Teaching Statement

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Artificial intelligence has advanced rapidly since the late 2010s, driving significant progress across various domains. With many advanced courses and materials now available online, several key questions emerge: What is the goal of education in this evolving landscape? What resources should we provide to ensure students remain competitive and maintain a leading edge? And how can we teach in a way that empowers them to drive future innovation? These questions highlight the need for new teaching and mentoring methodologies. I firmly believe that education should not be a privilege, but a powerful tool to open new worlds for individuals, helping them grow and become better people. Teachers play a crucial role in guiding students toward success. During my PhD journey, I actively engaged in teaching and mentoring activities, including delivering lectures, presenting my research, serving as a teaching assistant for five courses, and mentoring students from diverse backgrounds in high-quality research. These experiences have inspired me to reflect on and shape my teaching and mentoring philosophy.

1 Teaching Experience

1.1 Teaching Assistant and Guested Lecture

My teaching experience focuses on artificial intelligence (AI), particularly in machine learning (ML) and data mining from multi-modality data, such as tabular and longitudinal EHR data. I have served as a teaching assistant five times for the introductory Programming Languages course (COP 3502C: Introduction to C Programming in Spring 2021, Summer 2021) and the core Machine Learning course (CAP5610: Machine Learning in Fall 2021, Spring 2022, and Fall 2022), each with an average of over 90 students. In these roles, I contributed to course instruction, supported students with their coursework, and assisted in the development of course materials. Additionally, I served as a guest lecturer for CAP5610, where I designed and taught the introductory sessions (the first two classes each semester). Unlike conventional teaching approaches, I focused on foundational concepts, highlighting their limitations and demonstrating how subsequent techniques address these gaps.

1.2 Research Talk Presenter

Beyond my academic work, I have presented research talks on the intersection of healthcare and machine learning to diverse audiences, which has helped practice my teaching skills outside the university. Notably, I shared my work with engineers and scientists at Visa Research and Amazon company, covering advances in tabular data representation learning and the use of large language models. These experiences have enhanced my ability to convey complex technical content with clarity, providing both high-level insights and detailed discussions.

1.3 Teaching Philosophy

1.3.1 Grounding Concepts in Intuition I served as the sole teaching assistant for the graduate-level class CAP5610: Machine Learning, where I was responsible for holding regular office hours, assisting in the design of homework assignments, and providing guidance on research-oriented projects. For instance, when teaching the introduction of reinforcement learning, I began with basic concepts such as basic problem definitions, the Bellman function, and value/policy iteration. I then covered model-free learning (Monte Carlo Algorithm) and incremental learning (Temporal Difference Learning), etc. I remember one student telling me that, despite reading several tutorials on reinforcement learning, he struggled to grasp the intuition behind many unfamiliar concepts. However, after my class, he suddenly recognized the connections between these concepts through my structured approach, and everything became much more intuitive and logical. Techniques may become outdated, but understanding the overall structure, the role of each technique, and their advantages and limitations fosters a scientific mindset, helping students quickly adapt to the fast-changing environment.

1.3.2 Promoting Learning by Doing I co-taught the undergraduate-level course COP 3502C: Introduction to C Programming for three semesters, covering programming language implementation, computer science algorithms, and coding projects. Rather than having students simply 'memorize' programming languages or specific algorithms, I aimed to provide a more holistic understanding of these concepts. For example, after the sorting algorithm section, I designed an assignment where students implemented a basic Search Engine Ranking algorithm. This assignment encouraged students to connect real-world applications with the algorithms they had learned, demonstrating how these concepts can be applied to solve practical problems. Additionally, students are encouraged to explore different sorting methods and discuss the differences in their approaches. I encourage students to explore different sorting methods, compare and contrast algorithms from various perspectives, and foster an environment where everyone feels comfortable sharing their thoughts through constructive discussion. Students have widely praised this course format for helping them understand the role of programming languages and the positioning of different algorithms. They gained a comprehensive understanding of how to apply what they learned to solve real-world problems.

