Statement of Teaching Interests

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Undergraduate Teaching Philosophy: As an undergraduate course instructor, my goal is to keep undergraduate students motivated and engaged by always linking the taught material to real use cases in robotics, machine learning, or computer vision. By presenting solid connections between abstract theoretical results and practical engineering applications, I provide my students with the ability to integrate knowledge gained across all levels of their undergraduate studies to formulate innovative strategies for solving engineering problems. During my teaching at the University of Waterloo, I effectively employed my second year general mathematics course tutorials to relate the tutorial's learning objectives to real problems in robotics, machine learning, and computer vision. I took five minutes at the beginning of each tutorial session on *Advanced Calculus* to provide a real-life use case of the concept I taught in relation to my research. As an example, before the tutorial on the chain rule for partial derivatives, I explained in a few simple slides how the chain rule relates to optimization approaches used to train deep neural networks. By linking mathematical concepts to my research, I sparked enough curiosity in some of my second year mechatronics students to approach me for research opportunities related to machine learning. During the subsequent term, I collaborated on two conference publications with undergraduate students who took my *Advanced Calculus* course. The students found concepts from the *Advanced Calculus* course essential when solving real robot perception problems using deep neural networks.

Graduate Teaching Philosophy: As a faculty member, my goal is to advance graduate students' curiosity, passion, and knowledge about the topic I am teaching. I do so by engaging students as colleagues and guiding them to become active contributors to knowledge, creativity, and innovation. To that end, I design graduate courses around a substantial independent research component by balancing advanced concept delivery with research-based projects that can be tailored to the personal goals of enrolled graduate students. Research-based course projects foster independent thinking and scientific writing skills, two important skills for the success of both course-based and thesis-based graduate students. I also incorporate multiple presentations where graduate students read and present state-of-the-art papers related to the topic at hand, improving their public speaking skills and preparing them for presentations in industrial or academic careers. Following this philosophy, I created the graduate course, *Perception for Autonomous Driving* [1], during my second year of PhD studies at the University of Waterloo. I delivered weekly lectures on the mathematics of deep neural networks and also had weekly student presentations on state-of-the-art papers related to the course topic. For the final course project, I personalized the learning experience of every graduate student in the course by allowing them to determine the scope of their course project, while making sure that their projects were feasible and could be completed by the end of term. As an example of the success of this approach, one of the students taking the course also worked as a robotics engineer for Clearpath Robotics. This student used the final course project to successfully develop a novel neural network perception system for their company's underwater robot. Other students used the course project to jump-start new research directions for their thesis. The videos of my lectures were released online as open-source content. The response to this course was overwhelmingly positive; I received multiple correspondences from many undergraduate and graduate students across the globe asking for deeper insights and clarifications on certain topics in the lecture videos.

Student Supervision Philosophy: While supervising graduate students during my academic career, I found that adapting to each student's personal needs and research background is a good approach for maintaining their motivation and productivity. Some graduate students come from a strong research background or are highly self-motivated, and thrive under little supervision. Other students require me to be more involved as a supervisor by closely guiding them on defining and solving problems in literature to prepare them for independent research. To accommodate for all students from various backgrounds, I will prepare an introductory workshop for all new members of my Laboratory on topics such as completing a literature review, how to read and write academic papers, how to use the available robot hardware, and good coding practices. I will also take the time to understand the goals of each student I supervise, and work with them on tailoring their research project to suite these goals. Using this philosophy, I have successfully mentored students at all levels, with the majority of supervised projects translating into published academic work.

I believe that the high quality research we produce as academics in engineering is propelled by well-trained undergraduate and graduate students. I will continue to hone my teaching and supervision skills through professional development courses and through learning from my experience with students throughout the rest of my career.

References

[1] A. Harakeh, "Perception for autonomous driving – spring 2017." `http://wavelab.uwaterloo.ca/indexaef8.html?page_id=481`, 2017. [Online; accessed 23-November-2020].