

Karan Ahuja | Teaching Statement

Throughout my academic career, I have been fortunate to learn from my students, mentors, peers, and teachers. Grateful for their support, I feel the urge to pay it forward by creating the next generation of practitioners, researchers, and innovators through teaching, mentorship, and community service. My approach towards achieving this is encapsulated by (i) understanding and supporting the student's background, abilities, motivations, and goals, (ii) working with students through active demonstrations and experiential project-based learning, and (iii) engaging with students through feedback and practice.

Teaching

I enjoy teaching, and as such, have exceeded the Ph.D. requirements at CMU. I have been a **co-instructor for one class and a teaching assistant (TA) for two others**. In the Fall of 2022, I was the co-instructor for CMU's Machine Learning and Sensing class with Mayank Goel, a class geared towards bridging the gap between theoretical machine learning concepts and the practical sensing applications it enabled. This class had many students who were new to programming and machine learning. For the class, I developed flexible and transparent policies on assignments, along with extended Office Hours and one-on-one meeting times outside of them to better support students. As the instructor, I gave half the class lectures, promoting **problem-motivated learning** by basing lectures on real-world examples and machine learning systems that have been deployed. I also appointed the TA, revamped the curriculum to cover relevant concepts such as Multimodal Deep Learning, Transfer Learning, and Real-time Sensory Data Analysis among others, and invited subject domain experts for guest lectures. I believe in **experiential learning and teaching by demonstrations**. Consequently, I had live coding sessions in my class and designed the assignments such that they built upon each other giving students a broad array of skills for their final project. I gave project groups weekly feedback, helped them scope their goals, and also discussed pathways to publishing for students interested in expanding their projects.

During the Spring of 2021, I was the TA for Building User-Focused Sensing Systems, a course directed toward building and understanding smart human-centric sensing devices. As the instructors were restructuring the curriculum that year, I was tasked with co-designing the assignments and lecture modules. I revamped the assignments from Java to Python, adding support for modern ML and UI prototyping frameworks, and led 4 class lectures. I also gave practical coding demonstrations within the class, which many students found particularly useful as it made the material digestible and approachable. I encouraged students to develop their own initiatives. To facilitate this, I held **expert office hours** where students could chat about their specific projects, research interests, career questions, and other topics of HCI. Many students from the class became interested in HCI research, even took it as an additional minor, and joined research labs to continue working on their projects.

I was also the TA for User-Centered Research and Evaluation during the Fall of 2021, a course that introduces students to User Experience methods in HCI and provides a systematic approach to design. I was responsible for leading weekly recitation sessions for the 20 students in my section. I also graded material, reviewed assignments every week, and helped students identify real-world applications of their UX methods for their projects. Students had positive comments about my teaching: "thank you Karan for the recitation and answering all our questions". Instructor feedback was along similar lines: "You presented with a comfortable lecture style, and were actively engaged with team activities in the classroom." Apart from TA and teaching responsibilities at CMU, I have given guest lectures on Activity Recognition and User Digitization in the Engineering Interactive Systems class at UCLA. My research has also been incorporated into several academic courses at CMU (Applied Gadgets, Sensors and Activity Recognition in HCI, and Designing Human-Centered Software among others).

Mentorship

Mentoring students and empowering them to be future thought leaders and innovators is a big driving force for me. Over the course of my Ph.D., **I have mentored 11 (6 undergraduate, 5 graduate) students, which led to 6 publications at top-tier HCI venues**. These hands-on research experiences were decisive factors in five students choosing to continue their research careers and enter Ph.D. programs at ETH Zurich, CMU, MIT, and the University of Toronto.

