Thesis Project Portfolio

Self Playing Xylophone with Real-Time Note Detection

(Technical Report)

A.I Generated Art Examined in Different Scenarios in Respect to Authorship

(STS Research Paper)

An Undergraduate Thesis

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Bachelor of Science, School of Engineering

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The Automation of Art Creation and Music Playback

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"Is this a fourth order Butterworth filter or is it just pancake syrup?"-Harry C. Powell

"I don't know much about compilers, but I know enough to be dangerous"-Mircea Stan

Nothing exemplifies the difference between learning and doing more than engineering. One of the most useful skills I have learned throughout my degree is how to apply abstract concepts to the real world. My biggest example of this is my capstone project, a self-playing xylophone (glockenspiel) seen in Figure 1. My motivation for this project came from my own enjoyment for music and wanting to combine it with my life's passion of electrical engineering. My passion for the intersection of art and engineering is what also motivated me for my STS research paper on A.I generated art authorship. Growing up I played the clarinet up until the end of high school and one of the biggest questions I had when I was in music class was "why do certain notes played together sound great, but others sound bad?". Exploring this question is what really put my foot in the door in electrical engineering as I began to learn about Fourier decomposition, frequency response analysis, and how the mathematical abstractions of signals exist in almost every aspect of our lives.

Figure 1: My Capstone Project the *Simophone*

My capstone project is a self-playing xylophone that can play MIDI files, which is a musical file format that can be downloaded straight from the internet. Beyond this, our project has a Simon Says feature in which the xylophone plays part of a song and expects the user to play it back. It will keep playing more difficult pieces until the user ultimately loses. To strike the bars of the xylophone, solenoids are placed underneath each key and are driven by bipolar junction transistors (bjts). The control logic for my project consists of an embedded microcontroller (the MSP432) which controls the actuation of each transistor whenever a note is supposed to be played. To control the xylophone a user interface is run by a Raspberry Pi in which the user can choose a song to play or upload a song that they want to be played. The Simon says feature is implemented via a microphone that can pick up what the user plays and compare it with what was supposed to be played and then decide whether the user played it correctly. This feature involved using the Fast Fourier Transform (FFT) in which notes are detected via the frequency response of the signal from the microphone.

In my STS paper I explore how the meteoric rise of A.I art generators have raised many questions regarding many of the humanistic aspects of creativity. Specifically, how the

perceptions people have towards human art are vastly different from A.I art in terms of expression. I wanted to explore this question in respect to copyright laws because of how many of the protections granted from these laws depend on the notion of authorship. Ultimately, I found that the perceptions of A.I art authorship vary based on the context. However, in each case A.I art was viewed drastically different from human generated art which suggests that A.I art cannot be placed on equal footing with human created art in the context of intellectual property laws.

My time in this course highlighted how engineering problems extend far beyond the technical domain. It highlighted how STS issues still exist in projects in which you may think that they are irrelevant. Thinking beyond the technical bounds helps dispel the illusion that issues surrounding the usage of our products are somehow out of our control. Avoiding the pitfall of abstracting yourself as a “cog in the machine” will ultimately lead to better systems.