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Siemens Product Lifecycle Management Software Inc

EFFICIENT TESTING METHODS FOR ADAS AND AUTONOMOUS VEHICLES

Apr-2019

OVERVIEW

1. What We Are Looking For?

- *We are looking for a master student with strong background in mathematics, control theory and computer science interested in autonomous vehicles and Advanced Driver Assistance Systems (ADAS).*
- *The student shall be familiar with system identification, especially with singular value decomposition applied for model-order reduction or other technical problems.*

2. Project Background and Description

Future ADAS systems as well as Autonomous Vehicles (AVs) of higher level of automation than today, will require more efficient and more comprehensive testing methodologies.

Virtual testing (deployed on parallel computing architectures) already enables efficient and comprehensive testing. However, with higher level of automation the test scenario space might increase exponentially (see Fig. 1).

One of the technical challenges, which we foresee is:

- *how to reduce the test scenario space, without reducing the relevance of tests?*

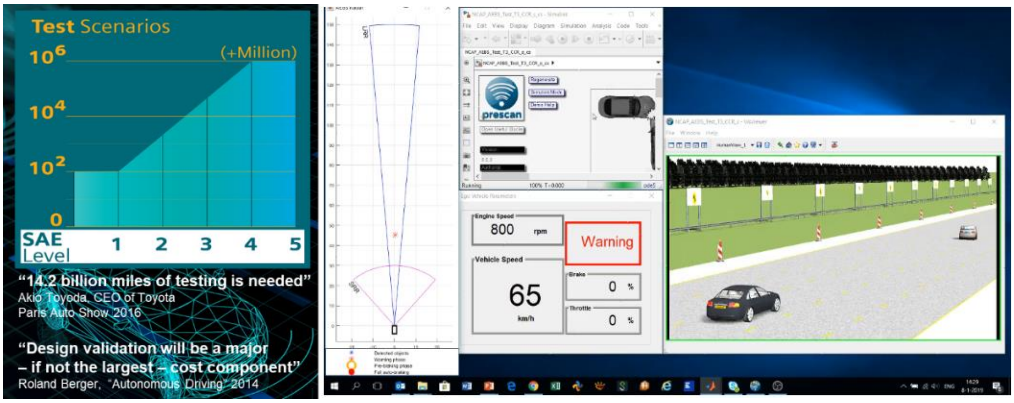

Fig. 1 – Exponential test scenario increase with the increase of level of automation and virtual test environment Simcenter Prescan

3. Project Scope

The scope of the project is to investigate and develop methodologies for efficient and comprehensive testing of ADAS and AVs, with main focus on the decision and control algorithms.

The developed methodologies shall focus on complexity reduction of the scenario space (see Fig. 2). The scenario space shall include:

- *a scenario space defined in international standards for ADAS systems (e.g. AEB, ACC) as well as*
- *a real-world scenario built from measurement data.*

The investigations should consider, how efficiency of testing could be improved by using, for example:

- *multi-level pseudo-random signal generation applied for EGO vehicle and other actors trajectories*
- *Principal Component Analysis and Singular Value Decomposition applied for a real-world scenarios.*

Definition of different test assessment metrics – useful to assess the ADAS and AVs safety and performance level (such as time-to-collision, headway time, vehicle longitudinal jerk, etc.) are also within the scope of the project.

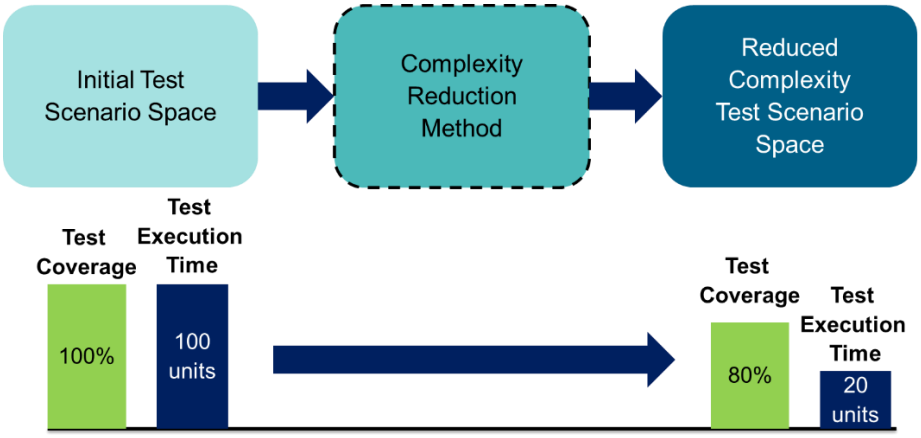

Fig. 2 Project goal: significant reduction in testing time with limited loss in test coverage

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4. High-Level Requirements

The proposed or used methodologies for complexity reduction shall specify mathematically performance bounds (e.g. reduction ratio, loss of accuracy, loss of relevance, etc.).

The proposed solutions shall be validated via simulations (Matlab/Simulink & Simcenter Prescan) in case of different test scenarios and shall be compared with the classical approach, where complexity reduction is not applied.

The complexity reduction algorithms shall be implemented in Matlab/Simulink.

5. Deliverables

Literature review

Investigation of complexity reduction methodologies and test assessment metrics

Implementation and validation of efficient testing methodologies

Simulation studies for different test scenarios (e.g. AEB, ACC, etc.)

Written documentation of all models and results

6. Involved parties

TU/e and Siemens PLM, The Netherlands

APPROVAL AND AUTHORITY TO PROCEED

We approve the project as described above, and authorize the team to proceed.

Name	Title	Date
Alexandru Forrai (Siemens PLM)	Dr.Ir.	29-Apr-2018
Peyman Mohajerin Esfahani (TU Delft)	Assistant Professor	29-Apr-2018

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