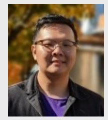
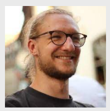
Welcome to
CSE 571 Robotics



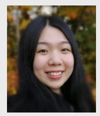
Instructor / co-Instructor

Dieter Fox, Jiafei Duan

Teaching Assistants



Marius Memmel



Helen Wang

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Organization

- Lectures: Tue/Thu 10:00 – 11:20
  (in person, but will also put Zoom recordings on Canvas)
- Office hours
  - Dieter: Tu 11:30-12:30pm
  - Marius, Helen tbd
  - Jiafei: Fri 4 – 5pm
- Tasks and grading
  - **2 assignments** (20% each)
    - Python programming: PF / EKF, and IL / RL
  - **2 projects** (teams of 3 students working with SO-101 manipulat
    - Part 1 (20%): warmup (manipulator setup, easy policy training)
    - Part 2 (35%: 5% proposal, 10% report, 20% presentation) self-guided SO-101 project (exception possible)
  - **Attendance** (5%, in person)
  - **Participation** (up to 5% bonus, in person)
- Late policy on assignments
  - Up to 6 late days without penalty. Beyond that, per day 20% off max points.
    No late days on final report.
- Readings: Papers and chapters from *Probabilistic Robotics*

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Academic Honesty

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).

While we can't check for the use of tools such as ChatGPT, we want you to develop your solutions independently and be honest about how you used such a tool in case you did (report as part of submission).

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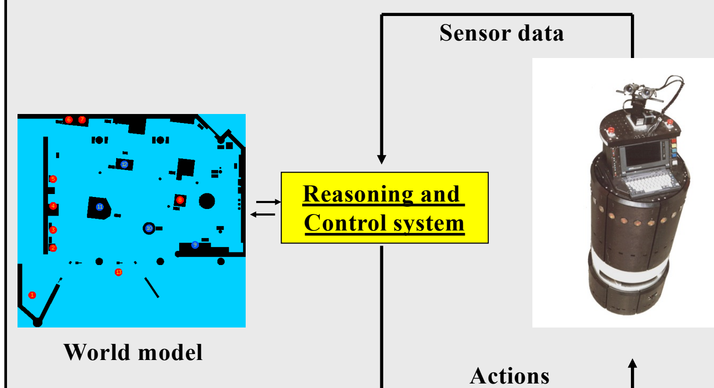
High-level View on Robot Systems



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Industrial Robotics Today

Minerva (CMU + Univ. Bonn, 1998)

Robots in Warehouses
(Kiva@Amazon)

DARPA Urban Challenge 2007

Self-Driving Cars

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UW RACER

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Amazon Prime Air

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Boston Dynamics BigDog (2008)

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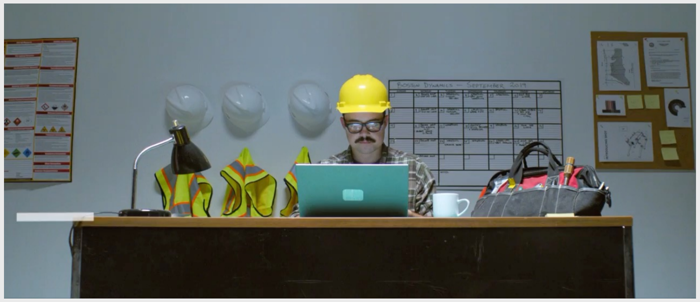
Boston Dynamics Spot



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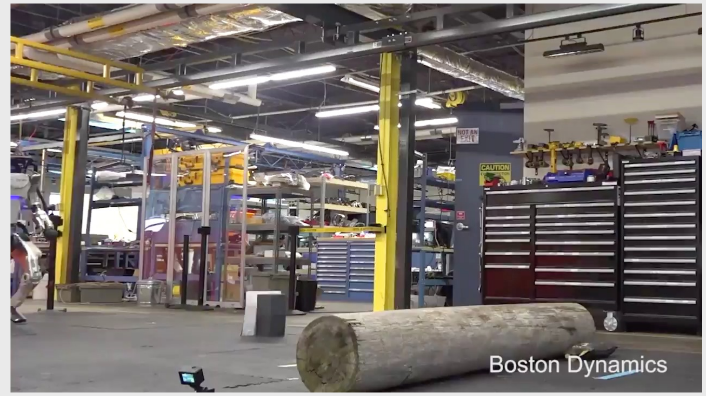
Boston Dynamics Atlas



