

CS4278/5478

Intelligent Robots: Algorithms & Systems

Instructor: **David HSU**

Co-Instructor: Panpan CAI

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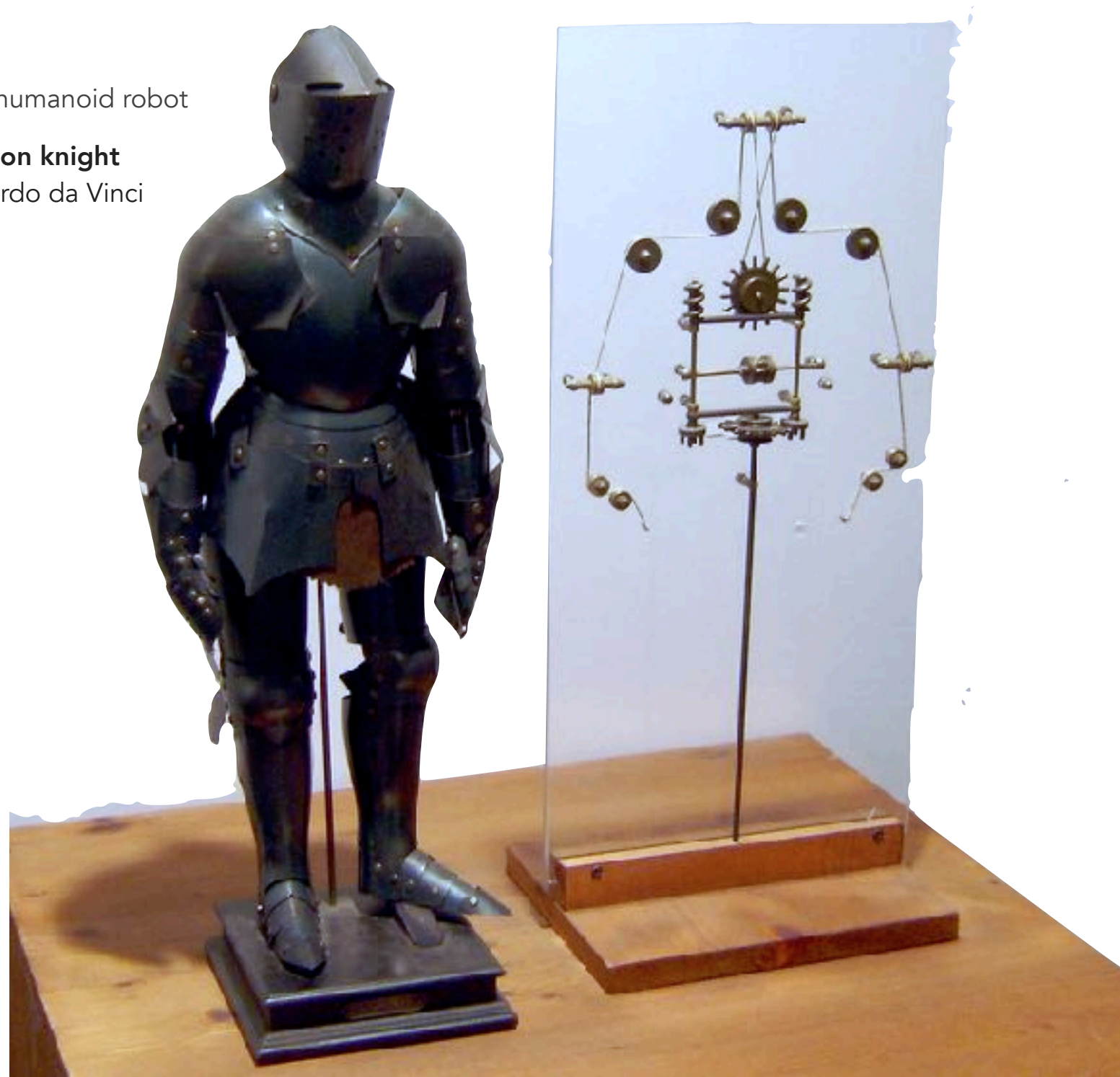
Robot



