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Statement of purpose

I've always been obsessed about wanting to understand how the brain and mind work. As early as my teenage years, my dream has been to understand the neural circuitry behind our decisions, feelings and perceptions. To fulfill this curiosity, I pursued degrees in the fields of psychology and neuroscience. The more I learned about these topics, the more amazed I became at how complex and fascinating the brain is. There will be a day when we understand how the brain manages to transform simple photons on the back of the retina into the perception of a home, or even how our mind decided to buy that house in the first place. I'm curious to see what such theories will look like, and I want to study computational neuroscience so I can help us get there. I am especially interested in neuroplasticity since I believe it is thanks to neuroplasticity that neurons learn to work together to solve complex tasks. Obtaining my PhD at the University of California at San Diego would be ideal as I could learn from leading experts in neuroscience and neuroplasticity.

My first real taste of research was in my third year of undergraduate studies, where I was given the opportunity to be in charge of my own research project. My work afforded me a first-author publication in the Journal of Cognitive Neuroscience titled **"Modulating episodic memory alters risk preference during decision-making"**, where we found that engaging episodic memory processes increased preferences towards risky decisions. I built this project from scratch and did almost everything including writing the ethics proposal, programming the computer task, testing participants, analyzing data and writing the paper. Completing this project helped me develop more autonomy and made me realize me how fulfilling it is to carry out my own research. This project prepared me to start my Master's degree and become a graduate student.

My master's thesis, "**Transient inhibition to light explains stronger V1 responses to dark stimuli"**, aimed to study the mechanisms behind stronger responses to dark than light stimuli in the primary visual cortex. We used machine learning to do system identification of recorded V1 neurons. We discover the stronger dark responses found by previous research (Jin et al., 2008; Shapley et al., 2009) to only occur at early latencies, and to be due to slower intracortical inhibition to dark than light stimuli. During this research project, I greatly improved my machine learning skills, learning how to use Tensorflow to build my own custom, biologically-inspired convolutional neural network. I also developed a solid expertise in both visual neuroscience and electrophysiology, on top of learning how to review and understand the literature to relate my results to it. The preprint of this work is currently available as a BioRxiv, and we are working to get it published in a peer-reviewed journal.

During my master's, I published a paper entitled **"Visual perception of texture regularity: conjoint measurements and a wavelet response-distribution model"** where I created the extension to an advanced statistical method to analyze our experimental data. We found the effect of jitter on regularity perception to be strongest at small element spacing and large texture element size, suggesting the visual system uses the edge-to-edge distance between elements as the basis for regularity judgements. This work was published in PL0S Computational Biology, and received compliments from Kennett Knoblauch, who invented MLCM.

We are rich in knowledge about how neuroplasticity works at the cellular level, but there is still little we understand about how these rules allow neural circuitry to solve complex problems. To make a difference, I want the next step in my research career to be studying computational models of neuroplasticity. An example project I am interested in would be to make computational models of neuroplasticity in hippocampus or primary visual cortex. I dream of being given the opportunity to obtain my PhD at the University of California at San Diego, as it has some of the best researchers in theoretical neuroscience. This includes Dr. Marcus Brenna, who does amazing theoretical research studying synaptic plasticity and memory consolidation. This also includes Dr. Johnatan Aljadeff, who does does great work studying computational models of neuroplasticity and electrophysiology data in bats. I am certain doing research for such supervisors would be both fascinating and propel my research career to the next level.