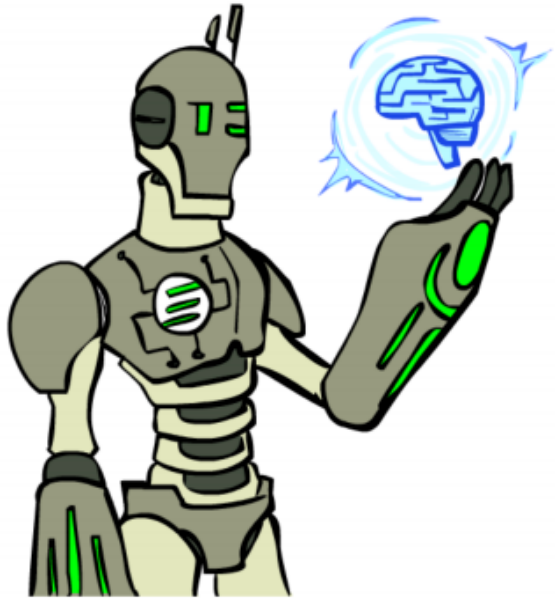
CS 1501: Intro to Robotics

Autonomy, AI, and Applications

Introduction



Rohan Raval

Monday 1-1:50pm, MEC 213

Course Structure

Instructor: Rohan Raval

- 4th year, BS Computer Science and Physics
- Interests: Autonomous Vehicle Motion Planning, UAVs
- Experience: Software Engineering Intern at Uber ATG (mapping)
- rohanraval@virginia.edu

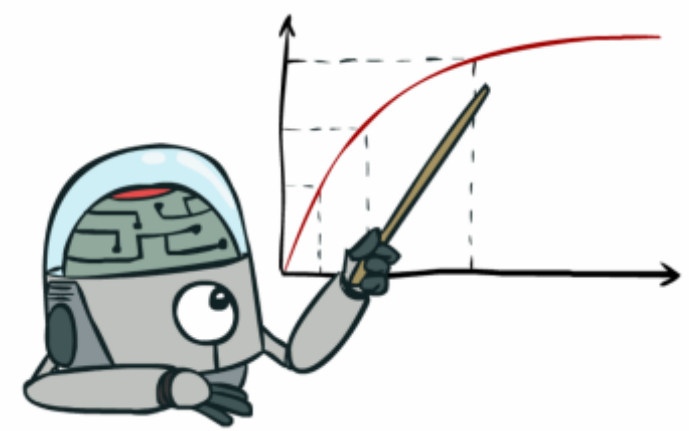
Faculty Advisor: Nicola Bezzo

- Assistant Professor, ECE and Systems Engineering
- Research Interests: Resiliency, Security and Adaptive Control of CPS
- nbezzo@virginia.edu

Course Structure

Grading

- 1-credit Pass/Fail
- Attendance (50%)
- Readings (50%)
  - Articles/blogs/papers/videos **OR** Programming Assignments



Content

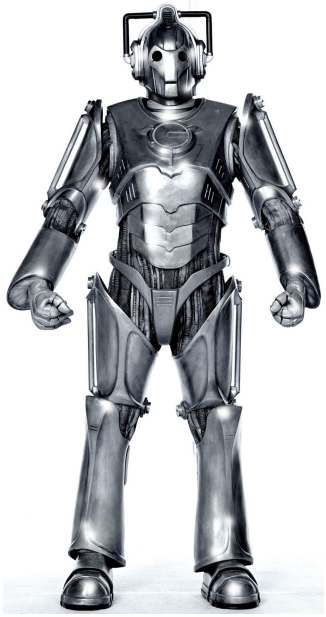
Covered

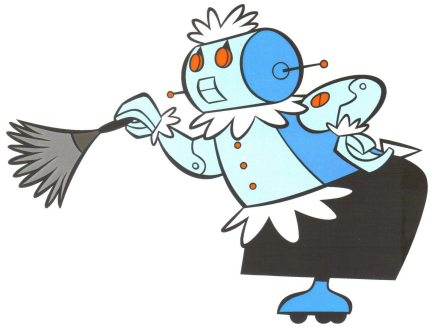
- “Artificial Intelligence”
- “Algorithms”
- “Programming” / “Implementation-oriented”
- “UAV’s” / Self-driving cars
- “SLAM”

Not Covered

- “Circuitry”
- “Mechanical parts”
- “do you actually work with real robots”
- “Computational Geometry”

What is a Robot?





