CSCI926/CSCI426 - Software Testing and Analysis
Autumn Session 2020

Group project description

Project title:
Developing a simulation testing tool for ADAS, automated, and autonomous driving systems

Total 45 marks

Note: In students' assignments and project reports, if any part (including sentences, figures/diagrams, tables, definitions, descriptions, data, and so on) are copied from other people's work (including both published and unpublished papers, reports, Web articles, etc), or if any idea is from other people, such work or people must be acknowledged explicitly. If you directly copy-and-paste sentences from other people's work to your report, you must use quotation marks to enclose the copied sentences and make a citation immediately following the quote. It is otherwise plagiarism.

1. Size of a group: minimum four, maximum six (except students currently in China, who can do the project single-handed on a smaller scale).

2. Progress report: Each group is required to submit a 2-page (you can include more pages if needed) progress report in **Week 4** lab. The progress report should cover the following points:

i. Every team member's name, email address and student number.
ii. What is your progress so far?
iii. Did you encounter any problems?
iv. Your future plan and timeframe.
v. Draw a picture to depict what is software-in-the-loop, hardware-in-the-loop, and vehicle-in-the-loop testing for ADAS and autonomous driving systems.

- **For students in Australia:** Submit your progress report to the Dr. Zhou in the lab.
- **For students in China:** Submit a PDF file or zip file to Moodle on the same day (Thursday, Week 4).

3. Submission of final report:
For students in Australia:
Submit a **folder** including the following items: (1) a hardcopy final report that addresses the marking criteria; and (2) a CD/DVD/USB storage including a softcopy of your final report, code, executables, presentation slides, screenshots, etc, and a readme file. You can also include additional data and figures, files, etc, in the external storage. The storage will not be returned to students.

Print every team member's name, student number, and login name in the cover page of your final report. The cover page should include all team members' signatures. Also indicate each team member's individual contribution in the cover page, as explained below.

For students in Australia:
Submit to Dr. Zhou at the start of Week 13 lecture. No late submission.

Submit your work in a zip file to Moodle by Wollongong local time 15:30 Thursday Week 13.

4. Assessment of individual team members:
Students in Australia:
Each team member is assessed individually based on his/her individual contribution. Basically, the "individual contribution" of each team member is assessed by all the other team members in terms of "contributed", "very little", and "almost no contribution". For a team member who has "**contributed**", he/she will receive **100**% of the group marks; for a member who contributed "**very little**", he/she will receive **50**% of the group marks; for students who made "**almost no contribution**", he/she will receive **0** marks for the group project. Details of individual contributions for each team member must be printed on the cover page of the final project report. In some situations, the above criteria may be adjusted by your lecturer.

Students in China:
No such issue if the project is completed single-handed, in which case the student can choose a portion of the project to complete.

5. Marking criteria (total **45 marks**)
(1) Progress report (**week 4 lab**): **1 mark**.
(2) Final presentation (at the start of **week 13 lecture**): **1 mark**. (For students from China: Dr. Zhou plans to create a WeChat group so that you can present your work in this group via WeChat on the same day – Dr. Zhou will contact you via email to make this arrangement in due course.)

- **Submission of final report for students in Australia:**

Submit a hardcopy of your presentation slides to the lecturer/tutor immediately *before* your group's presentation. It is *not* compulsory for all team members to speak, but all team members must stand in front of the class during their group's presentation. If a student is absent from his/her group presentation, the student will receive 0 presentation marks.

- **Submission of final report for students in China:**
                              Submit to Moodle before the Week 13 class starts.

(3) Technical value and writing of the final project report (due at the start of **Week 13 lecture**):
                                                                           43 marks.

6. Technical tasks (43 marks)

Step 1: (5 marks) Literature study and market survey

Conduct a comprehensive survey on the available platforms, frameworks, and tools for the testing of ADAS (advanced driving assistance system), automated driving, and autonomous driving vehicles, with a focus on X-in-the-loop testing using simulation testing techniques where X can refer to software, hardware, vehicle, driving, and so on (refer to ISO_26262-6-2018.PDF in the Moodle site under Readings->Driving, which defines the concept of X-in-the-loop). You need to read the papers in the Moodle site under Readings->Driving, and will also need to read other articles of your own choice.

Write a summary of your study and conduct a critical analysis on the <u>advantages and disadvantages</u> of each tool/platform/framework that you have surveyed.

Step 2: (28 marks).
Build a testing tool that can conduct X-in-the-loop testing where "X" is of your own choice. You can use any programming language and any platform of your choice. Your tool can be based on existing autonomous driving simulation platforms such as (1) the open-source platform Carla (http://carla.org/), (2) Matlab Simulink and automated driving toolbox, e.g.:
https://au.mathworks.com/products/automated-driving.html
https://au.mathworks.com/help/mpc/ug/lane-keeping-assist-with-lane-detection.html
and even a camera-in-the-loop and vehicle-in-the-loop testing tool with an OBD2 reader.
You may refer to the article "2019 China Blue Book.pdf" under the "Readings-> Driving" folder for a partial list of available simulation testing platforms.

Marking criteria for this task include the functionality and usability of the implemented tool.

Step 3: (10 marks) Apply your tool to test real ADAS/automated driving/autonomous driving systems. Document your test results.

Marking criteria for this task include the selection of subject programs under test (e.g. Are they practical and realistic programs or just toy programs?) and the effectiveness and efficiency of the testing process as well as any issues or bugs detected.

Frequently asked question: Where can I get the software to be tested?

Answer: You need to find out the answer yourself. For example, you could find some pre-trained autonomous driving models or ADAS systems that are available on the Internet. Examples include Baidu Apollo, Autoware, and deep-neural-network models for autonomous driving from various websites.

Remark: As a Master or Honours level subject the students need to conduct a substantial amount of self-study in order to complete this project. This project is challenging but exciting.