Introduction to Artificial Intelligence

CSE 415

Spring 2014

Administrative Details

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- Course Home Page: www.cs.washington.edu/415
- Text: Artificial Intelligence: A Modern Approach (3rd edition), Russell and Norvig

This Lecture

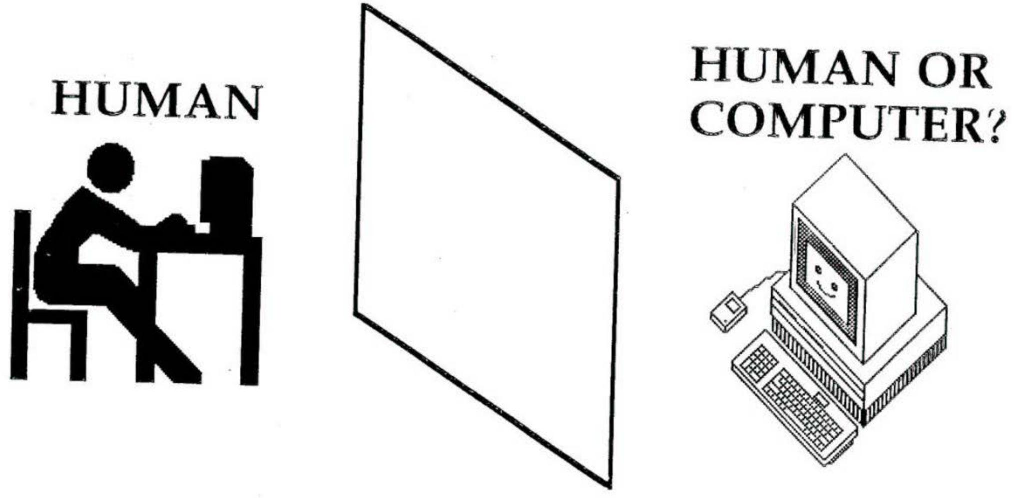
- What is AI all about, roughly from Chapters 1 and 2.
- Begin looking at the Python language we will use.

What is intelligence?

- What capabilities should a machine have for us to call it intelligent?

Turing's Test

- If the human cannot tell whether the responses from the other side of a wall are coming from a human or computer, then the computer is intelligent.



Performance vs. Humanlike

- What is more important: how the program performs or how well it mimics a human?
- Can you get a computer to do something that you don't know how to do? Like what?
- What about creativity?

Mundane Tasks

- Perception
  - Vision
  - Speech
- Natural Language
  - Understanding
  - Generation
  - Translation
- Reasoning
- Robot Control

Formal Tasks

- Games
  - Chess
  - Checkers
  - Kalah, Othello
- Mathematics
  - Logic
  - Geometry
  - Calculus
  - Proving properties of programs

Expert Tasks

- Engineering
  - Design
  - Fault Finding
  - Manufacturing planning
- Medical
  - Diagnosis
  - Medical Image Analysis
- Financial
  - Stock market predictions

