Personal Statement - John Wu - CSE PhD

On the surface, nearest neighbors, regressions, neural networks, and A* are simply machine learning algorithms that perform different objective functions. However, what lies underneath reveals a whole set of intuitions behind what learning is and its relation to computing. As I continue to be stimulated by the challenges of machine learning coursework and my time working in an immunology and computer systems lab during my undergraduate career, I realized my love for machine learning was analogous to a cost function. The more I delved into its landscape, the more I wanted to go deeper. Each lecture and project became a step towards understanding the theory of machine learning and its application towards improving our standard of living, whether it's through automation or uncovering cell behavior.

My time working on parameter estimation software for rule-based modeling in an immunology lab has shown me the endless applications of machine learning in understanding biological processes. To further understand single-cell systems, scientists design their hypotheses in the form of either equations or agent-based models that define the rules of cell behavior. In such models, numerous parameters must be estimated from single-cell data. In parameter estimation, machine learning algorithms provide a unique solution in accelerating our understanding of cell behavior. Every Monday, seeing the amazing work done in understanding immune cell behavior and protein engineering through generative deep learning algorithms during our literature reviews excites me about the future of machine learning in medicine.

Furthermore, my time in a computer systems lab has shown me the potential of machine learning's application towards the automation of time-consuming yet vital tasks. By working with another undergraduate student, we benchmarked different models on different niche datasets, including ones related to agriculture. Although our intended goal was to understand the relationship between a model's performance and different datasets, through interacting with computer scientists working on automating crop disease detection, I had been exposed to the many ways that machine learning is helping farmers today. In automating tasks that were once strenuous, the time saved is often redirected to other important tasks, or more importantly, rest, which is key to maintaining a farmer's already task-saturated week.

Both of these experiences have been transformative in furthering my confidence and my desire to work on machine learning problems. It is with this burning passion that I am applying to the University of Michigan's PhD computer science program.