1.3.3 Encouraging Collaboration and Personalized Training Collaboration and personalized instruction are core elements of my teaching philosophy, which I believe are essential for helping students succeed. I encourage students to engage with peers,

share ideas, and learn from one another, which enhances their problem-solving skills. Based on my previous teaching experience, I also recognize the significance of personalized support to address the diverse needs of students. For instance, while teaching COP 3502C, I designed open-ended problems such as a search engine sorting challenge, encouraging students to explore different sorting methods, share insights, and compare their results. One student, majoring in business with no prior programming experience, initially struggled but showed significant improvement after receiving personalized guidance through office hours and interacting with peers. Her final grade improved by over 20 points compared to her mid-term exam, and she expressed her gratitude for my support. This experience reaffirmed my belief in the value of collaboration and individualized instruction as essential components of effective teaching and student success.

2 Mentoring

In addition to my teaching experience, I have collaborated with five junior students and researchers on machine learning projects. This collaborative process involved brainstorming research ideas, providing relevant technical resources to help them understand the context, discussing experimental designs, editing paper drafts, and jointly navigating the paper rebuttal process. Two of these students have already published their first machine learning papers with me, while three others have submissions currently under review. Learning through curiosity is a powerful approach to inspire students, helping them appreciate the beauty of critical thinking, expand their boundaries, and foster creativity. I have mentored several students in directed research, with one recent master student publishing a first-author paper at ICASSP 2024 under my guidance. Our collaboration began with data analysis, where I encouraged him to reflect on his findings and propose new questions based on his insights. This iterative, curiosity-driven process spanned over six months, and his ability to independently pursue research has led to a second submission in progress. I believe publications and grades are merely outcomes; the true value lies in cultivating a student's ability to ask the right questions, formulate meaningful problems, and develop the insight to tackle real-world challenges. Fostering curiosity, critical thinking, and the ability to identify important problems is the essence of the learning process.

3 Teaching Interests

My academic background in computer science and informatics enables me to teach a wide range of undergraduate and graduate courses. The goals of these courses are sketched below:

- **Basic Courses in Computer Engineering** I am well-equipped to teach courses typically included in undergraduate computer engineering curricula, such as Data Structures and Algorithms, Signal Processing, and Introduction to Python/C.
- **Foundation Courses in Machine Learning** In addition to these foundational courses, my research expertise positions me to teach both introductory and advanced courses in Data Mining, Machine Learning, Artificial Intelligence, Optimization, and Natural Language Processing in a graduate-level.
- **Human-Centered Generative AI**: This graduate-level seminar explores the integration of generative AI technologies, such as large language models (LLMs), with human-centered design principles. The course covers the technical fundamentals, business implications, and ethical considerations of generative AI, focusing on enhancing creativity, decision-making, and problem-solving. Students will examine issues like bias, accountability, and the impact of AI on human roles, while prioritizing transparency, fairness, and interpretability. Through hands-on projects, they will apply generative AI to real-world challenges, considering user needs, cost-efficiency, and ethical implications. Case studies from healthcare, robotics, and business will highlight practical applications.
- **Machine Learing for Healthcare** This course is designed for senior undergraduates and graduate students interested in applying machine learning to healthcare, with a prerequisite of programming, mathematics, and basic machine learning knowledge. This course focuses on integrating machine learning into healthcare applications, with an emphasis on disease prediction, treatment recommendations, medical imaging, and personalized medicine. Students will gain experience working with healthcare data such as Electronic Health Records (EHR), medical images, and wearable data, while addressing unique challenges such as data privacy, ethical issues, and model interpretability. Lectures of covered topics (e.g., machine learning interpretability, algorithmic fairness, federated learning, user privacy protection) will be delivered along with research paper presentation and course project presentations from students.
- **Advanced Topics in Time Series Analysis**: This advanced seminar course is designed for graduate students with a strong foundation in statistics, machine learning, and time series analysis. The course will cover recent developments and cutting-edge techniques in the field, starting with the representation of heterogeneous data, such as tabular data, before moving to more complex time series representations, including irregular time series like longitudinal data and temporal graph analysis. Key downstream tasks will include time series forecasting, anomaly detection, generation, and time series data fusion. Students will gain practical experience through research-oriented projects, applying advanced methods to real-world time series problems. The course will also feature paper discussions on emerging topics like spatiotemporal data analysis, transfer learning for time series, and applications in finance, healthcare, and IoT.