

Title: Probabilistic Mobile Robotics

Lectures/Tutorials/Lab per week: 3/0/0

Instructor: Gaurav Pandey

Pre-requisites: Probability Theory, Linear Algebra and Programming (MATLAB)

Description: This will be an advanced course on theory and applications of probabilistic methods and algorithms for autonomous mobile robotics. This course will introduce to the students the state-of-the-art algorithms for robot perception (using a variety of sensors: cameras, lasers etc), recursive state estimation, mapping, localization, and path planning. There will be regular programming assignments that will help students to apply the theory learned in the class into some practical applications.

Tentative Syllabus:

1. Introduction to Probability Theory
2. Robot Motion and Coordinate Frame Transformations
3. Robot Vision: Lidars and Cameras
4. Recursive State Estimation
 1. Bayesian Filter
 2. Kalman Filter
 3. Extended Kalman Filter
 4. Unscented Kalman Filter
 5. Information Filter
 6. Particle Filter
5. Mobile Robot Mapping
 1. Data Association
 2. Occupancy Grid Map
 3. Pose Graph
6. Mobile Robot Localization
7. Simultaneous Localization and Mapping (SLAM)
8. Visual SLAM and Place Recognition
9. Path Planning (A*, Randomly exploring random tree (RRT), Potential fields etc)

Reference: *Probabilistic Robotics*. Sebastian Thrun, Wolfram Burgard and Dieter Fox. MIT press, 2005.