Teaching Statement

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I believe learning can be best achieved when students are *self-motivated*. Hence, to help students discover their motivation and realize the value and potential impacts of their learning, as an instructor, teaching assistant, and mentor, I use a multipronged strategy to inspire self-motivation in students' learning process. My approach has been recognized by the **TA of the Year Award** in the computer science department at Georgia Tech.

Teaching Philosophy and Experience

Connecting course material to students' interests. One effective way to motivate students to learn is helping them understand *why* and *how* the course contents matter. Thus, I help students recognize the connections between the course contents and students' everyday lives and their personal interests. For example, in the graduate-level Database Design course that I TA'ed, taught by Prof. Sham Navathe, I applied this idea to help a student who was initially struggling to decide on a project topic. Through multiple discussion and brainstorming sessions, he was encouraged to integrate his personal interests, helping him generate creative ideas based on his knowledge in rugby. In the end, he delivered one of the best projects in the class.

Promoting hands-on experience with real data. When we introduce students to new topics that involve data (e.g., machine learning, data visualization), I believe they best learn through working with real-world datasets, as real data often presents many practical and unexpected challenges, enabling students to discover many interesting insights that small or synthetic data cannot provide. When I taught my own database course for 45 undergraduate students with statistics background, I introduced a group project module for the students to work with real data. I prepared five real databases about nearby restaurants, movies, baseball, and elections; students would apply statistical techniques to extract features (or variables) from these databases to build data mining models. Many students found the project interesting and they created many high-quality project deliverables.

Considering technology's practical use and societal impact. When learning new technologies, it is crucial to consider and discuss how they can be used in real-world contexts and for society. For example, based on my industry experience working with data scientists and researchers at Google and Facebook, I learned that *feature engineering* is a critical part of machine learning workflows in industry. However, this topic is often not covered in conventional database or machine learning classes. Therefore, I developed a guest lecture that introduced students to the important aspects of feature engineering in the database course that I TA'ed, helping students better prepare for their future professional careers. In addition to the practical use of technologies, it is important to teach how these technologies may transform our society. For instance, as artificial intelligence (AI) is increasingly assimilated into our everyday lives, affecting people's actions and decisions, I plan to discuss more urgent challenges in AI, such as interpretability, ethics, and fairness, as a major component of the courses on AI and data science.

I was awarded the **Graduate TA of the Year** in School of Computer Science at Georgia Tech. In the end-of-course survey of the database design class, I received excellent scores: a median score of 4.8 for overall effectiveness and median scores of 4.9 each for *respect for students*, *attitude toward teaching*, and *approachability*.

Student Advising and Mentoring

I have been fortunate to advise and mentor 7 talented undergraduate and master's students at Georgia Tech, in various research projects. Among them, Zhiyuan Lin, who was a computer science undergraduate student, worked with me in multiple projects for three years. Together, we published 6 papers in top conferences both in data mining and visualization. He is now a Stanford PhD student. As an advisor and mentor, I apply my teaching philosophy that encourages self-motivation to guide and encourage my students to develop their own ideas, by helping them reflect on their interests and technical strengths. Also, I greatly enjoy working students from diverse backgrounds, adapting my advising based on what would best help them excel at what they are good at, and help them develop new strengths that complement their existing skill sets. For example, for a student who has a flair for design and is interested in building systems, I help that student recognize the power of combining effective visualization techniques and scalable algorithm backends for creating novel interactive tools that help people make sense of large, complex datasets.

Broadening Education Access through Interactive Tools

I am committed to enhancing learning with technology, through my research on designing usable, interactive exploration tools. Recently, I developed an open-source interactive visualization tool, called GAN Lab [1], for non-experts to interactively play and experiment with *Generative Adversarial Networks (GANs)*, one of the very popular, but hard-to-understand deep learning models. Implemented using a new JavaScript-based library, my approach enables anyone to access the tool using their browsers without the need for expensive hardware that may not be accessible to students, and thus significantly broadening people's education access to such tools. GAN Lab has been used to teach GANs in a deep learning course at Georgia Tech, taught by Prof. Dhruv Batra, for both undergraduate and graduate students. I also developed an in-browser machine learning education module for K-12 students with Prof. Hal Abelson at MIT, providing students with hands-on experience to learn the foundations of machine learning. It is now in the process of deployment as a part of Google's engEDU program.

Example Courses

My research and teaching experiences across a wide array of fields — including data visualization, database systems, data mining, and machine learning — have prepared me to teach students in a broad range of computer science and data science topics at both the undergraduate and graduate levels. I also look forward to designing new courses, such as:

Human-Centered AI: This course covers a wide range of human-centric aspects in artificial intelligence (AI). The first part of the course will cover topics that have huge implications for our society, such as interpretability, fairness, and ethical issues in AI. After that, students will learn how to design human-in-the-loop interactive systems that support AI-based systems or use AI techniques.

Visual Analytics for Machine Learning: This course focuses on using visualization for building and analyzing machine learning models. Students will first learn how to use data visualization to better interpret machine learning models and results, and then design new interactive tools that visualize complex models for researchers, practitioners, and students.

References

[1] **M. Kahng**, N. Thorat, D. H. Chau, F. Viégas, and M. Wattenberg. GAN Lab: Understanding Complex Deep Generative Models using Interactive Visual Experimentation. *IEEE Transactions on Visualization & Computer Graphics (VAST)*, 2018. https://poloclub.github.io/ganlab/