Towards a Human-Centered Approach in Education and Learning

As an AI researcher, I hold education in equally high regard, if not higher than my research. I view teaching as one of the most impactful and rewarding dimensions of academia, and I am both excited and passionate about shaping the next generation of AI researchers and practitioners. Teaching offers a unique opportunity to influence students' intellectual development and inspire them to explore new ideas with confidence. I recognize the essential importance of not only transferring knowledge but also building an inclusive, dynamic, and engaging classroom environment where students feel empowered to think creatively, ask questions, and share ideas freely. Through thoughtful teaching and mentoring, I aim to *create an **human-centered** atmosphere that nurtures curiosity and encourages students to take ownership of their learning journey, equipping them with the skills and confidence to address complex challenges in both academia and industry.*

1 Teaching Experience and Philosophy

Teaching experiences. During my PhD studies at University of Wisconsin-Madison, I had the great pleasure of serving as course assistant for two computer science courses: *CS 540—Introduction to Artificial Intelligence*, and *CS 762—Advanced Deep Learning*. The first course offers undergraduates a deep dive into the linear algebra, knowledge-based search techniques; machine learning, and probabilistic reasoning techniques. Students develop applications in tasks such as problem solving, data mining, game playing, natural language understanding, and robotics. There are more than 300 students enrolled. As a teaching assistant, my initial focus was to re-design and update the course materials by collaborating with the professors and the fellow TAs. Specifically, I work on revamping the course delivery on linear algebra and PCA section, including revising the lecture notes, slides, reading materials, and project assignments to emphasize the fundamental connection between linear algebra and unsupervised learning and algorithm intuitions rather focusing on the mathematical details. In addition, I was responsible for guidance and feedbacks for students, i.e., holding office hours, developing assignments and exams, leading discussion sections, and assisting with grading. It was particularly rewarding to witness students' growth in understanding the fundamental principles of artificial intelligence in this process. I consistently received positive feedback on Piazza, such as "Thank you Xuefeng, you are helpful in clarifying any questions regarding assignments!"

For the *CS 762—Advanced Deep Learning* course, which catered to graduate-level students, I was actively involved in fostering a research-oriented learning environment. Beyond helping prepare lectures on deep learning architectures, optimization techniques, and model interpretability, I designed open-ended research projects that encouraged students to explore state-of-the-art topics. These projects were structured to simulate real-world research experiences, allowing students to delve into advanced concepts and develop problem-solving skills. I also emphasized collaboration by encouraging students to team up for group presentations and projects, which is beneficial for creating a culture of teamwork, critical thinking, and collective learning. This collaborative approach not only enhanced the quality of the projects but also created a vibrant environment for exchanging ideas and exploring diverse perspectives within the field of deep learning. I personally really enjoyed interactions with students in this process.

Teaching philosophy. My teaching philosophy is rooted in the belief that education should serve human benefits & growth. It emphasizes promoting a deep understanding of fundamentals, nurturing confidence & curiosity, and encouraging active interaction in the learning process. I discuss these principles in detail next.

- **Focusing on the Fundamentals**: Mastery of foundational concepts is essential for students to excel in machine learning. I emphasize core principles like optimization, probability theory, and linear algebra, which are crucial for understanding advanced topics. By integrating real-world examples, I help students develop an intuitive grasp of complex subjects, such as representation learning and the interpretability of transformer architectures.
- **Nurturing Confidence and Curiosity**: Creating a learning environment that enhances confidence and curiosity is vital, especially for freshmen college students. By encouraging students to address real-world problems rather than just textbook examples, I aim to spark curiosity and intrinsic motivation. Through open-ended projects and well-designed problem sets, I empower students to take intellectual risks and ask thought-provoking questions, which will ultimately boost their confidence in mastering the material.
- **Encouraging Active Engagement and Interaction**: Active engagement and peer collaboration enhance learning. I promote interactive discussions, group projects, and peer reviews, enabling students to share

diverse perspectives and challenge each other's ideas. In graduate courses, I design collaborative exercises for analyzing and critiquing the latest research papers to help students develop critical thinking habits and refine their research interests.

2 Mentoring Experience and Philosophy

Mentoring experiences. Throughout my academic journey, I have been fortunate to receive guidance from exceptional advisors, which inspired me to mentor the next generation of researchers. Over the years, I have mentored 7 undergraduate and 2 junior PhD students, who have made significant strides in their research.

My early mentoring focused on hands-on guidance in coding, troubleshooting, designing experiments for idea verification and conduting ablation studies. This hands-on guidance helps students develop strong experimental planning skills and gain practical experience in machine learning, and led to submissions to notable conferences and journals, including BMVC, Bioinformatics, and TMLR. As I gained more experience, my mentoring approach evolved to focus on higher-level aspects of machine learning research, such as guiding students in formulating research questions, writing project proposals, and critically evaluating their findings in relation to prior work. I actively encourage students to engage with theoretical foundations, connect their research to the broader context of the field, and identify potential future directions. This approach nurtures their ability to think like independent researchers and contributes to their success, with some of them achieving publications in top-tier ML and vision venues, such as ICLR and CVPR **oral**.

Additionally, I have actively mentored students from *underrepresented groups*. In Spring 2024, I had the opportunity to mentor several undergraduate students from Africa at UW-Madison on research projects that applied NLP techniques to the Ghanaian language. Specifically, I guided them in understanding the current landscape of using AI for African languages, which results a survey paper—the first foundational work on understanding this research area. This semester, I continue to mentor them on how to preprocess text data, fine-tune NLP models, and evaluate model performance for low-resource languages, with the aim of producing several publications in NLP conferences. This experience has allowed me to witness their growth and confidence in tackling complex ML challenges, reinforcing my commitment to supporting diverse voices in AI research.

Mentoring philosophy. My mentoring approach is centered on encouraging independence, good time management and communication skills, and perseverance in my students. I believe the role of a mentor extends beyond guiding students through immediate research challenges; it also involves helping them develop skills and mindset necessary to become self-sufficient researchers who can tackle complex problems independently.

(**1**) I prioritize autonomy by guiding students to take ownership of their research projects. By empowering them to make decisions throughout the research process, I help build their confidence and self-reliance, which are essential for a successful research career. (**2**) I emphasize the importance of effective time management by assisting students in setting realistic goals and establishing priorities. This approach enhances their productivity and reduces stress, particularly during critical phases such as submission deadlines. (**3**) I promote open communication by encouraging students to express their ideas, challenges, and any concerns they may have while seeking constructive feedback. This practice helps identify problems early on and fosters collaboration with peers. (**4**) I instill resilience by sharing my own experiences of overcoming research challenges. By encouraging students to view setbacks as learning opportunities, I help them cultivate a growth mindset essential for their development.

3 Teaching Plan

I plan to teach courses in machine learning as well as in some application areas with which my research has overlapped, such as computer vision, bioinformatics and natural language processing. These courses can either be introductory courses or advanced/seminar courses. I am open to teaching other relevant courses too.

I am interested in developing a new graduate course focusing on *reliable machine learning*, which delves into cutting edge research topics in ML reliability from theory to practical algorithms, and the topics on reliable foundation models. The course addresses the gaps in existing curricula which focus more on general ML and AI topics. It is planned to included lectures, group presentations, group research projects and several coding / mathematical questions to help students grasp both the foundational and state-of-the-art methods. The main goal of this course is to offer students a unique perspective on machine learning, focusing on reliability, and to equip them with the skills necessary to optimize it.