

Intelligent Robotics Module Overview

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Motivation

- Increasing demand for autonomous systems:
 - Surveillance, navigation, assistive technology.
- Main challenge:
 - Systems that *learn* and *adapt* in response to uncertain sensing and actuation.
- Probabilistic methods provide a strong mathematical basis.

The Stars...



Module Overview

- Model *uncertainty* in integrated systems that sense and interact with the world
- Understand *mathematical basis* of probabilistic state estimation algorithms.
- Apply algorithms to challenging problems:
 - Perception and actuation.
 - Localization and mapping.
 - Learning and representation.
 - Control and coordination.

What it is... and is not...

- Collective learning and investigation.
- Individual initiative and teamwork: need to be able to work alone and with others.
- Analyze and criticize existing/prior work.
- Ask questions, discuss and help each other learn.
- *Everybody will be treated as postgrad students.*

Content – Subject to change!

- Probabilistic state estimation.
- Gaussian and non-parametric filters.
- Robot motion and perception.
- Localization, mapping and SLAM.
- Probabilistic sequential decision making.

Content – Discussed in two parts...

- **Part I:** material to work on projects.
 - Weeks 1-6 (approximate).
 - 2-3 lectures + 1-2 tutorials each week.
 - Relevant reading material.
- **Part II:** understanding mathematical basis.
 - Weeks 7-11 (approximate).
 - 1-2 lectures + 1 tutorial each week.
 - Relevant reading material.

Assessment

- **Intelligent Robotics:**
 - 100% CA.
 - Based on 2-3 programming assignments (includes final project), writing tasks.
- **Intelligent Robotics Extended:**
 - 50% CA, 50% final exam.
 - CA based on 2-3 programming assignments (includes final project), writing tasks.
- **Programming assignments:**
 - Software, demo, viva, report.

Timetable/Schedule is Confusing!

- Class size changing. *Please inform instructor of updates.*
- Schedules for online/in-person sessions may change.
- Topics and assignments will be revised accordingly.
- Check Canvas page for teaching team, PGTAs, office hours, zoom sessions.
- Please keep track of announcements on Canvas and those made in lectures.

How to do well in the course?

- Keep up with lectures and tutorials.
- Complete assignments (programming, reading, writing) on time.
- Read chapters and other material.
- Participate in discussions.

Action Items I

- Review programming concepts and Linux environment;
proficiency is expected!
- Review probability, calculus, linear algebra, statistics:
 - Level of first/second-year mathematics module.
 - Textbooks; Gilbert Strang's lectures on linear algebra.
 - **Proficiency expected!**
- Make sure you have access to resources!
- Look at the website of book:
 - Probabilistic Robotics: Thrun, Burgard and Fox (2005)
<http://www.probablistic-robotics.org/>
 - Other resources made available as needed.
 - Problem solutions, errata, additional resources.

Action Items II

- Project groups:
 - Organize in groups of five; inform TAs (CC instructor).
 - Let TAs know if you want them to allocate you to groups.
 - Programming assignments and final project.
 - Understand responsibilities and expectations.
- Preparation:
 - Follow up on announcements.
 - Consider resources, schedules; **take module iff you meet prerequisites and the time commitments.**
 - Set up software environment.