I tailor my mentoring style to different projects and students and evolve them over time. For students, with little or no research experience, I start with the **apprenticeship model**, where I first get them acquainted with research methods and critical thinking by working on scoping out problem statements. This approach was evident in Andy Kong, a 2nd-year undergrad at CMU, who

started working with me on Direction-of-Voice (UIST '20), a project utilizing speech as a directional communication channel. He started working on the live-visualization pipeline and the user interface for the data collection and user study. Then, I explained to him the signal processing and sensing modules that I had developed, providing him with a holistic understanding of the project. This helped him build strong technical foundations before working more independently and taking on additional responsibilities. Consequently, I encouraged him to drive his own first-author research project, EyeMU, a gaze + IMU-based gestural interaction technique for smartphones, which resulted in a publication at ICMI '21. I have also mentored Vimal Mollyn, a CMU REU student, and helped him lead a paper at UbiComp '22 on motion and sound-based activity recognition. I am continuing to mentor him and we have another paper under review at CHI '23.

For students that already have prior research experience, I **customize my mentoring to their individual backgrounds, knowledge, and expertise.** This manifests in understanding their goals, creating a shared vision, and consequently devising a roadmap toward it. This was the case with Daehwa Kim, who I met as her session chair at CHI 2021. She had already done research at KAIST but wanted to build her profile for Ph.D. applications for schools in the US. She started working as a visiting scholar in our lab and our work with her resulted in an Honorable Mention paper at CHI '22. Daehwa is now a first-year Ph.D. student at CMU. In the same fashion, I mentored Riku Arakawa, then an incoming HCI Ph.D. student, on his paper RGBDGaze - a multimodal gaze estimation system for smartphones that leveraged the front-facing RGB and Depth data. This led to a publication at ICMI '22 where I was the last author.

As a senior Ph.D. student in the lab, I have been working with my advisors to **shape an open and healthy lab culture by encouraging collaboration between lab members.** To this effect, I led a project with several junior members of FIGLAB that culminated in ControllerPose, a project that embedded cameras in handheld controllers for full-body pose tracking in VR, published at CHI '22. Similarly, I worked on EduSense - a holistic classroom sensing project spanning 15 collaborators across interactions, systems, and learning sciences, which led to 2 publications and our system running live in over 45 classrooms across 3 universities. These experiences have been very rewarding and insightful. I will continue to refine my mentoring approach to help my students learn and grow with greater autonomy.

Community

Beyond teaching my own classes and mentoring students, I have sought to spread knowledge about CS, HCI, and my research area to the broader community. One way I have done this is by being the Editor in Chief (EiC) of ACM Crossroads (XRDS), where I manage a large team of editors from all over the world. I fostered the creation of team structures and roles that value diversity and inclusion (refer to my DEI statement) and am proud to have led the team in producing 8 issues for our 50k readers worldwide. I also disseminate my research broadly to the greater public by producing high-quality, accessible multimedia, which is regularly covered by media outlets such as NBC News, CNN, TechCrunch, and Engadget among others. I have given invited talks at many academic (Stanford, UCLA, U Chicago, UT Austin) and industrial (Microsoft AI Breakthroughs, Apple AI/ML, Meta Reality Labs, Qualcomm, etc) venues to disseminate my research. As a member of the HCI community, I have served as a reviewer for over 100 papers, program committee member (ACM UIST, MobileHCI, CHI LBW), session chair, and organizing committee member for multiple conferences. As a faculty, I will continue these efforts to help foster community outreach.

Future Courses

In addition to general Computer Science courses, my interdisciplinary background equips me to teach a wide range of undergraduate and graduate classes. I look forward to courses that teach the fundamentals of HCI ranging from its history to user research methods, UI/UX design, prototyping, and evaluation. Potential courses along these lines are Introduction to HCI, User-Centered Research Methods, and HCI Process and Theory. Apart from these, I feel confident in designing and teaching advanced topics that I specialize in such as Applied Machine Learning, Signal Processing for HCI, Machine Learning and Sensing, Ubiquitous Computing, Health Sensing, Human-AI Interaction, Interaction in Extended Reality, and Prototyping Interactive Systems.