ELEC3210 Machine Learning and Information Processing for Robotics

Course Description

The course is to introduce the basic concepts of information processing techniques used in robotics. Course content include Bayes theory, hidden Markov model, localization and mapping, kernel methods for regression, Gaussian process, classification, support-vector machine (SVM); common sensors, software platform and algorithms used in robotics research. *Prerequisite(s):* [(ELEC 2600 OR ELEC 2600H) AND MATH 2111] OR ELEC 3200

List of Topics

Week 1: Introduction to Information Processing and system design

Week 2: Machine Learning and Probabilistic Reasoning

Week 3: Probabilistic SLAM and pose-graph

Week 4: Kinematics of Mobile Robots

Week 5: ROS and Vrep/gazebo (see whether we have offline)

Week 6: Path-planning and Obstacle Avoidance

Week 7: Sensors and calibration, cameras

Week 8: Iterative Closest Point - with application to 3D reconstruction in real-time

Week 9: Mean shift and clustering approaches - with application to visual tracking and quantisation

Week 10: Robust estimation using Hough Transform and RANSAC - with application to vision-based reconstruction

Week 11: System Integration of robotic system

Week 12: Deep learning and Deep Reinforcement Learning - with application to general recognition and control problems

Statement of Objectives/Outcomes:

On successful completion of this course, students will be able to:

CO1 - Able to mark the importance and complexity of probabilistic modelling and information processing.

CO2 - Acquire first-hand know-how during class about modern robotic platforms such as Turtle-bot

CO3 - Comprehend fundamentals of basic machine learning techniques by lecture assignments

CO4 – Implement practical algorithms to realize basic perception for robotic systems by projects.

CO5 - Enhance the knowledge in computer science, signal processing and practical programming.

CO6 - Use the aggregate knowledge to perform robotic tasks to operate simulated robots in simulated scenarios.

Textbook(s):

Sebastian Thrun, Wolfram Burgard, and Dieter Fox. 2005. *Probabilistic Robotics (Intelligent Robotics and Autonomous Agents)*. The MIT Press.

Reference:

Materials are provided along with the course on CANVAS system.

Relationship of Course to Program Outcomes:

Please refer to the Report Section 4.3.2 (iii).

Grading Scheme:

Homework (3)	30%
Midterm Examination	40%
Final Robotic Challenge	30%