

Bachelor's/Semester/Master's Thesis, Guided Research, Interdisciplinary Project (IDP)

Formal Verification of Automatically Generated Code in Automotive Systems

Keywords: Automotive – Large Language Models – Artificial Intelligence

Background

As part of the CeCaS research project, a group has been formed to develop a new system architecture for future vehicles, with a focus on autonomous driving. The development of new autonomous vehicles requires a rethinking of systems, software and software engineering to keep up with the growing complexity and implementation of the latest technologies, such as AI-based functions in automotive engineering. To this end, the software we develop is first integrated on an HPC system and then tested on real vehicles.

Description

A key challenge in developing a centralized system architecture for vehicles is the increasing complexity of software development. Due to the enormous variety of requirements, such as safety requirements like ISO 26262, tools such as automated code generation will have to be used in the future. The emergence of large language models provides an opportunity to implement this theory. General purpose models such as GPT4 or Llama 3 are not yet able to implement the requirements. As a result, there are many open research questions before these approaches can be used in industry. These include, but are not limited to:

- Design and selection of appropriate programming languages, principles, and structures.
- Selection and implementation of formal verification mechanisms for automated verification of automotive code
- **Your ideas:** If you have any other ideas for research in this area you are welcome to suggest your own topic.

Your Tasks

- Familiarization with automated code generation, automotive safety requirements and formal verification
- Research the problem (study state-of-the-art Verification mechanisms)
- Development of a novel solution approach
- Realization of the approach on Hardware and Software level
- Integrating your approach into our system

Requirements

- You are currently studying Computer Science, Robotics, automotive engineering, ...
- High motivation and ability to work independently on your research topic as well as contributing to our teamwork.
- Interest in AI and Large Language Models
- High motivation in the fields software development, automotive, large language models
- Basic knowledge in programming languages: Python, ...
- First experience with PyTorch

