

Gareth Fultz

Senior Design

For my senior design project, my group and I are creating an intuitive graphical user interface (GUI) for creating, managing, and testing neural networks. The goal is to make building simple and sophisticated neural networks more approachable by removing the complexity associated with using machine learning libraries. To do this, we will focus on making the interface accessible without sacrificing support for more advanced abilities. Additionally, if possible, we would like to add support for features like Kubernetes, hyperparameter tuning, and user-created functions/layers. This project is an idea I've had for a while, and it ties into a lot of my school and co-op work. I believe it will allow me to improve my knowledge of machine learning, software architecture, and user-centered design in a real-world setting.

I have taken a number of courses that will be directly applicable to my senior design project. First, my Software Engineering course (EECE3093C) contained information on Git, project management techniques, and software creation principles. All of these skills will be useful when working with my team to create this application. Another applicable class is Computer Networks (CS4065). I can apply knowledge learned in this class on networking between the frontend and backend and the associated communication protocol. As for the machine learning itself, the content from my Intelligent Systems (EECE5136) will be helpful. This class went into the underlying concepts and math behind many different machine learning models and processes.

I also believe that the experience gained from my co-op work will be applicable to this project. My first position was at Kinetic Vision, where I was a Software Engineer Co-op on their Interactive Solutions team. The technology I worked with has little overlap with my senior design project, but the problem solving strategies will be useful. Additionally, at Kinetic Vision, I worked on software projects with a diverse team of professionals, and those teamwork skills will be beneficial when working with my senior design team. My second position was at SRC as a Software Engineer Co-op. Here, I created an application that allowed users to easily debug and demo arbitrary chains of algorithms. This project has a lot of architectural overlap with my senior design project. Both use a web-based frontend interface to control processes running on a python backend. I believe I can apply the knowledge from this project at SRC to effectively and efficiently design large parts of the project.

My primary motivation for this project is an interest in machine learning and software architecture. Furthermore, I am excited not only to learn more about machine learning but also to make a tool that makes neural network creation more accessible. I believe that creating this application with both a user-friendly and powerful interface will be an interesting challenge with practical benefits. Additionally, I see this project as an opportunity to learn new technologies and

improve my software engineering skills. Beyond that, I'm looking forward to working collaboratively with my team. Together, we aim to build something that could be genuinely useful in both academic and professional settings.

Our team has a basic idea for the project approach. The code itself will be divided into two main parts: the front-end and the back-end. The front-end will be a web app (most likely) created using TypeScript and the Svelte library. The back-end will be a python webserver using Quart (or possibly Django). For machine learning, we will use the PyTorch library. As for the approach itself, we are going to design and create the project feature by feature. We plan to start with the ability to create networks, then to train them, then to manage existing networks, and then to add any of the optional features I previously mentioned. In the end, we expect to have an intuitive interface for creating and training basic neural networks without code. Ideally, however, we will also support complex networks and other features. By the end of the project, I will consider it a success if we've created a robust and accessible tool that simplifies neural network development. I will consider my contributions a success if I can pinpoint a nontrivial set of features or code in the final version that I designed, created, or significantly contributed to.