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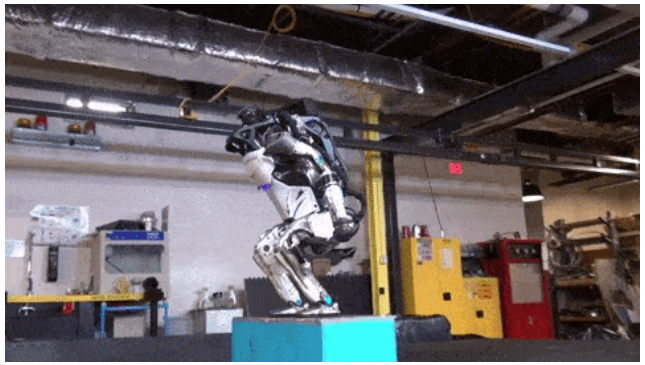
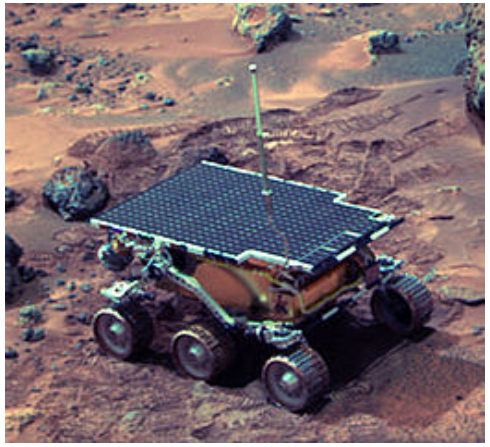




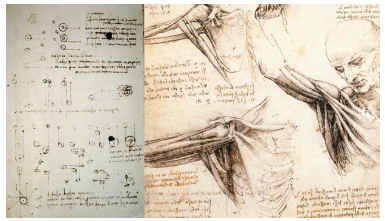
Types of Robots

- **Manufacturing Robots**
  - Arm-type robot, fixed base
  - Local, repetitive tasks
- **Service Robots**
  - Medical, cleaning, etc.
- **Field Robots**
  - Moves in complex, cluttered, changing environments
  - Military, security ops
  - Self-driving cars, Drones, etc.
- **Humanoids**

History of Robots

Ancient Times: concepts, simple mechanical designs

1495: Leonardo da Vinci's Mechanical Knight



1738: Jacques de Vaucanson's Mechanical Duck

1898: Nikola Tesla's remote-controlled vessel

1921: "Robot" coined by Karel Čapek in play "Rossum's Universal Robots"

- "robot" ← Slavic "robota" ← "worker"

History of Robots

1942: Isaac Asimov's 3 Laws of Robotics

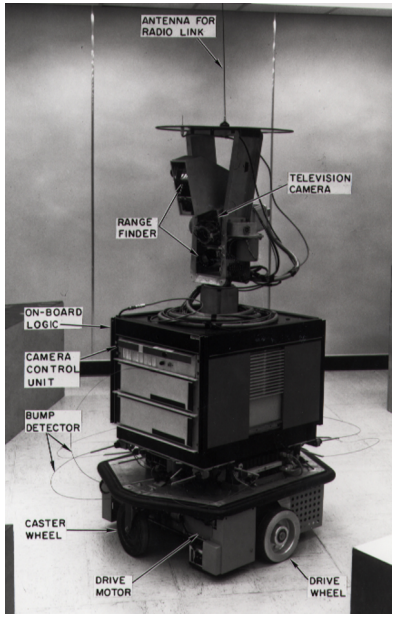
1. Robot may not injure a human being (or by inaction, allow harm)
2. Robot must obey human orders (unless conflict with 1)
3. Robot must protect its own existence (unless conflict with 1 and 2)

1961: George Devol's first patent of robot

- Mechanical arm with gripper → industrial robotics

1966-72: Shakey the Robot

- First general-purpose robot to be able to reason about its actions
- Stanford Research Institute



History of Robots

2004: DARPA Grand Challenge

- 150 miles in Mojave desert
- Farthest distance?
  - **7.32 miles** (CMU)... Epic Fail!

2005: DARPA Grand Challenge

- 5 finalists completed the course!
- Winner: Stanford's "Stanley"
- feat. UVA's Team Jefferson!

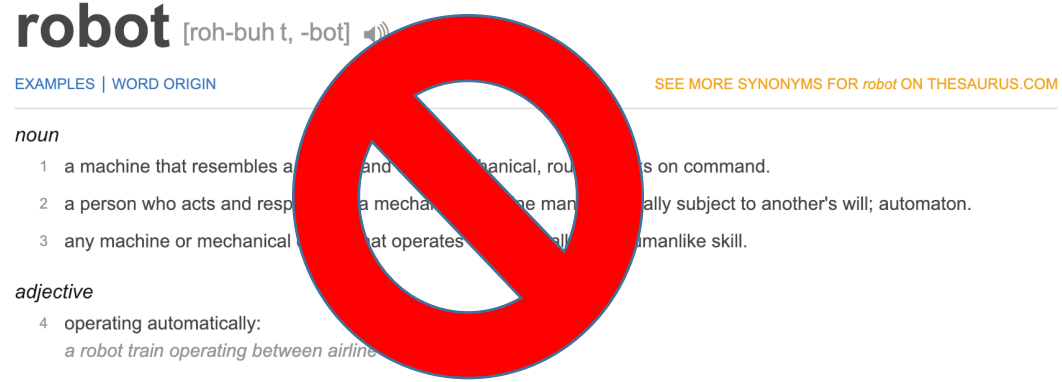
2007: DARPA Urban Challenge

- Winner: CMU's "Boss"