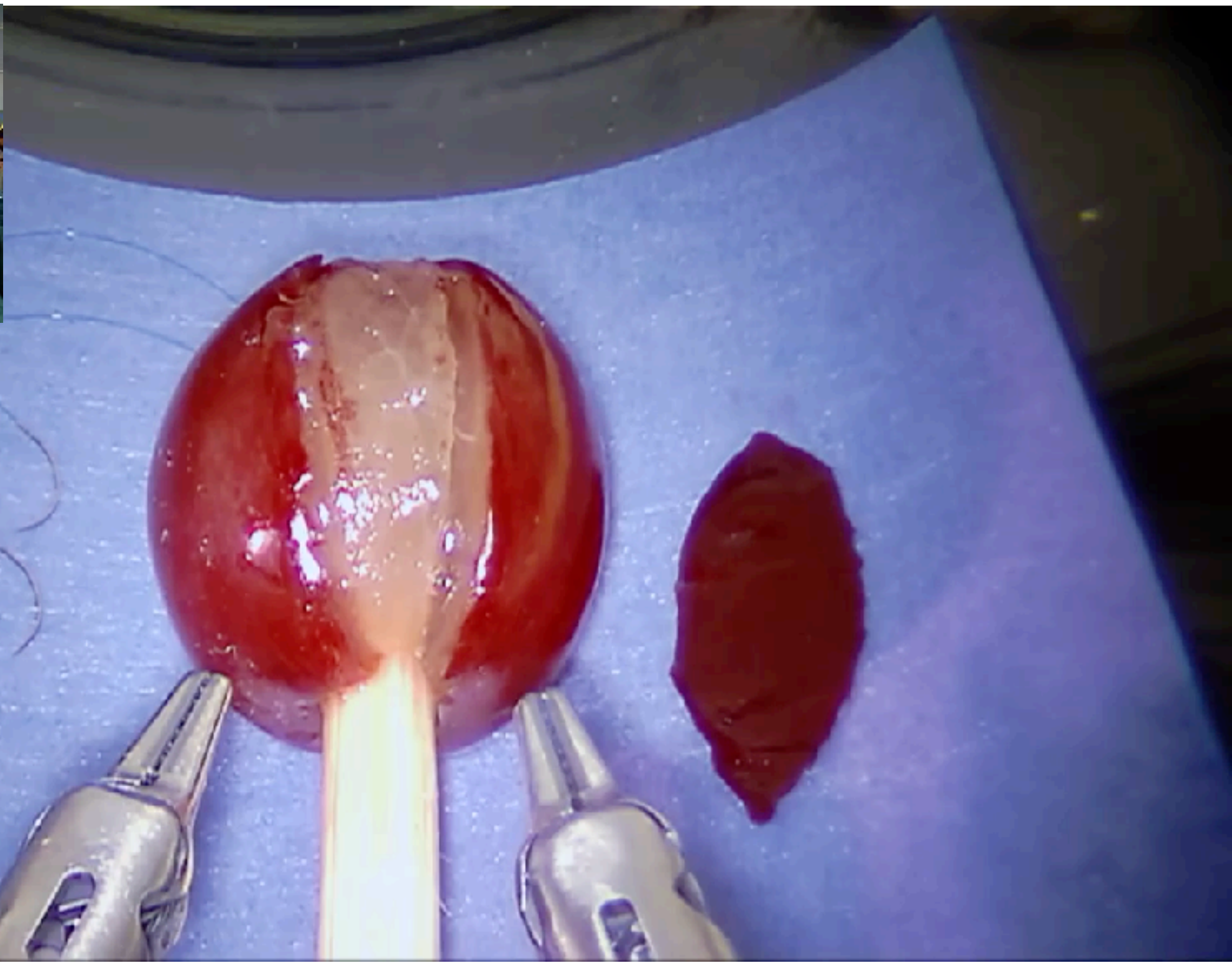
Leonardo's robot

The first humanoid robot

Automaton knight
by Leonardo da Vinci
(~1495)

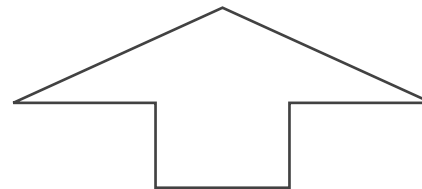


da Vinci surgical robot



“Intelligent” robots

2000s



1980s, 1990s



Objectives

- Understand, implement, and analyze robot algorithms. Apply them in specific robot task domains.
 - **State estimation** and mapping
"Where am I?"
 - **Reasoning and decision making**
"What shall I do?"
 - Control
"How do I do it?"
- Understand the common architectures of intelligent robot systems.

