As transistors are approaching a physical limit on miniaturization, it will be necessary to use alternative computer architectures to continue to improve the processing power of machines. I believe that biologically inspired massive parallel architectures will be the key to unlocking a wide variety of tomorrow's technologies, such as radiation-tolerant deep space computers, low-power rapid image and audio processors, and advanced personalized education. Today's technology provides us with the necessary tools for building and simulating large neural networks to gain insight on the hidden layers as well as understand how to effectively encode and process information. Although it has been demonstrated with custom FPGA systems that massively parallel neural networks are superior to traditional computer architectures such as GPGPUs and CPUs, massively scalable systems have yet to been built successfully. This is because the neuroscience community focuses on building the tools for making small networks in order to bring studies through the proof-of-concept stage. Because I have gained significant experience using Altera FPGAs as an undergraduate, as well as real-world industry experience in designing, testing, and building electronic hardware and low-level software. By introducing novel innovative ways of simulating the thermodynamics of neurons on FPGAs, it may be possible to solve the scalability issue. This increase in scalability will inevitably cause simulations to run into the memory wall, as fetching data out of RAM will become the bottleneck rather than the processing speed of the network. Therefore, it would be advantageous to have a large input layer to the neural network that comes from a device such as a silicon retina, rather than RAM. The entire vector of data from this kind of sensor would be readily available to the network immediately, similar to how the brain processes sensory input, eliminating the issue of the memory wall.

"Joggling" is the sport of running and juggling simultaneously, and it has become an inseparable part of my identity. Not only has it been a way of challenging my body physically and mentally, but it has allowed me to begin tackling one of my long term goals; providing personalized education globally. Though training and setting three Guinness World Records in the sport proved to be difficult on its own, using the publicity to raise support for Rhotia Valley, Tanzania was what made the feats truly fulfilling. The primary school in this village was trying to introduce One-Laptop-Per-Child computers into the curriculum to give young students the opportunity to use technology to pursue their interests and become members of the 21st century. Furthermore, this progressive application of low-power, sophisticated electronics appealed to my background as an Electrical Engineer and inspired me to get involved.

Although studying Electrical Engineering as an undergraduate has given me a deep understanding of modern electronics at all scales, from the solid state physics of devices to the architecture of global networks, I believe that neuromorphic engineering will be a huge player in the future of computing, regardless of whether traditional CPUs are still used or not. Therefore, the digital design and software concepts I learned as an undergraduate will not necessarily translate well when developing on neuromorphic systems. My studies in the Department of Engineering will give me the most rigorous understanding of neuromorphic technology and allow me to work ahead of the trajectory of the field, rather than behind it. As stated by the computer pioneer, Alan Kay, "those who are serious about software build their own hardware," because it is only possible to build fully optimized software when the designer has a profound understanding of the underlying hardware and architecture. Ultimately, I hope to leverage neuromorphic systems to solve the two problems that are most important to me; advanced personalized education, as it is one of the Grand Engineering Challenges of the 21st century, and radiation-resistant computing in deep space, as spending time working at SpaceX has only galvanized me in my goal of making humans a multiplanetary species.

"Joggling" is the sport of running and juggling simultaneously, and it has become an inseparable part of my identity. Not only has it been a way of challenging my body physically and mentally, it has been a vehicle for targeting specific issues that are important to me. When I first heard about Rhotia Valley, Tanzania, my engineering side was inspired by the community’s mission to incorporate One-Laptop-Per-Child laptops into the primary school, as it applies low-cost, robust technology to proliferate education and bring more of the world into the 21st century. I successfully broke two joggling world records to raise support for this project, and although it was satisfying to break 22-year-old records, the partnership with the community in Rhotia Valley made the feat truly fulfilling.

One year after these records, I travelled to Japan and meet some victims of the Tohoku Earthquake in Minamisanriku. One of the most memorable parts of the trip was when one of the elder men in the town told us, “when you return to the big cities in America, do not forget about us. The media forgot about us but we are still struggling.” This moment galvanized me into taking action while conducting summer research on nanomaterials at Rice University. I decided to set a third record to raise awareness and support for this Japanese community, spending countless hours training and assembling a team of coaches, media, and supporters to help out. Though I was successful in breaking the record and raising support, this journey was sprinkled with unusual challenges, such as being invited for a live radio interview for a Minnesota station whose premise turned out to be humiliating their guests. The experience of candidly responding to their malicious banter and demeaning of the situation in Minamisanriku with composure and eloquence was a turning point in my personal growth. It was the most piercing antagonism I have ever received in my decade-long joggling career, but taught me the importance of strong commitment and leadership.

My passion for joggling is a reflection of my passion for engineering. Although my research and industry experience has been an eclectic mix of nanomaterials, space electronics, and photonics, these experiences have driven me towards my true interests. They have instilled me with the mindset to have a creative and interdisciplinary approach to neuromorphic engineering, which will be necessary as the paradigm of computing changes. My background in Electrical Engineering has allowed me to master the basic tools to build complex electronic systems, and being able to apply them to the BIMPA project in the Computer Laboratory at the University of Cambridge would allow me to help pave the future for the next generation of computing. Ultimately, I hope this new technology will enable my two long-term goals; making humans a multiplanetary species and advancing personalized education. Although I have already taken steps in working towards these goals, through my experience at SpaceX and my work with Rhotia Valley, there is still much work to be done.