. Particularly, in my own realm of research, the compiler will play a critical role in all aspects of system research in the future to expose applications' characteristics to the OS, runtime, and middle-ware. Hence, a cross-cutting course about compiler/program analysis and systems is one of my interests. Materials for this course are the recent publications on topics of compiler analysis, as well as the new and emerging hardware components (e.g. GPU and NVRAM). Such a course can help students identify the open problems, brainstorm ideas through course discussions, and design and implement solutions via course projects.

Teaching Methodology

My teaching strategy will emphasize the following aspects:
- **Every Student has a story.** Each student has different interests, learning styles, and goals, and they each bring their own educational background. I would like to utilize the office hours to help them strengthen their weaknesses and encourage them to pursue more in the classroom. I would also make it clear that I am always available on request, and can devote time to personal tutorship on demand. For graduate level classes, I would prefer to give students more freedom to pursue their passions and interests in related topics.
- **Courses are different.** Different course materials require different teaching strategies. For lab or graduate-level courses, I would like to take a student-centered teaching strategy, and let them practice their skills and explore their interests. I will stand behind them to give them required help and suggestions.
- **Teaching is a learning experience for both sides**. As an instructor I strive to be flexible in my methodology and approach, to deal with unusual students and learning strategies, and to communicate better every time I teach.