

Mark Kim

Statement of Purpose

As a graduate student researcher at San Francisco State University (SFSU), I have had the opportunity to explore diverse research areas. During my undergraduate studies, I was also provided the opportunity to work closely with several professors in the fields of Statistics, Mathematics, and Mathematics Education, which included change-point analysis, graphical models for brain networks, and remote instruction pedagogy in Mathematics. This work segued into a summer at the University of Houston's NSF funded REU program followed by another summer working as a research engineering intern at Cofense Inc. These experiences have culminated in my current role in two projects: supporting early stage computer science undergraduate students; and utilizing large language models (LLMs) for college program advising to maximize student success. As the program lead for "AI-STAARS," I, under the supervision of Professor Anagha Kulkarni and Professor Shasta Ihorn, work closely with students with the aim to improve retention and academic achievement in Computer Science through providing academic support and stimulating students' sense of belonging and identity. Working under Professor Hui Yang on the "AdvisingGPT" research team, we are investigating methods to provide automated course equivalency evaluation and personalized academic advising, which includes approaches such as instruction fine-tuning, retrieval-augmented generation, prompt engineering, and more traditional machine learning techniques.

Coming from a teaching-oriented, as opposed to a research-oriented, school such as SFSU, the opportunities for participating in research are sparse, so I have had to be extremely proactive in seeking out and creating my own opportunities. Not being able to find faculty whose interests or expertise lie in the specific area of research I am most interested in has not deterred me. Instead, I have followed avenues of study that I can build upon towards my future research and

career goals. Between my active engagement with the computer science community through leading several student organizations, qualitative research in Professor Ihorn's psychology lab, quantitative research with Professor Yang, and my choice of coursework, I have been consistently and persistently equipping myself for graduate study in computational bases of cognition, and I believe that UC Berkeley is the perfect school for me to continue this journey.

Building on my experiences in education and programs like "AI-STAARS," my academic journey has deepened my fascination with the intersection of artificial intelligence and human cognition. While applied AI technologies like ChatGPT and Gemini capture the public's imagination, their limitations highlight the vast chasm that still exists between human and machine intelligence. My curiosity lives in this space and drives my desire to explore biologically plausible neural networks, not only as a means to emulate intelligence but also to uncover insights into the intricate interplay between motivation, learning, and decision-making. Such explorations align with burgeoning research areas like continual and localized learning, both of which offer promising avenues to bridge the gap between artificial and biological systems. Recent work into continual learning use a combination of multiple techniques to allow artificial neural networks to consolidate synapses to mitigate forgetting and strengthen connections between contextual information. Similarly, exploring mechanisms of localized learning could provide insight into neural network optimization where parts of a neural network are updated from local signals rather than being dependent on the entire model.

Many breakthroughs in artificial intelligence have deep roots in biomimicry, and I believe that we still have much to learn from the disciplines of psychology and cognitive science. In the context of Cognitive Behavioral Theory, I would like to examine the link between the behavior, emotions, learning, and metacognition. This could take many forms such as expanding upon recent research examining the semantics of different emotional or behavioral states captured by embedding models or delving into the latent representations hidden within different neural networks. Questioning our own understanding and reflecting upon our thoughts is a hallmark of human cognition, learning, and long-term decision making. Combining all of these separate, yet related subjects could unlock new paradigms of artificial intelligence.

My interest in artificial intelligence extends beyond an intellectual interest in computers and computation. In fact, my passion is closely associated with the cognitive sciences. Researching novel neural networks that more closely mimic biological systems could help uncover a greater understanding of the human mind. Creating models of cognition that closely simulates biological brains could unlock new insight into neurological diseases, mental illness and wellness, and learning. By pursuing a doctoral degree in Computer Science at UC Berkeley, I will have the opportunity to join the Graduate Designated Emphasis in Cognitive Science. Leveraging the diverse community of paragons in computer science with the expertise housed in the Graduate Group in Cognitive Science would provide a nearly unparalleled resource equipped to assist me with my research interests. It is my hope that through my journey I will be making incremental discoveries towards unearthing more powerful and effective models of intelligence while broadening our understanding of the interrelationship between affect, cognition, and behavior.