

**SCENARIO2VEC: A SCENARIO DESCRIPTION LANGUAGE TO CHARACTERIZE
TRAFFIC SCENARIOS FOR THE DEVELOPMENT OF A CERTIFICATION SCHEME**

**THE CHARACTERIZATION OF AN ETHICAL SAFETY STANDARD FOR THE
AUTONOMOUS VEHICLE (AV) FIELD: HOW WILL HUMAN SAFETY BE
PRIORITIZED?**

An Undergraduate Thesis Portfolio
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EXECUTIVE SUMMARY

As autonomous vehicles (AVs) become more commercialized, the standardized protocols that ensure the vehicle's safety will be paramount in ensuring the passengers' and pedestrians' safety. The regulators of roadway safety rely on automotive companies to present safety features of their design, while the companies each have a different interpretation of what constitutes safe driving behavior. This can present consumers and regulators with a false sense of safety and security. The goal of the technical project was to consolidate the goals of safety and optimization into a standard certification scheme for AVs. The STS research project developed 11 guidelines grounded in moral and ethical principles to evaluate how well this certification scheme prioritized human safety over optimization and suggested areas for improvement.

The plethora of safety standards from AV manufacturers make it difficult to provide a fair assessment of the safety of an AV and thus a unified certification scheme is necessary. The first step in designing a certification scheme was to develop a unified representation of a traffic scenario. The descriptions of scenarios will eventually be used as labels for videos to train a network that can generate a scenario descriptor for an unseen video. The ability to automatically label a traffic scenario using a standardized language can help identify whether a vehicle is complying with road safety standards. For example, if a pedestrian is crossing the street, it will be important for the AV to capture this information quickly and take the appropriate course of action to ensure the safety of the pedestrian. The scenario description language (SDL) developed in the technical project accounts for actors, actions, and scene elements to capture information in a scenario. To test how well these scenario descriptors represented the video, a similarity metric for the SDL was developed to extract similar SDLs given a reference SDL. This process was compared to a baseline Sent2Vec model's ability to perform the same task. The comparison of

these two methods resulted in an F1-score of .268 indicating that the baseline performed better and further refinement may be required in how much information is captured in an SDL.

The STS research project focused on how to develop a standard that evaluates a vehicle's performance while also prioritizing safety. The 11 guiding principles suggested by Busch in "Standards: Recipes for Reality" served as a guideline and subset of Pinch and Bijker's Social Construction of Technology framework to construct guidelines for the safety certification scheme. These principles prioritize moral considerations regarding safety and highlight fairness, equity, and effectiveness as keys to a balanced standard. The principles were adapted to AVs to develop a new set of guidelines that could serve as evaluation criteria for determining whether a standard is ethical. Busch's 11 guiding principles serve as a broad, yet actionable list of guidelines for the development of standards. He focuses on the ethical principles the standard must follow to be accepted by relevant social groups. The 11 guiding principles were adapted to safety standards for the AV field and served as a guideline for developing an actionable standard. The resulting guidelines measured both the optimization of the AV and prioritized human safety over an optimal vehicle by being flexible and open to changes following the rapidly developing field, and being designed with input from the relevant social groups.

The certification scheme is still in its developmental stages and it's premature to come up with a list of detailed moral obligations for a standard that has not been fully tested. However, the 11 guiding principles serve as a starting point for questioning the ethical and moral obligations of a safety standard in the AV field and will direct future research in a way that prioritizes safety over optimization.

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