Teaching Statement

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I seek to engage students through active, inclusive classroom experiences that connect the dots between fundamental skills and students' personal goals and passions. ***I teach Computer Science (CS) and more specifically Computer Vision and Machine Learning (CV/ML) as impactful tools for social and environmental good.*** I build strong interdisciplinary learning environments that both teach computer science students how to engage effectively with real-world problems and empower ecologists and conservationists to build CV/ML tools to answer their own ecological research questions and effectively monitor protected areas.

This philosophy is informed by my own non-traditional path to STEM. I am passionate about art and environmental sustainability, both of which seemed disconnected from math and CS during my early education. After my first career as a ballerina, I studied at Seattle University, an institution with social and environmental justice at its core. It was through this lens that I learned how CS can facilitate scalable, accessible social and environmental impacts. By connecting CS to my own passions, I found a sense of belonging in the field that was previously absent . Experts on inclusive teaching practices attribute the attrition of diversity in STEM majors in part to this lack of social belonging [2]. I base my own teaching practices on this pedagogic research by clearly demonstrating and emphasizing the potential real-world impact of technical skills and tools, learned in both rigorous courses of study and early research experiences, as an opportunity to foster present and future diversity in STEM.

Teaching fundamentals through the lens of real-world problems

My teaching practices empower students to make real impacts and demonstrate the effectiveness and promise of CV/ML as a tool for public good. This year I adapted the projects-focused "Advanced Topics in Computer Vision" course at Caltech to focus on conservation and sustainability. To set up project groups for success, I curated a set of ecological challenges with publicly available image and video datasets and matched projects to NGOs and research groups that would directly benefit to provide domain expertise and context. I mentored 5 teams of computer vision students in structuring these real-world challenges as CV problems, and assisted them in holistically evaluating their solutions and effectively communicating them to both CV experts and the ecological community.

I am passionate about democratizing access to the powerful tools and technical skills found in in CV/ML. ***I am developing the curriculum for a three week summer school*** [1] ***designed to teach applied computer vision to senior graduate-level ecologists, where each student will bring their own ecological question and relevant data and leave the course with a prototype system to process the data using state of the art computer vision methodologies.*** I have secured funding for the school for the first three years from the Resnick Sustainability Institute, Microsoft AI for Earth, and Amazon AWS. One of the main goals of this summer school will be teaching the thought process behind computer vision. Beyond fundamental concepts, we will teach the intuition behind how a computer vision researcher might (1) define a specific ecological problem

[1] cv4ecology.caltech.edu

within the framework of ML, (2) build a dataset, (3) select model architectures, and (4) evaluate performance – teaching how we think, instead of what we know [3].

Designing inclusive, student-centered learning experiences

My teaching practices result in student learning outcomes that support their career goals. ***I took the Caltech course "Principles of University Teaching and Learning in STEM" to learn to apply modern pedagogical tools in my teaching, including backward design, active learning, improved student assessment, and building inclusive classrooms*** [1, 5]. I applied these teaching tools while co-instructing "Advanced Topics in Computer Vision." We explored different active learning approaches in a virtual classroom and found prerecording lectures and flipping the classroom in order to devote in-class time to open discussion sessions and hands-on project mentorship [1, 5] in small groups dramatically increased student engagement. We adapted the course to include weekly project update presentations which helped students grow comfortable communicating their work and receive direct feedback to improve their technical communication skills – a vital skill for future careers in science and in industry.

Mentoring the research process end-to-end

I seek to provide mentees with valuable research experiences no matter what level they are at or discipline they are from. ***I have led and mentored a diverse set of research projects in both computer science and ecology, for students from high school up through PhD, as well as in industry, leading teams of engineers on projects at Google and Microsoft.*** I take pride in learning the personal and professional goals of my students and working with them to define projects that further those goals, providing enough guidance and support to set them up for success while giving them freedom to investigate and pursue alternative approaches. My mentorship includes guidance in all aspects of a successful scientific career, including my own learned best practices for organizing research documentation and code and how to effectively communicate research to broad and highly specialized audiences across disciplines. An example of my approach to research mentorship: I worked with a Caltech undergraduate student to develop a human-AI system for long-term elephant population monitoring [4]. I mentored him through the research process, from initial problem formulation to our development of methodology which combines computer vision and expert knowledge for re-identification. I brought my student with me to Kenya to deploy our system and work on-the-ground with our local ranger team. Our field visit led us to expand our system to include injury tracking for human-wildlife conflict. He is graduating early, and will spend the six months before he starts his PhD in computer vision as a Conservation Technology Research Fellow in the Greater Mara Ecosystem, an opportunity I designed and funded via the Allen AI Institute.

Developing and teaching courses

I am comfortable teaching courses in computer vision, machine learning, and deep learning, at both the undergraduate and graduate level, and I have experience teaching these subjects across disciplines. I've built tutorials for ecological audiences including a workshop on machine learning for aerial wildlife surveys for the US Fish and Wildlife Service. I've taught CV/ML experts how to work with real-world data from static sensors via 2D3DAI, and I've given guest lectures on using computer vision for ecology and biodiversity monitoring for CV/ML courses at Caltech and Georgia Tech. In addition, I can instruct introductory mathematics and programming, as well as advanced topics courses aligned with my research interests e.g. object recognition with context, multimodal computer vision, and distributional robustness and generalization.

[1] Deslauriers et al. Measuring actual learning versus feeling of learning in response to being actively engaged in the classroom. *Proceedings of the National Academy of Sciences*, 2019.
[2] Dewsbury et al. Inclusive teaching. *CBE—Life Sciences Education*, 2019.
[3] Talanquer et al. Let's teach how we think instead of what we know. *Chemistry Education Research and Practice*, 2010.
[4] Peter Kulits, Jake Wall, Anka Bedetti, Michelle Henley, and **Sara Beery**. Elephantbook: A semi-automated human-in-the-loop system for elephant re-identification. *Proceedings of the 4th ACM SIGCAS Conference on Computing and Sustainable Societies*, 2021.
[5] Tanner. Structure matters: twenty-one teaching strategies to promote student engagement and cultivate classroom equity. *CBE—Life Sciences Education*, 2013.