COMPSYS 306 Artificial Intelligence and Machine Learning

Project phase 2 (30%), due Friday 20th Oct 10pm

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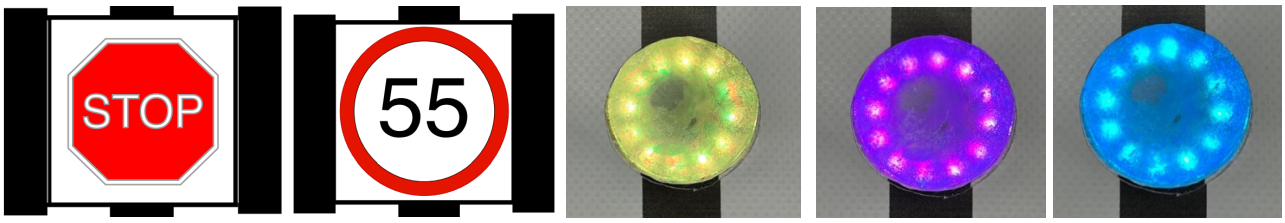
The project is designed for the purpose of engaging you in the process of designing a real-world machine learning application. In the second part of the project, you will be collecting your own dataset and train a support vector machine to recognize a small set of traffic signs. Based on the trained model, the robot (equipped with JetsonNano) will need to perform real-time traffic sign recognition and operate accordingly.



(a) (b) (c) (d) (e)

Fig. 1 (a) STOP sign (b) 55 (or speed-up) sign (c) YELLOW light (d) RED light (e) GREEN light.

1. STOP sign: Upon recognizing the STOP sign, the robot will need to stop for a fixed amount of time (up to 5 seconds) and then resume at the same speed before it stopped.
2. 55 (or speed-up) sign: Upon recognizing this sign, the robot will speed up and stay at that speed until it meets a YELLOW light. The robot should increase its speed by a fixed perceivable amount to give indication that the sign is recognized. (Hint: have a look of the lfrobot.py to see how to change robot speed.)
3. YELLO light: The robot will return to its original speed.
4. GREEN/RED light: The robot will continue to go or stop when it recognizes the GREEN or RED light respectively.

Similar to project phase 1, you can try all the necessary pre-processing and parameter tuning as you see fit in order to improve the model performance. However, the most important thing in phase 2 is to make your model perform reliably and control the robot accordingly to achieve autonomous real-world operation. You can consult with the GTAs and the Lecturer during the clinical lab sessions.

Two testing tables (as shown in Fig 2(a)) are available in the MDLS lab (one in 405.522 and one in 405.536). The tables will be available in the MDLS labs all the time during the project period, so you can do data collection and model testing whenever you can. At the edge of the table, there are two switches, that allow you to control the traffic lights, as shown in Fig. 2(b). One switch controls the YELLOW light and has a higher priority. If the YELLOW light switch is in the off position, then the other switch can be used to turn on the GREEN or RED light.

(a) (b)

Fig. 2. (a) Testing table, and (b) switches for controlling the traffic light.

The deliverables of this part of the project include:

1. The code (4%) should be submitted as a Python or a Notebook (.py or ipynb) file.
2. The constructed model (3%) should be saved as a .joblib file.
3. The raw image datasets (i.e. the training and testing datasets you collected, 3%) in a folder that can be later compressed into a .zip file.
4. Final interview (20%), which will be conducted in the last lab session (Friday 20th October). More details about the interview schedule will be provided in due course.

Item 1-3 should be compressed into a .zip file and submit on Canvas before the due time. During the interview (item 4), you will need to demonstrate that your robot can recognize those signs, operate according to the recognized signs on some custom tracks, and answer interview questions individually. **Once you start the robot, it should be fully autonomous without any human intervention, no remote commands/communication are allowed.**