

Academic Statement of Purpose; PhD Application for the University of Michigan

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Computer Science, PhD Application

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When I was eight, I dreamed of getting my PhD, fixing General Relativity at atomic scales, and changing the world. Fourteen years later, nearing the end of my dual undergraduate degrees in computer science and cello performance, surprisingly little has changed—only the field of study. I am still emphatically determined to make my difference in the world through research and exploration. My focus, however, is no longer astrophysics but rather computer science. In particular, I am interested in the intersection of computer science with education, ethics, and policy. I want to build and develop systems that help students of all backgrounds understand and manipulate the technology which increasingly forms the backbone of our society. Specifically, I am interested in the effectiveness and design of tools such as autograders, educational code visualizers, visual debuggers, and compiler error messages. The University of Michigan is the perfect place for me to pursue these research goals. During my undergraduate here, I have fallen in love with the campus and town. Most importantly, though, the computer science department here is fantastic; there are so many professors here that have inspired me, are doing exciting work in the area I'm interested in, and who I would love to work with. I am therefore eager to continue my studies at the University of Michigan as a computer science PhD student.

I have excelled in and thoroughly enjoyed a variety of undergraduate courses that will help me in my graduate studies, including Operating Systems, Computer Networks, and Machine Learning. As a dual degree student, I have also taken various music history courses, performed in chamber ensembles, and regularly practice my cello for hours on end. Balancing the demands of my two degrees has engendered excellent time management, communicative skills, and a diverse approach to problem solving in both fields. However, it isn't the courses I have taken but the courses I have taught that have most shaped my doctoral aspirations and prepared me for achieving them.

Over the last four years, I have had the privilege of being an instructional aide for computer science courses spanning the undergraduate curriculum. My first teaching experience was during the first semester of my sophomore year, when I was on the staff of EECS 183: Elementary Programming Concepts. This course is the prerequisite for the prerequisites for the computer science major; seventy percent of students who enroll in the course have never even seen a line of code. EECS 183 introduced me to the absolute joy and excitement of teaching students who know virtually nothing about the topic. It also, however, exposed me to some of the challenges inherent in computer science pedagogy. How do you get students who learn in vastly different ways to collectively visualize something that is codified abstraction at its core? Furthermore, how can you effectively and efficiently grade in a way that is constructive for the student while still enforcing real-world problem solving? Working on EECS 183, therefore, solidified my passion for computer science. I have

decided to continue onto graduate school in order to focus on alleviating the educational challenges I observed.

After four semesters on EECS 183 staff, I was asked to be an IA for the upper-level EECS 490: Programming Languages. This was an incredibly exciting opportunity because EECS 490 hadn't been taught at UM for ten years. Therefore, I not only learned the course material in advance, but also helped develop the course infrastructure. My duties included developing scripts and criteria for automated grading of projects and code-based assignments, tasks which presented a challenge because the course assignments were in a variety of programming paradigms requiring innovative autograding solutions. The following semester, due to my investment in the course and my enduring curiosity, I undertook a directed study to analyze data collected in EECS 490 and draw conclusions about the course and ways to improve it. I also developed more homework problems and projects, improved the syllabus, and ameliorated the structure of existing projects for easier autogradability. Currently, I am again an IA for EECS 490, and it is incredibly fulfilling to see the work I did in my directed study successfully improve the course.

My passion for research was further fueled by my internship at MITRE, a federally funded research center, where I worked on a variety of research and data analysis projects, many of them confidential or classified. One project I can discuss, however, was my work on TIREM, an application that models radio wave propagation loss over a spherical earth with rough terrain. Through my investigations, I identified several discrepancies in still-used legacy versions of TIREM, fixed these issues, and generated a platform-independent version that improved TIREM's numerical stability, efficiency, and accuracy. For my work, I was awarded a MITRE Special Recognition Award, an honor rarely granted to interns. I also absolutely loved designing experiments and identifying and solving problems. This experience confirmed my desire to pursue my doctoral degree in computer science.

My dual degree and extensive teaching experience have greatly prepared me for graduate study. I have excellent time management, perpetual curiosity, and proven research skills. I ultimately plan to conduct research and teach as a professor at a university. As an impassioned advocate for diversity, both in academic thought and in demography, I hope to influence policy decisions about the role and implementation of computer science in both local and national school systems. As technology advances, so should education methodology. Attaining a PhD is essential for achieving these dreams, and a PhD from the University of Michigan in particular would allow me to explore the areas I am most passionate about.