Class hierarchy for object detection

Relevance to the Automotive Industry:	Object detection for automated driving typically depends on object classification. However, current classes are arbitrary and without any clear connection to safety requirements that conforming with traffic laws. Safety assurance requires transparent requirements for classification, which will be developed in this project.
Research Location:	Technische Universität Darmstadt Institute for Automotive Engineering (FZD)
Homepage (Engl.):	http://www.fzd.tu-darmstadt.de
Faculty Mentor:	Prof. Dr.-Ing. Steven Peters
Faculty Mentor Email:	steven.peters@tu-darmstadt.de
Graduate Mentors:	Ken Mori, M.Sc.
Graduate Mentor Emails:	ken.mori@tu-darmstadt.de
Project Description: May 30 - Aug 06, 2022 (10 weeks, 40 h/week)	The Technische Universität Darmstadt Institute for Automotive Engineering (FZD) is participating in the VIVID project that attempts to develop perception requirements. This NSF REU project will be concerned with the classification of objects in driving context. The objective for the NSF REU student is to develop a hierarchical classification structure based on semantic or kinematic object attributes. This includes consideration of legal texts governing traffic behavior. The successful outcome will be a hierarchical classification structure that is well grounded in existing legal and semantic requirements and that can serve to evaluate object classification. **PHASE A** (2 weeks): During this introduction phase, the NSF REU student will review relevant research; investigate existing datasets, classifications, semantic structures, natural language processing, and legal texts, as well as detail and distribute project responsibilities for the remainder of this NSF REU project. **PHASE B** (3 weeks): Next, the student will develop one or more classification hierarchies considering the aforementioned aspects and document this work. Different variants may emphasize different aspects such as dynamic behavior, required action or semantic meaning. **PHASE C** (3 weeks): Then, the student will evaluate the hierarchies with respect to continuity with previous work and compliance with legal requirements. Evaluation criteria will be developed that allow the selection of one classification hierarchy. The effort of maintaining and updating the hierarchy, future labeling effort and possibilities of automated generation and updating will be evaluated and discussed. **PHASE D** (2 weeks): Finally, the NSF REU student will document the research performed, prepare a written report, and deliver an end-of-summer presentation on the research performed.
Target publications:	• IEEE ITSC 2023: 26th IEEE International Conference on Intelligent Transportation Systems
Necessary Skills/ Knowledge:	
Desirable Skills/ Knowledge:	• Experience with Python, Object classification and detection
Additional Online Resource(s):	

NSF REU Students must have completed at least two semesters of engineering studies prior to the proposed summer research, and they must have at least one semester remaining before they can earn their BS in Engineering.