Thesis Project Portfolio

Human Trust and Computer Vision in Autonomous Driving

(Technical Report)

Disinformation in Targeted Health Advertisements and Posts in Social Media and Real-World Factors Related to Vaping

(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

Zi Zeng

Spring, 2020

Department of Computer Science

Table of Contents

Sociotechnical Synthesis

My STS and technical theses are unrelated as they investigate two separate fields: 1) social media and vaping, and 2) autonomous vehicle systems.

Vaping among young adults has aroused widespread concern. Vaping has been widely accepted as an alternative to traditional tobacco products, and there is no scientific evidence that its long-term effects are harmful. However, countless (and potentially misleading) posts on vaping are spreading rapidly across social media. For my STS thesis, I am interested to explore why and how social media technologies appear to be accelerating the increase in the number of younger vapers. I wish to investigate both the digital and real-world lives of users, emphasizing social media's influence and providing insights toward a holistic intervention that would include future vaping regulations. The literature review and the case studies examined confirm the correlation between social media content related to vaping and college students' perceptions of and behavior toward vaping. Actor–network theory is used to investigate various parties—e.g., schools, vaping companies, and government agencies—that have the potential to prevent or worsen the negative effects that the spread of unverified information has on young adults. The STS thesis arose from a general concern about the dissemination of misleading health information on social media. This involved an investigation of vaping, with social media making the empirical evaluation possible. As with all research, there are limitations to this thesis. It would therefore be beneficial if future researchers considered other aspects of the story, such as the psychological impacts of vaping and cultural differences on the subject.

Regarding my technical thesis, self-driving vehicles are already a reality. However, there are many areas needing improvement before general public use will become feasible. Deeply curious about the mystery behind self-driving vehicles, I joined an autonomous car research group investigating human trust in these systems. During this time, I used sensors on autonomous vehicles, which led me to explore their more technical aspects. Camera sensors assist in operating decisions by using computer vision technologies to extract useful information from input frames. My technical thesis, therefore, focuses on human–vehicle interactions in terms of trust and the autonomous systems' use of computer vision technologies. I intend to investigate several important aspects that must be considered when constructing a multi-functional and trustworthy autonomous vehicle system. Human trust experiments reveal how different autonomous system algorithms can potentially affect drivers' trust. Trust-building is crucial, especially when people first experience autonomous driving. Computer vision technologies still have flaws, but they have great potential. Given the progress made to date, it will be interesting to watch autonomous systems mature sufficiently to enable public driving. The technical thesis presents a rough understanding of the important aspects of autonomous systems, and I have done hands-on work to explore the implementation of some actual computer vision algorithms. A feasible next step will be to build a mobile app for use with smartphones equipped with cameras. This would combine detection and warning features to be used in both normal and autonomous vehicles.