Thesis Project Portfolio

A Robust Pedestrian and Cyclist Detection Method Using Thermal Images

(Technical Report)

Psychological Ownership: A Study of Individuals and "Their" Autonomous Mobility

(STS Research Paper)

An Undergraduate Thesis

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Bachelor of Science, School of Engineering

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Sociotechnical Analysis

Autonomous Vehicles are a technology that promises to change the transportation from the ground up, aiming to make it safer, faster, and more efficient. While the future promised by AVs are bright, there is still much work to be done to reach this utopian view of technology. The following theses explore AVs aiming to improve upon and provide insights into the technology.

The technical thesis aimed to address the safety concerns regarding autonomous vehicles' driving in environments with low visibility where traditional means of object detection have higher levels of failure and errors. The goal of the project was to utilize thermal information to detect pedestrians and cyclists in real-time for a self-driving vehicle. The thesis describes this complication to further detail and details the processes and models utilized to create a robust thermal pedestrian and cyclist detection system. The final solution was a FasterRCNN model trained on thermal pedestrian and cyclist data from the viewpoint of a car.

The STS research sought to address how AV technology could be implemented into society. Specifically, it explored the importance of AVs in the sociotechnical construct of ownership. The research initially aimed to compare two different AV usage methods: private ownership and ride-hailing. However, this meant that the scope would be too large to tackle in a single paper. Due to this, the research was simplified to the exploration of ownership on a private use scenario for AVs under the following ownership models: physical ownership, access, and privacy. Literature review was conducted on psychological ownership and its various facets, views of current and future AV owners, as well as usage scenarios proposed by AV companies to analyze how distinct approaches to private AVs would affect one's sense of ownership of the vehicle.

The technical project was a success. While we were not able to achieve everything we set out to do, from implementing LSTM or utilizing 3dCNN in our model, we were able to create a robust

pedestrian and cyclist detection model with an F1 value of over 80% with a false negative value of less than .1%. This showed to us that utilizing thermal information in AVs will improve detection. Especially due to the minimization of false negatives. The next step in this research would be testing the feasibility of a multimodal approach to pedestrian detection. The STS research introduces the entanglement of ownership with autonomous vehicles; it explores how design choices could affect one's perceived notion of usefulness of the vehicle. I believe it is able shed some light into how even traditional means of ownership could be altered as AV technology is implemented and, hence, the implementation should consider sociotechnical realities of society.

To conclude, I would like to thank my teammates Navya Annapareddy and Sander Abraham helping me successfully achieve our capstone goal. I can not do but indicate my endless appreciation for Tariq Iqbal for his guidance and insight on our capstone and for Sean Ferguson for his advisory and counseling on my STS research.