Teaching Statement

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Teaching is a deeply fulfilling aspect of my academic career, one that complements and energizes my research. I take great joy in engaging with students at all levels, guiding them as they navigate complex ideas and develop their own intellectual curiosity. In each of my lecture and tutorial, I see the classroom as a collaborative space where concepts are not just delivered, but constructed joinly by me and the students, through discussion, exploration, and critical reflection. Whether I am writing on a chalkboard or designing interactive assignments, my aim is to make abstract theories tangible and relevant. My teaching approach is grounded in **three core values**: creating a supportive learning environment, promoting conceptual clarity through intuitive explanations, and encouraging independent thinking and lifelong learning.

I will outline my past teaching experiences, guiding principles and future teaching plans as follows.

Teaching Experiences

My journey in teaching began during my sophomore year as an undergraduate at The Chinese University of Hong Kong (Shenzhen). I was selected by Prof. Chak Wong to assist in his course *Reading for Excellence for Economics and Finance*, where I helped students read nonfiction books in English and improve their essay writing. That was the first time I discovered my passion for teaching and supporting others in their learning. Since then, I continued to serve as one of Prof. Wong's teaching assistants for five of his courses over the next three years. This role provided me with valuable opportunities for one-on-one interaction with students, allowing me to help them overcome specific academic challenges. Another milestone came in my junior year, when I was invited by Prof. Stark Draper to be a teaching assistant for his PhD-level course, *Optimization Theory and Examples*. To support Prof. Draper, I developed, organized, and compiled lecture notes from scratch by LaTeX. By the end of the course, I had written a complete set of notes totaling 155 pages, which became a helpful resource for the PhD students enrolled in the class.[1] This was a unique and rewarding experience, which deepened my belief that teaching is not a one-way process; rather, for myself, it is also one of the best ways to learn.

After completing my undergraduate studies, I began my PhD at The Chinese University of Hong Kong (CUHK). During my time at CUHK, I served as a teaching assistant for **eight** courses, **seven** of which were distinct. In each course, I prepared teaching materials, led weekly tutorials, held regular office hours, met with students individually to help them better understand the course content, and graded assignments and exams. My teaching experience spans a wide range of subjects, including information theory, optimization, probability theory, statistics, mathematics, discrete structures, electronic circuits, and practical computer network laboratories. I feel very fortunate to have gained such broad and diverse teaching experience during my doctoral studies. This breadth will greatly support my ability to teach a variety of courses across different areas when I take on an instructor role.

I would like to highlight one particularly memorable teaching experience: in Fall 2022, I was the sole teaching assistant for the **graduate-level** course *Information Theory*, which had more than **60** PhD students. This was a unique experience not only because I handled a large course entirely on my own without support from other teaching assistants, but also because information theory is my own research

[1] The lecture notes is available at https://yanxiaoliu-mike.github.io/Notes/CIE6010_2019Fall.pdf

area. It was my first time approaching the subject from the perspective of an instructor. Each week, I independently prepared tutorial materials and answered students' questions one-on-one. Through this course, I gained not only valuable experience in teaching information theory, but also the joy of designing the structure of weekly tutorials. This experience also significantly enhanced my ability to connect with students, helping me better recognize and adapt to their diverse learning styles.

Teaching Philosophy

Based on my teaching experiences, I present my teaching philosophy as follows.

- **Build on Prior Knowledge and Emphasize Core Ideas:** I believe the most effective learning happens when new concepts are introduced as natural extensions of familiar ideas. I focus on revealing the underlying structure of the subject, drawing connections across topics, and emphasizing a deep understanding of core principles over covering every variation. This approach empowers students to generalize and apply their knowledge independently, especially in technical fields where foundational concepts recur in diverse forms.
- **Balance Intuition and Formalism:** Many students struggle with the abstraction of technical material. I aim to bridge intuitive explanations with rigorous mathematical formalism, helping students grasp the qualitative behavior behind definitions, theorems, and formulas. In doing so, I encourage curiosity and connect course material to broader themes and advanced topics, fostering intellectual exploration beyond the syllabus.
- **Foster a Collaborative and Engaging Environment:** My teaching aims to create a space where students feel both challenged and supported. I model the learning process by approaching problems with curiosity and openness, including sharing and refining flawed approaches. I structure lectures to minimize cognitive overload and simulate the novice's perspective. By combining enthusiasm, clear preparation, and guided exploration, I cultivate a dynamic learning environment where students feel like active participants rather than passive recipients.

Future Teaching Plans

I list the following courses that I am fully prepared to teach at both undergraduate and graduate levels:

- Information Theory
- Matrix Analysis and Computations
- Statistics
- Machine Learning
- Differential Privacy
- Probability Theory
- Stochastic Processes
- Optimization
- Simulation and Statistical Analysis
- Information Infrastructure Design Lab

Besides, I am open to designing new courses from scratch. I am particularly interested in developing a course on **information theory in machine learning**, which could be project-oriented. In recent years, information-theoretic techniques have greatly advanced the understanding of crucial problems in machine learning. I would include topics like lossy compression and quantization for large language models, communication-efficient federated learning, information theoretic generalization error bounds for stochastic algorithms, rate-distortion-perception tradeoff in image compression, deep learning based goal-oriented compression and neural compression.

Looking ahead, I am excited to bring my commitment to teaching into a faculty role, where I can continue to grow as an educator while contributing to the intellectual and professional development of the next generation of engineers and scientists.