History of Robots

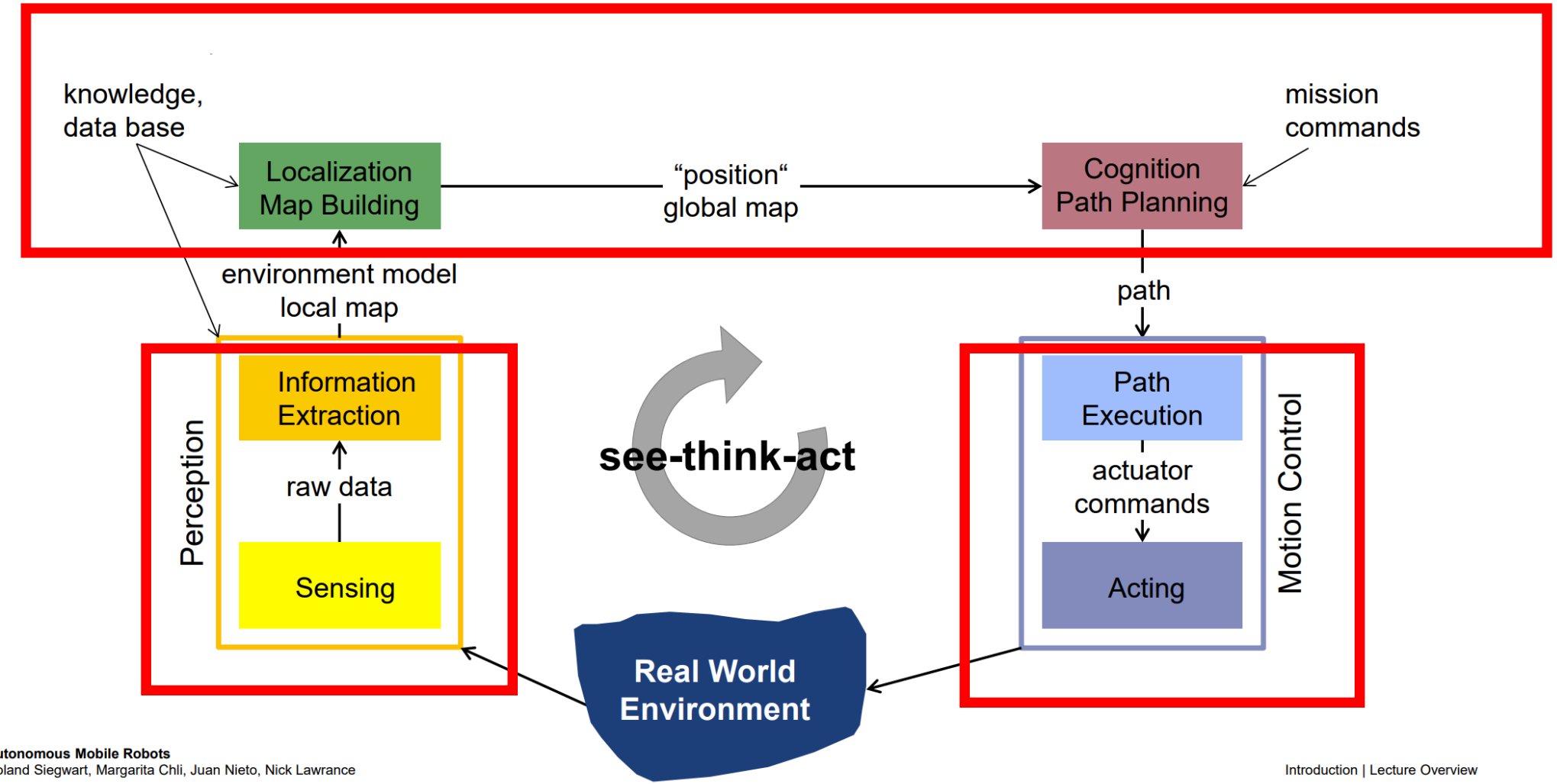
CMU Boss DARPA Urban Challenge 2007

What is a Robot?



"a robot is a goal-oriented machine that can sense, plan and act" - Prof Bezzo

See, Think, Act



Perception, Planning, Control