Thesis Portfolio

Temperature Checkpoint System
(Technical Report)

Mitigating Harmful Machine Learning Dependencies
(STS Research Paper)

An Undergraduate Thesis

Presented to the Faculty of the School of Engineering and Applied Science
University of Virginia • Charlottesville, Virginia

In Fulfillment of the Requirements for the Degree
Bachelor of Science, School of Engineering and Applied Science

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Spring, 2021

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Sociotechnical Synthesis

The technical project in this portfolio is a temperature checkpoint system. This is an automated health screening door connecting temperature measurements to a door lock. When a prospective entrant approaches a door outfitted with this system, they will place their wrist under a mounted box, triggering a motion detector and awakening a non-contact temperature sensor. The temperature sensor will then transmit a temperature to a microcontroller and decide whether or not to unlock the door. Data is also sent to an external server for data analytics and further computation. Access to this external server is available through a locally hosted website. The STS portion of research was also inspired by the recent COVID-19 pandemic. In the early onset of the pandemic, rapid shifts in human behavior caused various machine learning systems to fail in unpredictable ways. The past data that these machine learning systems were trained on did not reflect the current behavior as the pandemic hit, thus the systems could not predict outside of their trained range. The paper aims to understand the harm in depending on machine learning systems that could potentially fail catastrophically. The paper synthesizes various sources on technological dependence in order to form a set of precautions: 1) aim for complete transparency during design, 2) have a robust backup system prepared, and 3) design with detection mechanisms in place for immediate transition to the backup system upon failure. These two projects are coupled in that the door locking mechanism is an example of a system that could be harmfully depended on if various backup systems are not in place. Some of these precautions were used in the design of this system, such as various backup mechanisms in the case of failure. For example, if the system loses power, the mechanism unlocks rather than locking to prevent

trapping individuals. Some of the hands-on design of the technical system inspired and led to the development of the set of precautions outlined in the STS portion of this portfolio.