Welcome to

CSE 571 Robotics

Instructor Dieter Fox

Teaching Assistants
Xiangyun Meng
Chris Xie

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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

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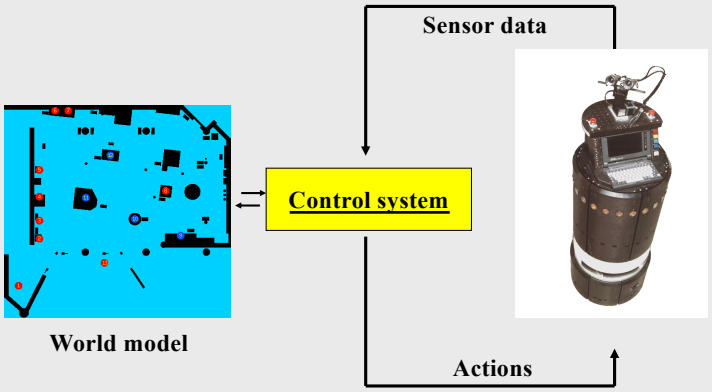
High-level View on Robot Systems



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Industrial Robotics Today

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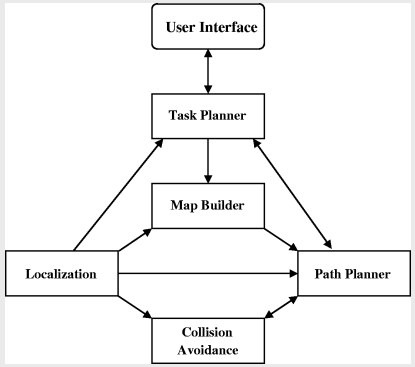
Minerva (CMU + Univ. Bonn, 1998)

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

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DARPA Urban Challenge 2007

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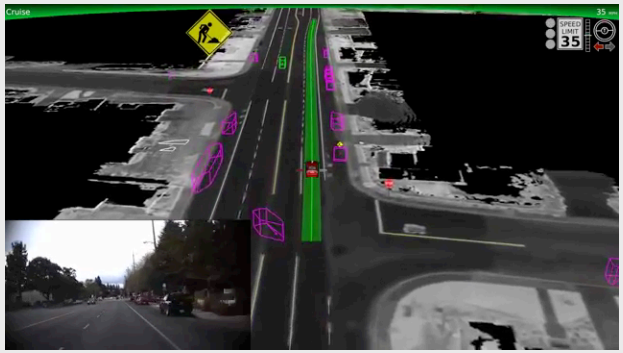
Self-Driving Cars



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Robots in Warehouses
(Kiva@Amazon)

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Amazon Prime Air

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DARPA Robotics Challenge 2015

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Getting out of Car

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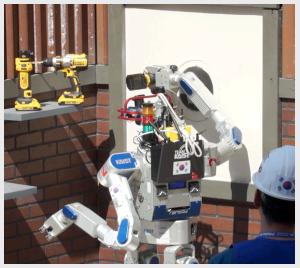
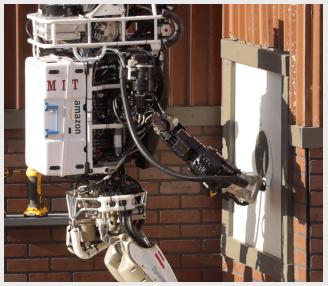
Drilling Hole





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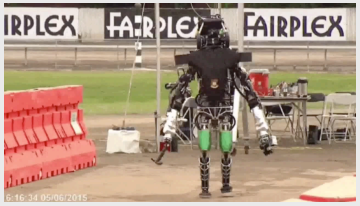
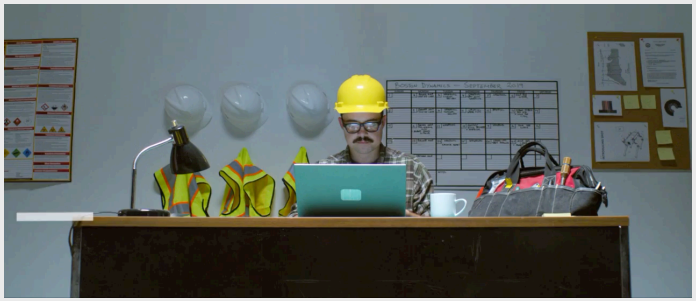
Humanoid robots



