Studying Electrical Engineering as an undergraduate has given me a fundamental and applied understanding of modern computing technology, from the smallest level of PN junctions to the largest level of global networks and signal processing. I feel that this level of understanding of electronics may have been very advantageous to working on the frontier of technology, but is now a fact that we are approaching the physical limit on the miniaturization of transistors. It will soon be necessary to design innovative technologies that require interdisciplinary and unconventional research in order to keep up with Moore’s Law and continue to make better computers. Some of the current contenders for the future of computing include carbon nanotube transistors, quantum computing, and neurosynaptic architecture. As stated by the influential computer pioneer, Alan Kay, “the best way to predict the future is to invent it.” I anticipate that neurosynaptic architecture will be a significant player in the future of computing, and I plan to be involved in the development of this technology. Because of its low power consumption, massively parallelized data processing, and ability to use heuristics at the hardware level, neurosynaptic computing has inherent advantages that make it superior to alternative technologies in certain applications. Specifically, advanced personalized education and human exploration in deep space are two phenomena that I strongly believe in and can be assisted with this technology.

I had been a “joggler,” or runner who juggles, for many years before ultimately training and setting a few world records in the sport. During the summer after my freshman year, I decided to use the publicity from my world record attempt, the fastest 400m while juggling 5 objects, to raise support for the primary school and children’s home in Rhotia Valley, Tanzania. The community is introducing One-Laptop-Per-Child devices into the education system to allow young kids to connect with the world, gain experience with computers, to satisfy their own curiosity, and become members of the 21st century global community. From a cultural perspective, I found this program fascinating and inspiring and wanted to get involved. From a technological standpoint, I was excited to see low cost, efficient, and well-designed technology be applied constructively to solve problems, as I studied electrical engineering as an undergraduate.

This project, however, is just the tip of the iceberg that is my passion for education. According to the National Academy of Engineering, one of the greatest engineering challenges of the future is advanced personalized learning. Although the proliferation of education through the One-Laptop-Per-Child program inspired me to use my talents to get involved, I believe that much larger revolutions in education are on the horizon as technology advances. It is important to equip children worldwide with the internet, which is essentially an encyclopedia with the entire knowledge of the human species, but personalizing each student’s education in order to maximize his/her potential is much greater task. While a human teacher can presumably provide a student with a very powerful and customized education, it is not logistically feasible to have one teacher for every student. Machine learning and neurosynaptics will be the key to cracking this global challenge.

On another note, it is impossible to work at SpaceX and not dream about the future of humans in space. Being around the brightest engineers and cutting-edge space technology has only intensified my long-term goal of helping humans become an interplanetary species. One of the current challenges with deep space exploration is that radiation has the ability to flip bits and corrupt data. Modern CPUs are highly susceptible to errors in the way data is bottlenecked through the processor without much redundancy. However, neurosynaptic architecture has an inherent advantage, as it processes data in massive, parallel networks, in addition to consuming a fraction of the power that modern CPUs use.

However, it was the result of many eclectic research and internship experiences that led me to converge on these two specific goals and dreams about the future of technology and the role of neurosynaptics. My first research experience was at Pennsylvania State University, designing and building MRI microcoils for imaging individual cells. Here I learned about circuit resonance and design, as well as standard laboratory procedures and methods. I had the chance to use 7T and 14T MRI coils and design my now Helmholtz resonators with remotely tuneable resonant frequencies via varactor diodes. Although this project was academically interesting, I later found other kinds of work that I enjoyed more.

The next summer, I was simultaneously accepted into the NanoJapan program through Rice University and as an intern at SpaceX. I decided that both were extremely valuable experiences and took off school in order to pursue both.

First, I had the opportunity to practice my Japanese skills that I learned in classes at the University of Florida, as well as study material Science from Japanese professors in Japan. However, because of the Fukushima incident, I conducted my actual research in the Ajayan Lab at Rice University. Although I did not get a chance to immerse myself for longer in Japanese culture and practice my Japanese skills that I spent about three years developing, I gained a lot of experience working with graphene and nanomaterials for energy storage applications. Furthermore, being at Rice University gave me the opportunity to train for and set a world record in “joggling,” or running and juggling simultaneously. One of the weekends I spent in Japan was a trip to Minamisanriku, a small village that was devastated by the Tohoku earthquake and tsunami. One of the most memorable parts of the experience was when one of the elder men in the town told us (in Japanese), “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 and I became determined to set a third world record to raise support and awareness for this community

Immediately after, I went to Los Angeles to work in Avionics Integration at SpaceX. This juxtaposition of fundamental scientific research and results-based industry work had a profound affect on my academic trajectory. While research at Rice was exciting and cutting-edge, seeing my work fly to space at SpaceX was enthralling. While research was full of dull moments waiting for chemical reactions to occur, SpaceX moved so quickly and put me under so much pressure that it was sometimes difficult to catch my breath. I decided that nanomaterials was not a field that I would enjoy spending the rest of my life in, nor was Avionics Integration.

One of my SpaceX projects, however, threw me a bone. I worked on the thermal imaging systems that monitors temperatures of the vacuum nozzle on the second stage of the F9R rocket. This sparked a heavy interest in photonics and led me to take a Photonics class at my university and apply to the Optics in the City of Light REU through University of Michigan. My project was designing and characterizing a full-field optical coherence tomography setup that could be coupled with optical tweezers for cell-level biological studies. Although I found this to be the most interesting and exciting work up to that point, I was still not satisfied settling on photonics as a career. I was developing a deep interest in computer and information science at the time.

I returned to SpaceX the next summer in the Hardware Development department to see if I would enjoy the hardware-software interface in industry. Although I found, for the second time, that SpaceX is not where I want to establish my career, I had the chance to work on a project that employed a small amount of machine learning in order to automate certain parts of the rocket design process. I loved programming the various algorithms and continued to learn more about the subject.