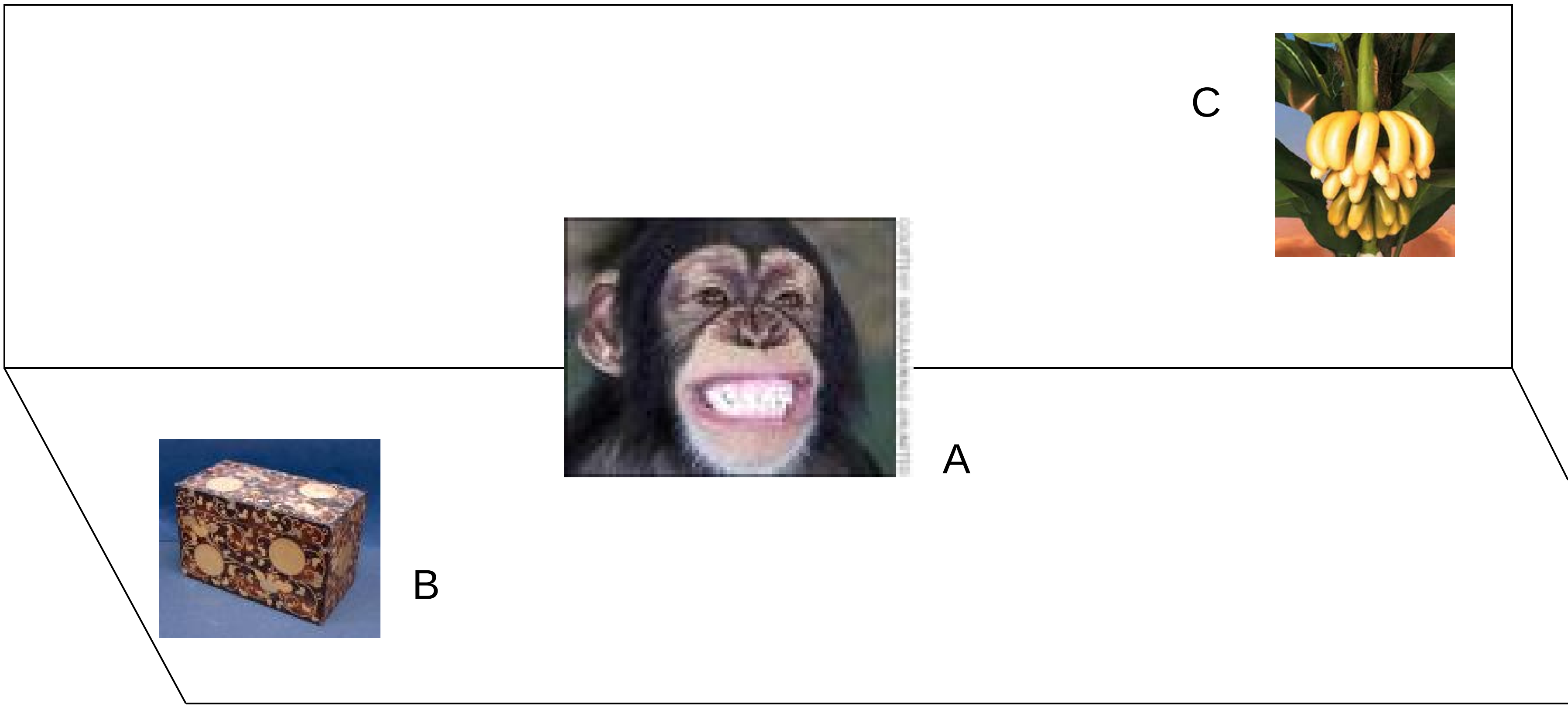
What is an intelligent agent?

- What is an agent?
- What does rational mean?
- Are humans always rational?
- Can a computer always do the right thing?
- What can we substitute for the right thing?

Intelligent Agents

- What kinds of agents already exist today?

Problem Solving



Find a sequence of operations to produce the desired situation from the initial situation.

Game Playing

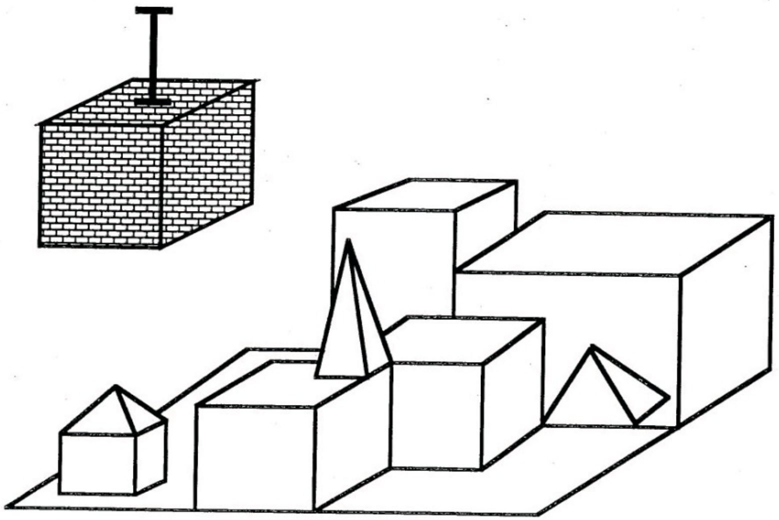
- Given:
  - An initial position in the game
  - The rules of the game
  - The criteria for winning the game
- WIN!

