Teaching Statement of Yue Wang

Teaching has been one of my main motivations to apply for a position in a university since I started my role as a PhD student. My interactions with students prepare me to pass on knowledge I learn as a researcher and practitioner to a broader audience. These experiences, in return, inspire me to understand the scope and impact of my field beyond research. Below, I elaborate my teaching experiences, teaching philosophy, and teaching plan.

1. Teaching Experiences

- **Teaching assistantship.** At MIT, I TA-ed *6.869 Advances in Computer Vision*, where I was responsible for grading assignments, hosting office hours, and designing the course project. I shaped the final project to give students opportunities to work on an open-ended research idea and submit the project report to top AI conferences. One PhD student from Harvard physics department incorporated her final project into her dissertation, followed by a publication [Yin+21] on The Astronomical Journal.
- **Tutorials and talks.** I co-organized a CVPR2021 tutorial session "Semantic segmentation of Point Clouds: a deep learning framework for Cultural Heritage" and gave a tutorial on "Deep learning framework and code implementation for point cloud models" to about 40 audiences. I regularly gave guest lectures at different institutes (e.g., Brown's Visual Computing Seminar, ETH's Computer Vision Seminar).
- **Research mentorship.** At MIT, I mentored several undergraduate students and support them to begin research in computer vision and computer graphics. In addition, I helped to organize and launch the ACM SIGGRAPH Undergraduate Mentorship program; through this program, I mentored two students from other countries. These students have been admitted to leading graduate schools in the US and continue working on computer science research.

2. Teaching Philosophy

My teaching philosophy is to *try walking in students' shoes* and to *create an environment that inspire their initiative and creativity*. As psychologists suggest, learning is not a static process of listening to lectures, memorizing proofs, and taking exams. Instead, learning should be an active, social, and personalized process. Below, I summarize how my past experiences have shaped my teaching philosophy that aims to facilitate such process.

- **Learning depends on motivation.** One lesson I picked up when serving as a K12 tutor during my undergraduate study is that the internal motivation typically determines how well students perform on a subject. To motivate students, I will carefully formulate materials as openly as possible by letting students define problems and figure out solutions. In addition, I plan to increase healthy competition in my classes, e.g., by holding a 3D shape classification challenge in a 3D computer vision class.
- **Learning is active and needs context.** "The human mind is better equipped to gather information about the world by operating within it than by reading about it" [MS95]. Indeed, the best way to learn is to engage in a learning context and practice repeatedly. As an instructor, I will give students chances to apply what they learn from classes to real-world questions. In MIT *6.869 Advances in Computer Vision*, we intentionally made assignments and projects open-ended and put class contents in a real context (e.g., our first assignment was to create a pinhole camera). In addition, my experience mentoring undergraduate research made me believe that working on real problems is the quickest way to learn. In the future, I will strive to increase the *practice* part in each assignment and each course project. In addition, I plan to design an course for students to work on real robotic systems and autonomous driving.
- **Learning is personal.** Students have a wide range of backgrounds, learning styles, and goals. I believe it is important to respect their differences and embrace diversity. I aim to create a personalized learning environment for every student. In addition to design project-based and open-ended assignments, we can use flexible evaluation metrics to measure learning outcome. In seminar-style courses such as advanced robot learning and autonomous driving, I plan to host a peer review system for class project to include students' feedback as part of the evaluation.
- **Learning requires accessibility.** My career strongly benefited from many open-sourced courses (e.g., Stanford CS231N Deep Learning for Computer Vision). To pay it forward, I would like to open-source my courses (with permissions) to benefit society beyond my school. I believe this will also be a good practice to develop the brand of my school and research lab.
- **Learning and teaching are mutually beneficial.** Teaching is a great opportunity for undergraduate and graduate students to internalize their knowledge and deliver it to others. My TA experiences helped me understand how to communicate my ideas to the students. I want to return the favor by helping TAs to develop their teaching/presentation skills. I would like to host regular meetings with TAs to collect feedback and help them practice recitation.

3. Teaching Plan

- **Existing courses.** Drawing from my past research and teaching experiences, I come equipped to teach: (i) *Computer Vision*, at both the introductory level and the advanced level. I will cover both classic *geometric vision* (e.g., multi-view geometry, simultaneous localization and mapping) and recent *learning-based methods* (e.g., 3D object detection, neural scene representation). (ii) *Robotics*, from perception to planning and control. This class will include fundamentals and recent developments in *adopting machine learning for planning and control*. (iii) *Computer Graphics*, including fundamental algorithms (e.g., geometry, rendering) and their applications to robotic design, simulation, and arts.
- **New courses.** To appeal to more advanced graduate students, I desire to teach new courses which link to recent research development: (i) *Autonomous Driving* is a vibrant research topic in robotics while there is rarely dedicated class of this topic. I would like to create a course on *building autonomous driving systems from scratch*. This class will focus on both *implementation of robotic algorithms in real systems* and *frontiers in autonomous driving*. (ii) *Advanced Robot Learning*. In addition to the robotics class stated above, I want to teach an advanced robot learning class. This course will emphasize recent works/papers that study how to teach a robot to *acquire novel skills or adapt to its environment through learning algorithms*.
- **Machine learning for STEM and all.** My background in computer science qualifies me to teach a fundamental machine learning course for STEM students and any students who are interested in *applying machine learning to their disciplines*. This course will center on promoting intersections between machine learning and other fields (e.g., machine learning for aircraft simulation).

My ultimate goal in teaching is to demystify AI and to pass on what I know about 3D deep learning and vision to the general public. By fueling the future researchers and engineers, we can speed up the development of 3D deep learning, robotic perception, and autonomous driving.

References

[MS95] H. J. Morowitz and J. L. Singer. *The mind, the brain, and complex adaptive systems*. Addison-Wesley Pub. Co., 1995.

[Yin+21] J. E. Yin, D. J. Eisenstein, D. P. Finkbeiner, C. W. Stubbs, and Y. Wang. "Active Optical Control with Machine Learning: A Proof of Concept for the Vera C. Rubin Observatory." *The Astronomical Journal* (2021).