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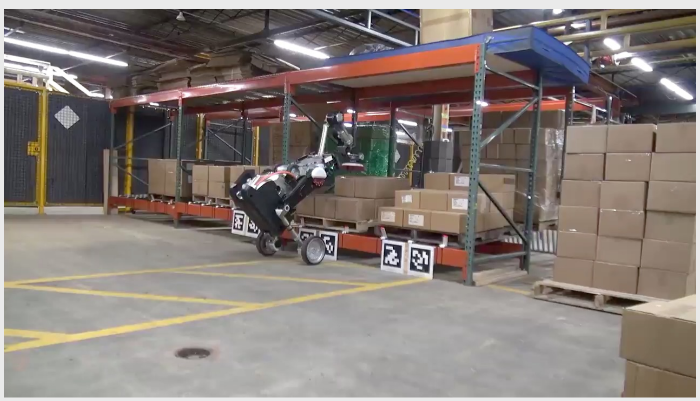
Boston Dynamics Handle



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Industrial Pick and Place

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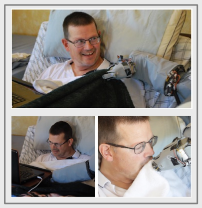
Service Robots

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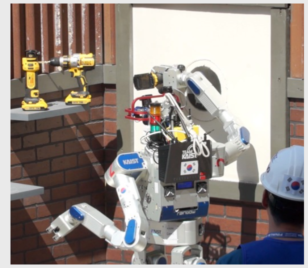
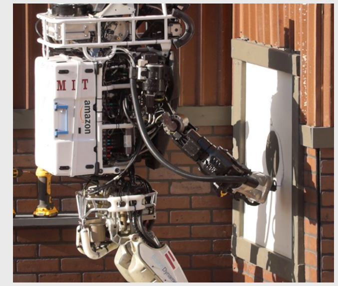
DARPA Robotics Challenge 2015: Drilling a hole

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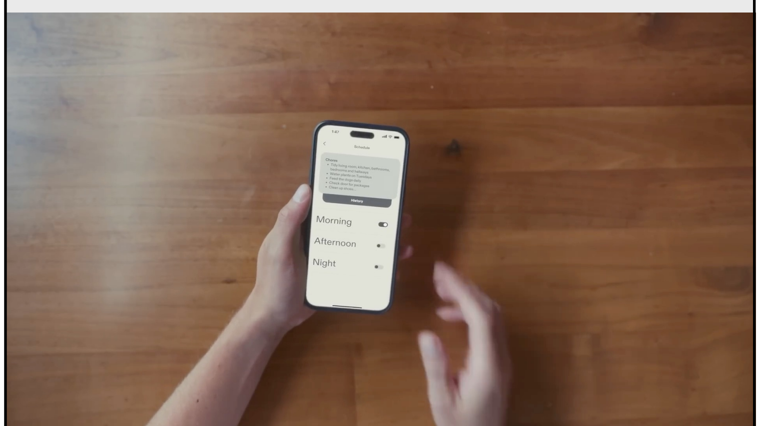
Humanoids 2025: 1X Neo



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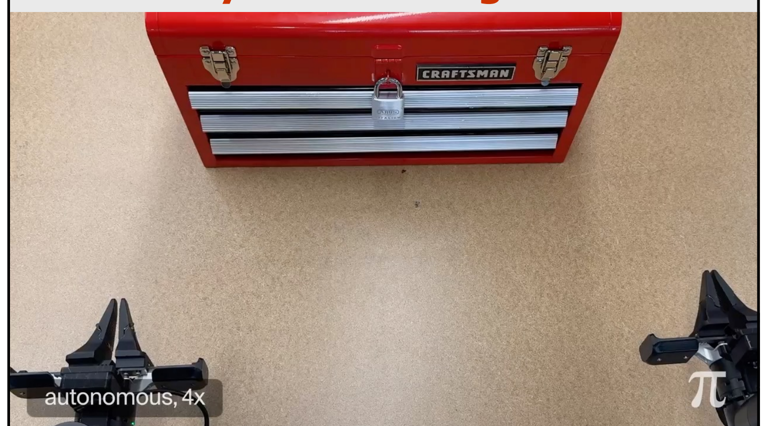
Foundation Models 2025: Physical Intelligence



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Current Trends / Topics

- Self-driving cars, (sidewalk delivery robots), warehouses, manufacturing sites, …
- Drones
- Industrial pick and place
- Humanoids

- Manipulation of everyday objects
- Complex household tasks (cooking, folding, …)
- Cobots, human robot interaction
- Foundation models for perception, control, imitation learning, recognition, LLMs/VLMs/VLAs

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
  - Model-based planning
- Trends in Gen-AI for robot manipulation
  - Learning robot control from data
  - Languageconditioned policies and planning
  - Large scale pre-training of vision-language-action models

Course Outline

Week	Content	HW / Project
#1	Introduction, Bayes filters	HW1 released
#2	Motion and sensor models, Particle filters	Project 1 released
#3	Kalman filters	
#4	Mapping	
#5	Path planning	HW1 due, Project 1 due
#6	Manipulation	HW2 released, Project 2 proposals due
#7	Motion planning, Deep perception	
#8	Imitation learning, Reinforcement learning	
#9	Deep learning for manipulation	HW2 due
#10	Foundation models, Recap	Project 2 report
Finals		Project 2 presentations (poster+demo)