Theorem Proving

- Given:
  - $\forall x$ (human(x) -> animal(x))
  - $\forall x$ (animal(x) -> (eats(x) & drinks(x)))
- Prove:
  - $\forall x$ (human(x) -> eats(x))

Natural Language Understanding

- Pick up a big red block.
- OK.
- While hunting in Africa, I shot an elephant in my pajamas.
- I don't understand.



Expert Systems

"I'd like to buy a DEC VAX computer with 8MG of main memory, two 300MB disks, and a 1600 BPI tape drive."

Today's Response: "You gotta be kidding."

XCON: "1 XVW756 CPU, 2 XVM128A memory boards, 1 XDQ780C disk controller, 1 XDT780V disk drive, 1 XTQ780T tape controller, 1 XTT981Q tape drive, 1 XBT560M mass bus"

Computer Vision with Machine Learning

Given: Some images and their corresponding descriptions

{trees, grass, cherry trees}

{cheetah, trunk}

{mountains, sky}

{beach, sky, trees, water}

●●●

To solve: What object classes are present in new images

?

?

?

?

●●●

Groundtruth Data Set: Annotation Samples

tree(97.3), **bush**(91.6), **spring flowers**(90.3), **flower**(84.4), park(84.3), **sidewalk**(67.5), **grass**(52.5), **pole**(34.1)

sky(99.8), **Columbia gorge**(98.8), lantern(94.2), **street**(89.2), house(85.8), bridge(80.8), car(80.5), hill(78.3), boat(73.1), pole(72.3), **water**(64.3), mountain(63.8), **building**(9.5)

sky(95.1), **Iran**(89.3), house(88.6), **building**(80.1), boat(71.7), bridge(67.0), **water**(13.5), **tree**(7.7)

