

## Robotics Overview

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CPS 196

## What is robotics?

- Mechanical man ideas go back at least to the Greeks
- Term comes from Czech playwright Karel Capek (or perhaps from his brother Josef) ~1917-1921
  - "robota" (obligatory work)
  - "robotnik" (serf)
- "Robotics" first used by Asimov in 1950
- Agents with physical embodiment
  - Sensors
  - Effectors
- Human-shaped robots = humanoids

## Common Robot Applications

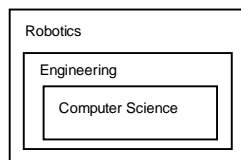
- Industry and agriculture
  - Building cars
  - Harvesting crops
- Mapping and Exploration
  - Mines
  - Mars
- Transportation
  - Delivery of mail/equipment
  - Military applications
- Medical devices
- Household aids
- Entertainment
- Human augmentation



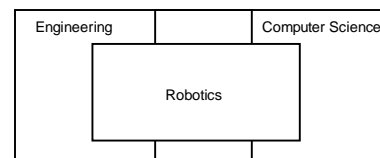
## Areas of Robotics

- Industrial/Mechanical robotics
  - Fabrication and (low level) control of robotic devices
  - Usually part of engineering
- Algorithmic robotics
  - Control algorithms for abstracted robots
  - Part of computer science theory
- Intelligent Robotics
  - Higher level control of robotic devices
  - Part of AI
- Probabilistic Robotics
  - Intelligent Robotics using probabilistic techniques
  - Subfield of Intelligent Robotics

## Different Views of Robotics I



## Different Views of Robotics II



## Robot Effector Types

- Many effector types simply move the robot
  - Wheels
  - Tracks
  - Legs
- Different effector types have different pros/cons
- Robot arms/hands
  - Usually not attached to mobile robots (some exceptions)
  - Used in factory automation

## Robot Effector Complexity

- Degree of Freedom (DOF)
  - Independent direction of movement
  - Rigid body in space = 6DOF (X, Y, Z, yaw, roll, pitch)
- Dynamic state (DOF x2 for derivatives)
- Effective DOF can be > true DOF
  - e.g. car (2 actual, 3 effective)
  - effective > true = nonholonomic

## Types of Robot Sensors

- Cameras
- Laser/Sonar/IR range finders
- Microphones
- Odometers
- Inertial sensors
- GPS
- Force/Torque/touch sensors

## Perception

- Perception is often a *probabilistic inference problem*
- Want  $P(S|O)$  (state given observations)
- Model  $P(O|S)$  (sensor model)
- Use Bayes rule