

Around the middle of the senior year of high school, I was very confident that I would spend most of my career as professional musician. Although I was only moderately proficient in guitar performance and studio recording, I was strong at music theory and composition for my age despite no formal education. My ego was fed through my status as the lead guitarist in a garage-band and constant awards and appraisals from my high school peers and music directors- but illusions can only last for so long. As I began to expose myself to more serious musicians, it became apparent that a career in the music industry was not a practical choice for someone like me.

In the Fall of 2017 I was enrolled in the Physics Department at the University of New Hampshire, and it became clear that a career in STEM was far more viable for my skill set, and something that I enjoyed just as much. I began my first research project in the UNH physics department, and soon I started making more time for the schoolwork and less time for the guitar. While I remained involved with music ensembles and wrote music for a Capella groups on the side, I could feel this large part of me slipping away. Music was more than just something I did, it was part of my identity, and that identity was fading. Garage band rehearsals were transformed into late nights programming for research meetings, scales and arpeggios became black-board exercises, and guitar lessons became the lecture hall. Something that I had previously devoted my life to was just a piece of the past.

By Fall 2019, I finished my project in the Physics department, and a former TA differed me to a new project with Dr. Kevin Short in the UNH Mathematics Department. Dr. Short presented me with a project that involved constructing a neural network that could learn to map a soundwave to the musical instrument that produced it. This was the chance to resurrect my musical side that I had been searching for. To succeed in the project, it would require the development of a set of features or predictors of sound waves that could represent the waveforms in compact and efficient forms. The world of music had collided with my passion for research. Suddenly musical timbre and Fourier Analysis, waveform envelope and Hilbert Transformations, human sound perception and digital signal processing were all halves of the same ideas. The same concepts from guitar and music theory that guided me to a musical career were now integrating with my mathematical and programming skills, allowing me to quantitatively describe a waveform or signal, which could be used in neural network classification.

While I had previously done a great deal of work in numerical computation, this has project also brought out a new, previously unfounded set of skills in machine learning and the desire for *more*. I have spent the last year continuing my research with Dr. Short and building up the necessary skills in signal processing, mathematics, and optimization to begin a proper career in the field of machine learning. Additionally, I partook in a project with Dr. Qiaoyan Yu in the UNH Electrical and Computer Engineering Department where I was able to merge math and my new experience with machine learning and python simulations. I was given the opportunity to present my research at the 2020 UNH URC and co-author three papers in the summer of 2020. To really strengthen my knowledge and experience, I seek to continue my education with a program such as applied mathematics to further delve into the grit of the field and better equip myself with the pertinent skills. I found that it was the intersection of physics and music that allowed a new part of me to be built from the old, and I use the opportunity to expand this further quite well at UNH.