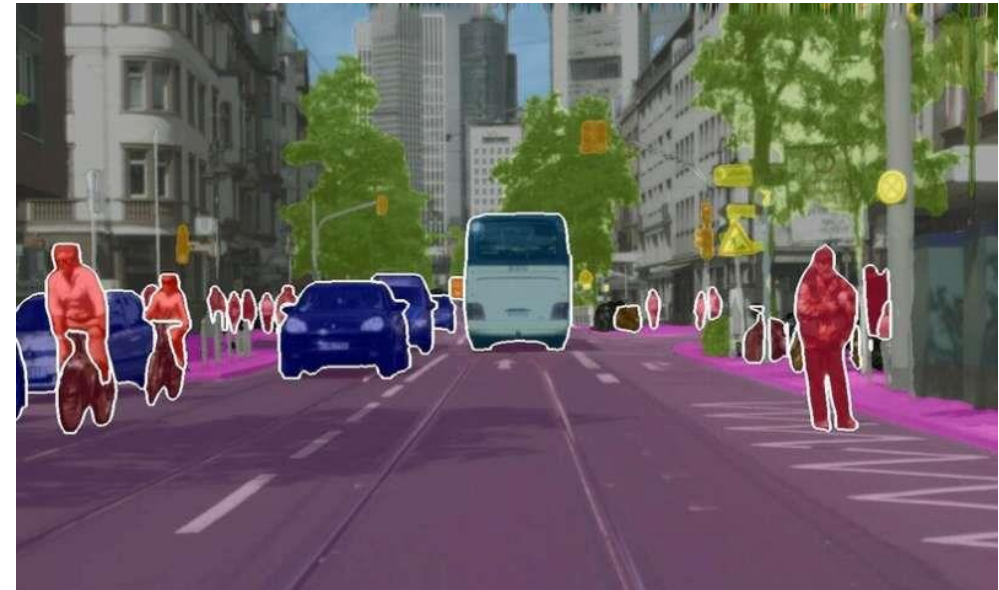# ESP3201 Machine Learning in Robotics and Engineering course

Dr Ng Gee Wah
Dr Shen Bingquan

# Lecturers

- **Dr Ng Gee Wah:** State Estimation, Kalman filter, Artificial Neural Network, Deep learning

- **Dr Shen Bingquan :** Non-Parametric Filter, Basic Machine Vision, Non-Parametric ML approaches,  Search, Reinforcement learning.

# Assessment:

- Individual assessment – 60 marks
  - 60 marks on 5 mini-assignment and/or quizzes. Mini-assignment will include report submission. Each mini-assignment and/or quizzes is 12 marks

- Group assessment – 40 marks
  - Student are free to propose a project that make use of machine learning for relevant robotics application.

**1. Week 1 to week 6** – every Monday 0900-1100hrs. Tutorial 1100hrs-noon. Venue:E5-03-19 (Note that week 1, Monday, 9 August, is a public holiday, the lecture is shifted to Thursday, 12 August, venue: E5-03-19, 2pm-5pm)

**2. Week 1 to Week 6** – every Thursday - 2pm to 5pm - Lab cum e-learning.

**3. Week 7 to Week 11** – Group projects

**4. Week 12** – Presentation and submission of group projects at Faraday lab@NUS on Thursday 2pm – 5pm.

# Details of lessons in each week

Week 1 (Dr Ng):  Introduction to the modules and admin matter.
          Introduction to State estimation; Kalman filter and its applications
          (MA – Kalman filter – tracking tasks <due on week 4>)

Week 2 (Dr Shen): Non-parametric Filters, Basic Machine Vision and CNN
          (MA - Particle Filter <due on week 6)

Week 3 (Dr Ng):   Introduction to Machine Learning and Artificial Neural Network.  (Part 1 and Part 2)
          (MA - using ANN for classification tasks <due on week 7>)

Week 4 (Dr Shen): Search, Non-parametric ML, Dimensionality Reduction
          (MA - Search <due on week 8>)

Week 5 (Dr Ng): Deep learning and CNN (Part 3 and Part 4).  Support Vector Machine (SVM)

Week 6 (Dr Shen): Reinforcement Learning, Deep Generative Models
          (MA - Value Iteration and Q-Learning <due on week 10>)

Week 7 – Week 11 (Dr Ng/Dr Shen):  Project work

Week 12 (Dr Ng/Dr Shen): Project work assessment, presentation and report submission;
          Group Presentation @ Faraday lab 2pm – 5pm.  Group 1, Group 2 and Group 3.

# Reference Material

Probabilistic Algorithms in Robotics by Sebastian Thrun

Artificial intelligence—a modern approach by Stuart Russell and Peter Norvig