Italy(99.9), grass(98.5), **sky**(93.8), rock(88.8), **boat**(80.1), **water**(77.1), Iran(64.2), stone(63.9), bridge(59.6), **European**(56.3), sidewalk(51.1), **house**(5.3)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Google
Mars Rovers (2003-now)
(See NASA website for latest updates)
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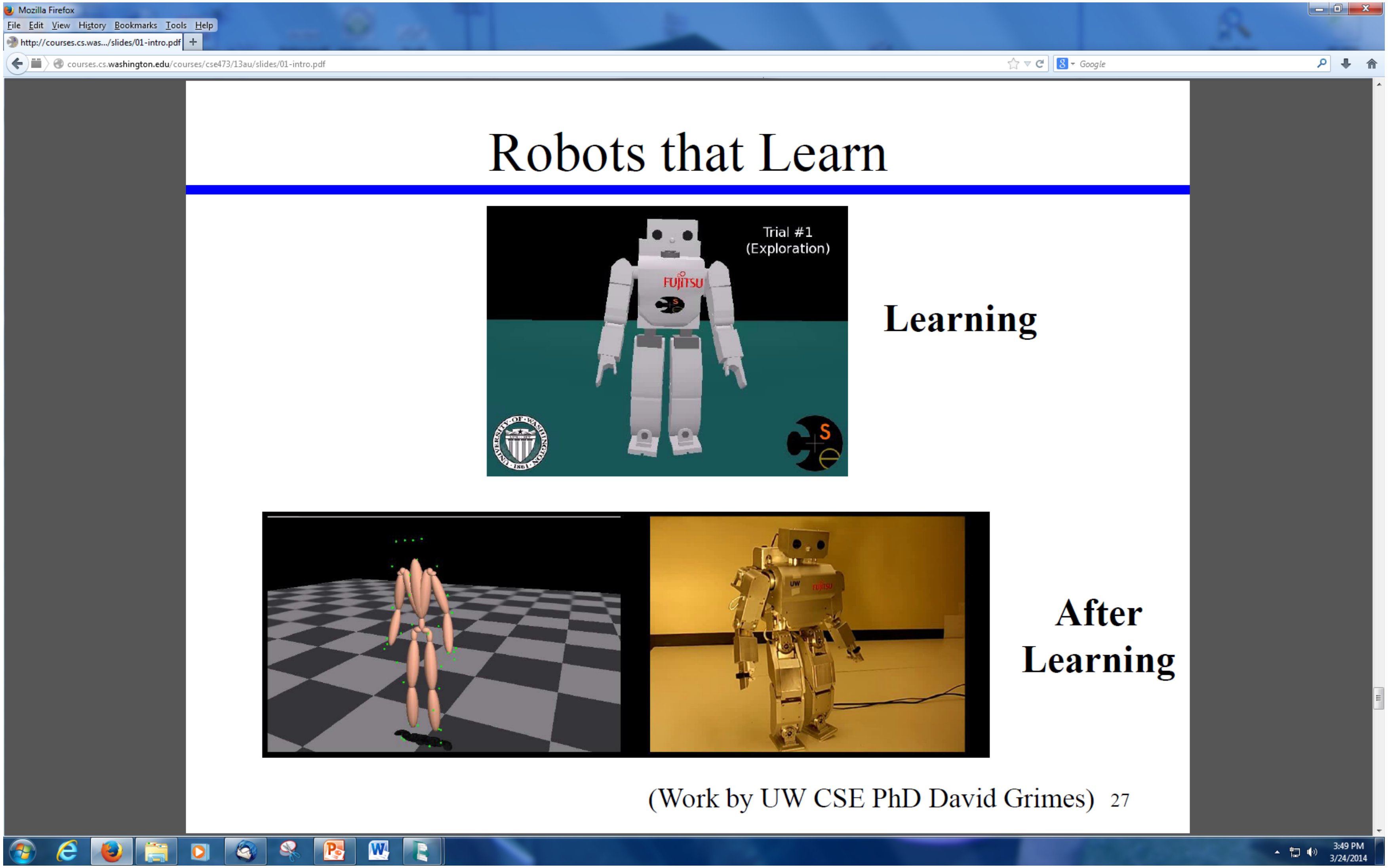
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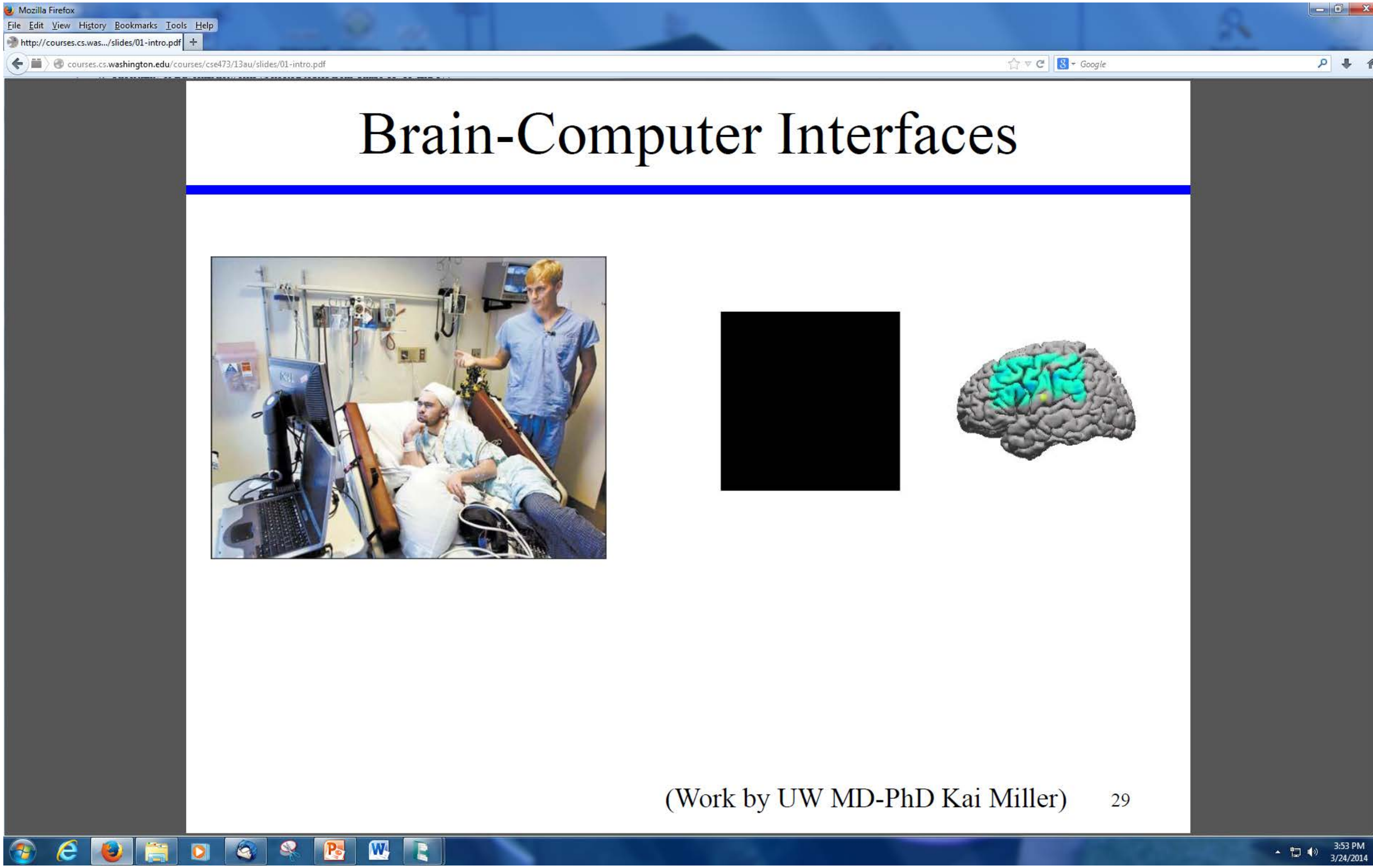
Robots that Learn
Trial #1
(Exploration)
Learning
After
Learning
(Work by UW CSE PhD David Grimes) 27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Brain-Computer Interfaces
(Work by UW MD-PhD Kai Miller)
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Stuart Russell's "Potted History of AI"