Objectives

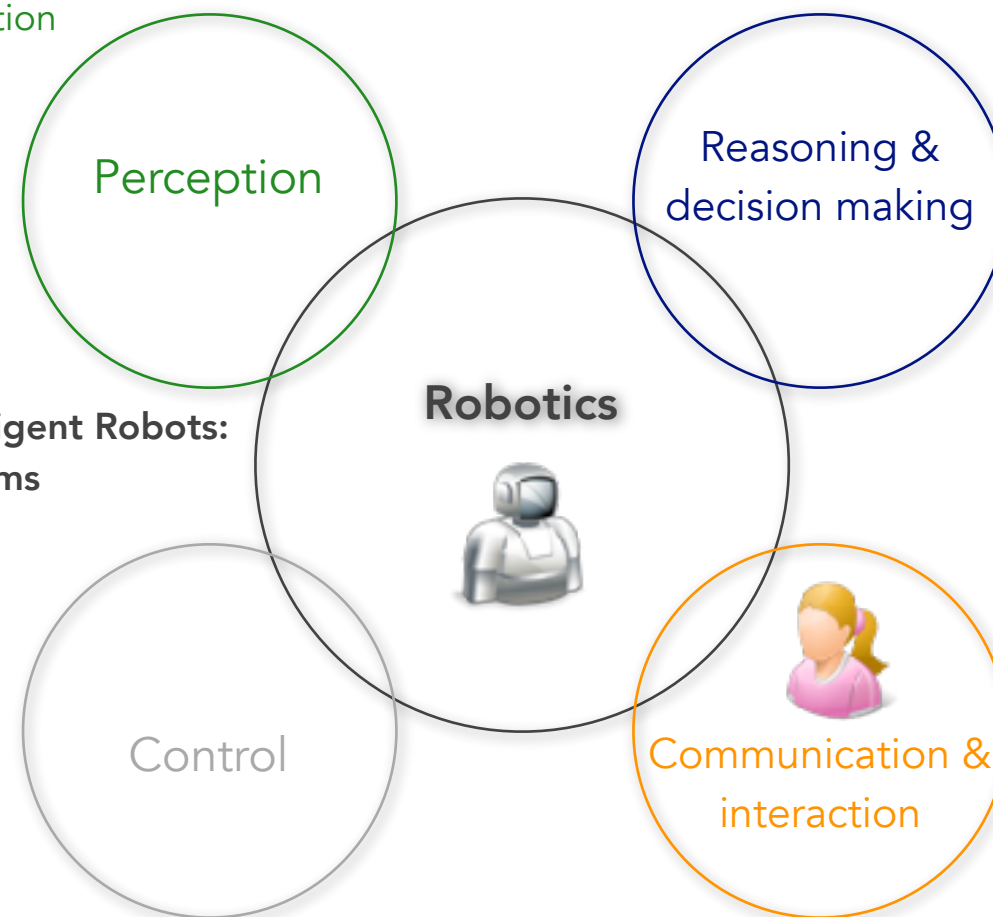
- Gain practical experiences in developing and debugging robot systems on common platforms, e.g., ROS.
- Gain exposure to one or more application domains of robotics.
 - Autonomous driving
 - Robot manipulation
 - ...

Related modules

CS4243 Computer Vision & Pattern Recognition
CS4277/5477 3D Computer Vision

CS4278/5478 Intelligent Robots:
Algorithms & Systems

Check offerings from BME, ECE, ME



CS3244 Machine Learning
CS4246/5446 AI Planning and Decision Making
CS5242 Neural Networks & Deep Learning
CS5340 Uncertainty Modelling in AI

CS4248 Natural Language Processing

CS6208 Advanced Topics in AI
CS6216 Advanced Topics in Machine Learning
CS6244 Advanced Topics in Robotics

Graduate Certificate in Robotics

- Requirements
 - CS5339 Theory & Algorithm for Machine Learning OR CS5242 Neural Networks and Deep Learning
 - CS5446 AI Planning and Decision Making
 - CS5477 3D Computer Vision
 - CS5478 Intelligent Robots: Algorithms & Systems
- “Stackable” towards MComp in AI
- More information

Prerequisites

- Calculus
e.g., "gradient"
- Linear algebra
e.g., "rotation matrix"
- **Probability**
e.g., "Bayes rule"
- **AI**
e.g., "A* search"

Prerequisites

- Programming experiences. Proficient in at least one programming language
 - **Python** or
 - C/C++

Workload

- 2 written assignments
- 2 programming assignments
- 1 project
 - 2-person team
- Midterm?

Textbooks

- Main textbook
 - *Introduction to Autonomous Mobile Robots*, R. Siegwart, I.R. Nourbakhsh, and D. Scaramuzza. 2nd ed.
- Supplementary textbook
 - *Reinforcement Learning: An Introduction*, R.S. Sutton and A.G. Barto
 - *Probabilistic Robotics*. S. Thrun, W. Burgard, and D. Fox

Course website

- LumiNUS
- Google directory

Consultation hours

- Wednesday after the class
 - Office: COM2 #03-52
- Otherwise, e-mail me to make an appointment.

Collaboration policy

- You may brainstorm, discuss ideas, etc. verbally with other students on problem sets and programming assignments.
- You must write up your solutions **independently** without resorting to any external help. In particular, "cut-and-paste" of any form and any extent is strictly forbidden and is treated as plagiarism.
- You should take reasonable precautions to prevent your work from being used for plagiarism.

Questions?