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### Masters of Science in Mathematics

Around the middle of the senior year of high school, I was very confident that I would spend most of my career as some form of 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 disillusion 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 more and more clear that perhaps a career in STEM was far more viable, 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 school work and less time for the guitar. While I still remained involved with some music ensembles, and wrote for a Capella groups on the side, I could feel this large part of me sort of slipping away. Music was more than just something I did, it had become my identity, and that identity was fading. Garage band rehearsals were now late nights programming for research meetings, scale and arpeggios became black-board exercises, and guitar lessons became lecture halls. Something that I had previously devoted my life to was just becoming a piece of the past.

By fall 2019, I had 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 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 desperately needed. In order to complete the project, it would require the development of a set of features of sound waves that could represent the waveforms in compact and efficient forms.

The world of music can collided with my 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 merging with my mathematical and programming skills to allow 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. 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 being a proper career in the field of machine learning. I would very like 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 integration of physics and music that allowed a new part of my to build built from the old, and I would work exceptionally to continue to build it in an academic environment.