- 1943 McCulloch & Pitts: neural nets model of the brain
- 1950 Turing's "Computing Machinery and Intelligence"
- 1952-69 Look Ma, no hands
- 1950s Early AI Programs: Logic Theorist, Checker Player, Geom
- 1956 Term "Artificial Intelligence" adopted
- 1965 Robinson's complete algorithm for logical reasoning
- 1966-74 AI discovers computational complexity; neural nets go
- 1969-79 Early development of knowledge-based "expert systems"
- 1980-88 Expert systems boom
- 1988-93 Expert systems bust: "AI Winter"
- 1985-95 Neural networks return
- 1988- AI and Statistics together
- 1995- Agents, agents everywhere
- NOW- PROBABILITY EVERYWHERE!
- NOW^{lgs}- Learning, Learning, Learning

Overview of Intended Topics

1. Introduction to AI (Chs. 1-2, done)
2. Python (Python as a Second Language, S. Tanimoto)
3. Problem Solving by Search (Ch 3) “Big Chapter”
4. Beyond Classical Search (Ch 4)
5. Adversarial Search (Ch 5) “Game Playing”
6. Constraint Satisfaction Problems (Ch 6)
7. Knowledge and Reasoning (Loosely related to Ch 7, 8, 9)
8. Learning (related to Ch 18)
9. Computer Vision (not from book)
10. Other Applications