Docket #: S19-289

Systems and Methods for Automatic Test Generation

Stanford researchers provide a testing strategy for autonomous vehicles that make use of rule-based domain knowledge. To certify the safety of a cyber-physical system, the system must be strenuously stress-tested in a diverse range of scenarios to ensure the system is certifiably safe and robust. A key challenge is devising tools, both in terms of language and computation, to design challenging scenarios to evaluate system performance in novel settings. We address this challenge by leveraging Signal Temporal Logic (STL), a logic language capable of describing spatial and temporal specifications of signals, and modern machine learning programming tools, namely automatic differentiation software. Although we primarily focus on autonomous or semi-autonomous vehicles settings, our resulting tool is general and can be used for automatic test scenario generation for various domains including aerospace, manufacturing, and mining.

Stage of Research
Proof of concept

Applications

- Autonomous driving
- Mining
- Aerospace
- Automated construction
- Cyber-physical systems

Advantages

- Non-transitory computer-readable medium of evaluating a test case using at least one parameter solved via the parametric temporal logic formula
- Incorporation of logical specifications into problems in a way that is amenable to gradient computation for solution methods

Publications

- Leung, Karen et al."Backpropagation through signal temporal logic specifications: Infusing logical structure into gradient-based methods." *arXiv preprint arXiv:2008.00097* (2020).

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