Welcome to CSE 571 Robotics

Instructor: Dieter Fox

Teaching Assistants:
Xiangyun Meng
Chris Xie

Organization

- Zoom lectures: T/Th 10:00 – 11:20 (recordings on Canvas)
- Zoom office hours
  - Dieter: Fri 9am
  - Chris: Mon 4pm
  - Xiangyun: Wed 2pm
- Tasks
  - 4 homeworks covering Gaussian processes, particle filters, RRT planning, and deep learning
  - Team project on simulation platform of your choice
- Readings: Papers and chapters from Probabilistic Robotics
- Web page: http://www.cs.washington.edu/571

High-level View on Robot Systems

Industrial Robotics Today
Minerva  
(UCM + Univ. Bonn, 1998)

Architecture of the Control System

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-99, Stockholm, Sweden
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 BigDog

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

<table>
<thead>
<tr>
<th>Week</th>
<th>Content</th>
<th>HW / Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>Introduction / Probabilities</td>
<td></td>
</tr>
<tr>
<td>#2</td>
<td>Probabilistic Models / State Estimation</td>
<td></td>
</tr>
<tr>
<td>#2</td>
<td>Gaussian processes, Bayesian filtering</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Motion and sensor models</td>
<td></td>
</tr>
<tr>
<td>#3</td>
<td>Filtering (localization, tracking, mapping)</td>
<td></td>
</tr>
<tr>
<td>#4 / 5</td>
<td>Localization: grid, particle filters, EKF, UKF</td>
<td></td>
</tr>
<tr>
<td>#4 / 5</td>
<td>Mapping: SLAM, RGB-D Mapping</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Filtering (localization, tracking, mapping)</td>
<td></td>
</tr>
<tr>
<td>#6 / 7</td>
<td>Deterministic and sampling-based planning, exploration</td>
<td></td>
</tr>
<tr>
<td>#8</td>
<td>Markov decision processes, inverse RL</td>
<td></td>
</tr>
<tr>
<td>#9</td>
<td>Planning / Control</td>
<td></td>
</tr>
<tr>
<td>#10</td>
<td>Deep Learning</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Model learning, visual navigation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Grasping</td>
<td></td>
</tr>
</tbody>
</table>

3/31/20 CSE-571: Robotics