Thesis Project Portfolio

Application of Machine Learning Algorithms to Predict Bus Arrival Delays

(Technical Report)

A Virtue Ethics Analysis of Intel's Response to Pentium FDIV Bug

(STS Research Paper)

An Undergraduate Thesis

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Sociotechnical Synthesis

My technical work and my STS research are related by the fact that both explore new technologies in the computer science and engineering field. Computer science has been a quickly developing subject since the introduction of personal computers, and accompanying the numerous applications are new ideas and techniques to improve the technology. My technical work focuses on machine learning, a newer subject that has found immense applications in real life due to the availability of data today. My STS research studies the ethical issues related to the handling of the FDIV bug in Intel's Pentium chip. The bug was introduced by using a new division algorithm at the time. While my STS research is pure research that focuses on ethical issues and my technical work is applying techniques, they both study developing technologies in computer science.

My technical work applies machine learning algorithms to predict bus delay time for the Charlottesville Area Transit bus line 7. My team first downloads the data found on CAT's official website. We then extract new features and formulate a regression problem to predict the delay time. After visualizing the data using histograms and correlation matrix, we apply linear regressor, random forest regressor, SVR with rbf kernel and polynomial kernel of degree 3, and finally ANN with three dense layers and an output layer on training data. We are able to achieve low root mean square error on test data for different models, with the random forest regressor achieving the lowest RMSE of 0.88 minutes. Compared to the span of delay time from -45 to 55 minutes, our model achieves great accuracy.

My STS research also explores topics in advancement in computer science, but from a different perspective. My research studies the ethics of Intel's reaction during the handling of the Pentium FDIV bug. The bug was found to cause division errors on some calculations due to a

mistake in the production of the Pentium chip. Intel first implemented a conditional replacement policy, emphasizing the triviality of the bug. However, facing consumer backlash and media criticism, Intel switched to an on-request replacement policy. I apply the virtue ethics framework to study the extent Intel's behavior was ethical or not. In particular, I argue that Intel's initial reaction is unethical for failing the virtue of clear communication, that Intel's switch of attitude is moral for adhering to the virtue of making compromises, and that the whole event exemplifies how virtue can be learned.

Having worked on both projects simultaneously enhances both. Having worked on implementing machine learning algorithms, I experience firsthand the difficulty of applying new techniques and the risks that come with it. Therefore, I can better understand the thinking that occurred during the Pentium crisis. On the other hand, being well-versed in ethical issues, I can think about the ethical complications of my technical work while working on it. For example, I can reason about the possible social impact caused by machine learning prediction models. In conclusion, working on both my technical project and STS research paper allows me to explore advancement in computer science from different angles and adds value to both projects.