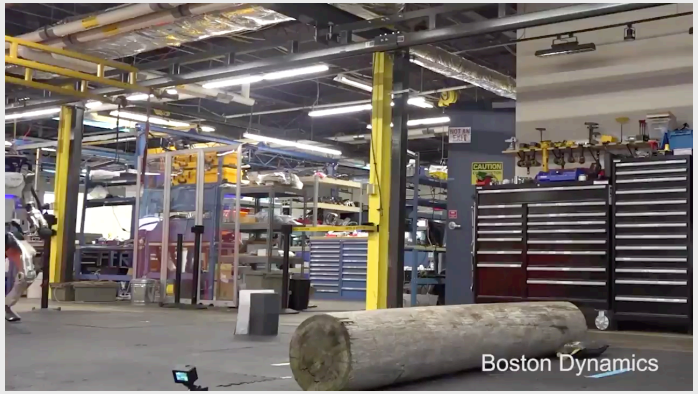



Boston Dynamics BigDog

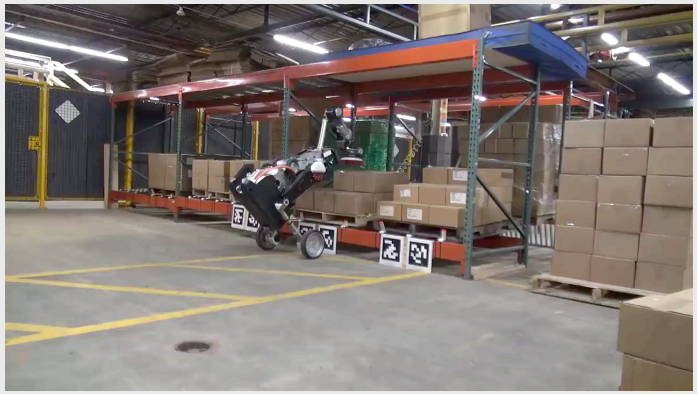
Boston Dynamics Spot



Boston Dynamics Atlas



Boston Dynamics Handle



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Industrial Pick and Place

Robotics
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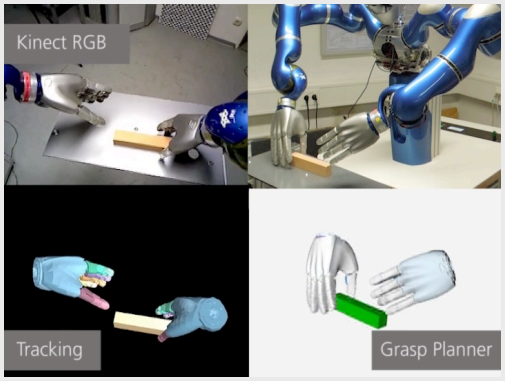
Manipulation



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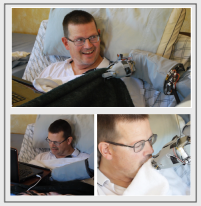
Service Robots

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Dexterous Manipulation

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HaptX Dataglove

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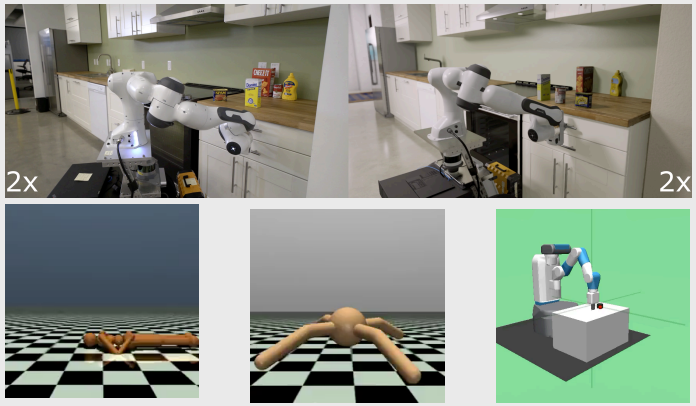
Simulation



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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

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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

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Course Outline

Week	Content	HW / Project
#1	Introduction / Probabilities	
Probabilistic Models / State Estimation		
#2	Gaussian processes, Bayesian filtering	HW1 assigned
#2	Motion and sensor models	
Filtering (localization, tracking, mapping)		
#3	Localization: grid, particle filters, EKF, UKF	
#4 / 5	Mapping: SLAM, RGBD 3D Mapping	HW2 assigned
Planning / Control		
#6 / 7	Deterministic and sampling-based planning, exploration	HW3 assigned
#8	Markov decision processes, inverse RL	
Deep Learning		
#9	Model learning, visual navigation	HW4 assigned
#10	Grasping	

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