Welcome to CSE 571 Robotics

Course Instructor  Dieter Fox
Today’s lecture by Karthik Desingh

Teaching Assistants
Mohit Shridhar
Wentao Yuan
Organization

- Lectures: T/Th 10:00 – 11:20  
  (will also put Zoom recordings on Canvas)

- Office hours
  - Dieter: Fri 9am (Gates 204)
  - Mohit: Wed 3pm (G60)
  - Wentao: Mon 10am (G60)
    - *ping on UW CSE slack to get access to G60*

- Tasks
  - 3 homeworks w/ Python programming, covering Gaussians, particle filters, RRT planning, and deep learning (50%)
  - 2 projects in teams of 2-3 (open-ended or guided) (50%)

- Readings: Papers and chapters from *Probabilistic Robotics*

- Webpage: [https://courses.cs.washington.edu/courses/cse571/22sp/](https://courses.cs.washington.edu/courses/cse571/22sp/)
Organization

- **Late policy**
  You are allowed to use 6 late days throughout the quarter. After this, assignments turned in late will incur a penalty of 20%, for each day. Please plan ahead and don't expect more.

- **Academic Honesty Policy**
  While we encourage students to discuss homeworks, each student must write up their own solution. It's fine to use a source for generic algorithms (with attribution), but it is not allowed to copy solutions to the problems. Additionally, students may not post their code online. If we determine that a student posted their code online, they will get an automatic 50% reduction on the entire assignment (math + code) and if they copy code for the problems from another student or from online, they will get an automatic 0% for the entire assignment (and possibly reported to the college).
High-level View on Robot Systems

- Control system

Sensor data

World model

Actions
Industrial Robotics Today
Minerva  (CMU + Univ. Bonn, 1998)
Architecture of the Control System

[Diagram showing the architecture of the control system with User Interface, Task Planner, Map Builder, Localization, Collision Avoidance, and Path Planner.]
RoboCup: Integrated System Research

- Focus on addressing all problems at once
  - Hardware development
  - Perception
  - Low level control
  - High level planning and decision making
  - Multi robot systems
RoboCup: Standard Platform
DARPA Urban Challenge 2007
Self-Driving Cars
Robots in Warehouses
(Kiva@Amazon)
Amazon Prime Air
DARPA Robotics Challenge 2015
Getting out of Car
Drilling Hole
Humanoid robots
Boston Dynamics Spot
Boston Dynamics Atlas
Boston Dynamics Handle
Industrial Pick and Place
Manipulation
Service Robots
Dexterous Manipulation
HaptX Dataglove
Simulation
Current Trends / Topics

- Self-driving cars, sidewalk delivery robots, warehouses, manufacturing sites, ...
- Drones
- Industrial pick and place
- Manipulation of everyday objects
- Complex household tasks (cooking, cleaning, ...)

- Object detection, 3D mapping, tracking, interaction
- Cobots, human robot interaction
- Deep learning for perception, control, imitation learning, recognition
Goal of this course

• Provide an overview of fundamental problems / techniques in robotics

• Understanding of estimation and decision making in dynamical systems
  • Probabilistic modeling and filtering
  • Deterministic and non-deterministic planning
  • Learning for perception and modeling
# Course Outline

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<td>Gaussian processes, Bayesian filtering</td>
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<td>#2</td>
<td>Motion and sensor models</td>
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<td><strong>Filtering (localization, tracking, mapping)</strong></td>
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<td>Localization: grid, particle filters, EKF, UKF</td>
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<td>Mapping: SLAM, RGBD 3D Mapping</td>
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<td><strong>Planning / Control</strong></td>
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<td>Deterministic and sampling-based planning, exploration</td>
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