Thesis Portfolio

Comparison of Multiple Neural Network Architectures on Historical Landmark Recognition Tasks

(Technical Report)

The Detrimental Impact of Artificial Intelligence on The Workers in The American Job Market in The Next 40 Years and How They Can Be Protected

(STS Research Paper)

An Undergraduate Thesis

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Sociotechnical Synthesis

The Capstone Project and STS research included in this portfolio revolve around artificial intelligence (AI) of robots. The Capstone Project, more specifically, aims to use a subset of AI, machine learning, to create an application to label images of buildings on grounds at the University of Virginia. The STS research paper speculates the future of the American Job Market with the introduction of AI as a means of aiding and eventually replacing workers. The Capstone Project is exemplary of this effect that AI has on the job market, as a successful building labeler can be evolved to provide details of the buildings and artifacts that are being investigated by users, thus eliminating the need for tour guides who relay such information. The technical research also shows the process of displacement, as the application will likely first be used as an aid to tour guides, and upon reiteration and improvement, eventually be used to replace them.

The Capstone Project aims to create an application that would enable users to take photos of building and artifacts on grounds at the University of Virginia and have them labeled. To do so, the project explores a technique of machine learning, known as transfer learning, on a novel dataset created with the help of crowdsourcing at the University of Virginia. Transfer learning is a technique that allows using pre-trained machine learning models on different datasets, by retraining the first and last layers of the neural network and fine tuning the specifics to achieve better results. The first step of the process was to create an application that allowed students to go out and take photos of buildings on grounds, followed by curating and cleaning the data. The data was then used to train the Resnet18 neural network, which was pre-trained for ImageNet. Lastly, the machine learning model was deployed using Google Cloud Platform and an application was created to allow users to click photos and have the neural network predict what it is.

Artificial intelligence (AI) has been on the rise since the start of the previous decade, to the point where it has become a buzzword. The STS research is centered around the *paradigm shift* that will be caused by the introduction of AI into the American workplace. This introduction will cause long term job displacement, with fewer new jobs being created than by any technological displacement in the past, due to the ease of replicability, production and sharing of AI. The research question is "How will the rise of artificial intelligence effect the American Job Market in the next 40 years?" The reason 40 years is chosen as the timeline is that once artificial intelligence becomes capable of replacing all human workers, the job market will be completely replaced and the economy will function differently than it does at present. In the next 40 years, however, before this level of intelligence is achieved, some humans will still have jobs while others will have been indefinitely replaced. The displaced Americans might have little to no source of income, and the state of the middle- and lower-class American might be worse than it has ever been. Documentary research and discourse analysis will be used to study this topic. The research aims to discover the order in which jobs will be replaced, thus warning the society from entering those fields, and propose policies that must be implemented to prevent the drastic impact AI may have on society.

The power of AI is easy to vastly misestimate: there are some who believe AI will never be capable of replacing humans, while there are other who think all human jobs will disappear almost instantly in the near future. Working on AI helps realize the actual power that such technologies have. Building the computer vision model for Capstone elucidated that while there are limitations, the technology can quickly catch up to replace tour guides. The technical research also exemplified how easily AI can be reprogrammed to solve different problems, with the project retraining a general image recognizer to a building differentiating tool. The

knowledge obtained from the technical research project helped me to tell the difference between claims that are unrealistic and those that are substantial, thus helping form a more conclusive argument for the predictive analysis in the STS research. The work done in the STS research showed me what it means to be an engineer: a person who improves society on all fronts. An engineer can only be considered good if they work for the good and mull the impact their work will have on others.