CSE 5522: Artificial Intelligence 2
Advanced Topics

Prof. Eric Fosler-Lussier

TR 11:10–12:30

Bolz Hall 436

Autumn 2015

Today's agenda

- Administrivia
- Course outline
- Course requirements
- Intro to the course

About me

- Research in automatic speech recognition and natural language processing
  - Statistical modeling & language
- Directs the Speech & Language Technology lab
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- Office hours: Th 9:30–10:30, 1:30–2:30

How do you say that name?

- Prof. Fosler-Lussier (faaz-ler loo-see-er)
  - But there are at least 2 variants of Fosler and 3 variants for Lussier within my family.
- Acceptable alternatives
  - Prof./Dr. Fosler
  - Prof./Dr. F
  - Use your judgment
- Unacceptable alternatives
  - Hey you!

Course information

- Course website:
  - carmen.osu.edu -> CSE 5522
  - I will try to keep slides updated on carmen
  - Discussion groups for homework, general comments
- Syllabus has a lot of information

Notes

Course goals

- You should walk away with:
  - Understanding of how AI problems are approached
  - Knowledge of some core AI techniques (different than those in 630/5521)
  - A good idea of the type of research that is done at OSU
  - Experience in running a (small-scale) AI experiment

The Book

- AIMA (Artificial Intelligence: A Modern Approach)
  - Stuart Russell and Peter Norvig
  - 3rd edition (Blue Cover, 2009)
  - Same book as in 630/5521!
- Some homework problems will be from this book
- Course covers much of the 2nd half of the book

Course format

- Course divided into roughly 2 parts
  - Part 1: basic building blocks
    - Machine learning
    - Probabilistic reasoning
  - Part 2: applications
    - Still learn some techniques
    - ~1 week on each topic
    - Each week capped off with a guest lecture on OSU research in area

Part 1: Building blocks

- Ch 13: Review of basic probability theory
- Ch 14: Bayes' nets
- Ch 15: (Hidden) Markov models
- Ch 18: Decision trees
- Ch 18: Neural networks
- Ch 18: Support vector machines
- Ch 20: Statistical Learning: EM algorithm

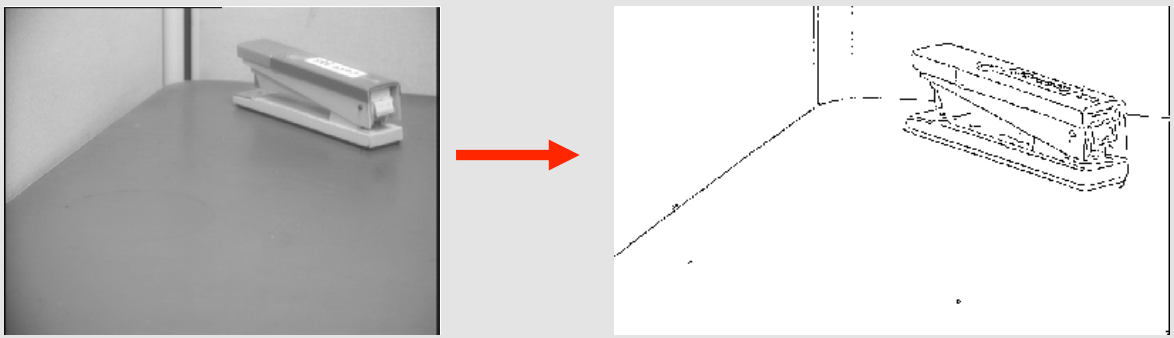
Machine Learning

- Other opportunities
  - CSE 5526 (AU): Neural Networks
    - Prof. Wang
  - CSE 5523 (SP): Pattern Recognition
    - Prof. Belkin/Prof. Kulis
  - ECE 7868: Pattern Recognition & ML
    - Prof. Martinez

Part 2: AI Application Areas

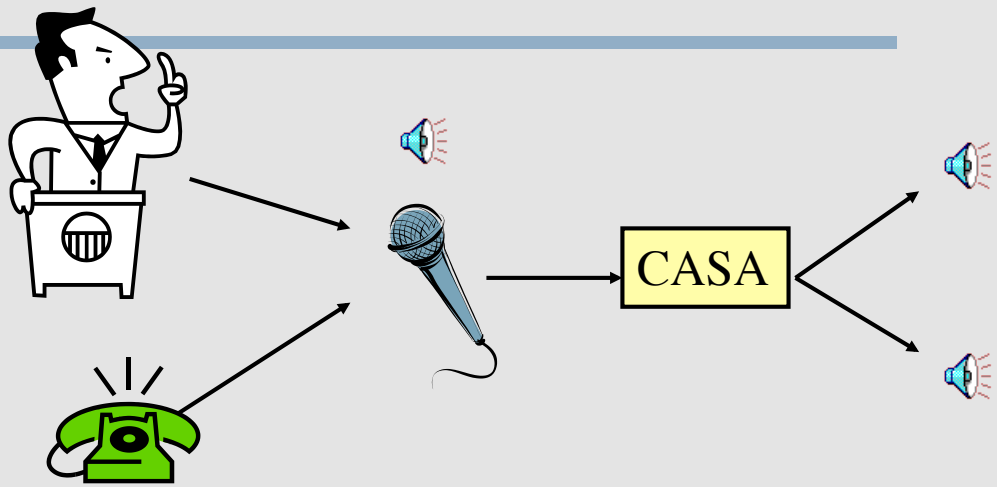
- Vision (Ch. 24)
- Audition (not in book)
- Speech recognition (Ch 23)
- Spoken dialogue systems (not in book)
- Natural language processing (Ch 22/23)
- [redacted]

Computer Vision



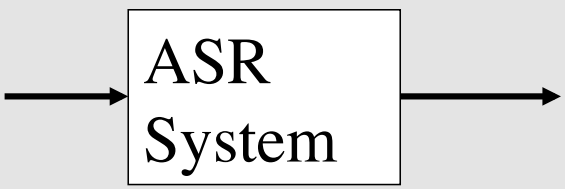
- Understanding the content of images
- AIMA Chapter 24
- Learning more: CSE 5524 (Prof. Davis)

Computer Audition



- Find acoustic “objects” in environment
- Supplemental readings
- Learning more: CSE 5539 (Prof. Wang)

Automatic Speech Recognition



- Transform acoustic signal into text
- Chapter 15.6, possibly supplemental readings
- Learning more: CSE 5525 (Prof. Fosler-Lussier)

Spoken dialogue systems

S: How can I help you?

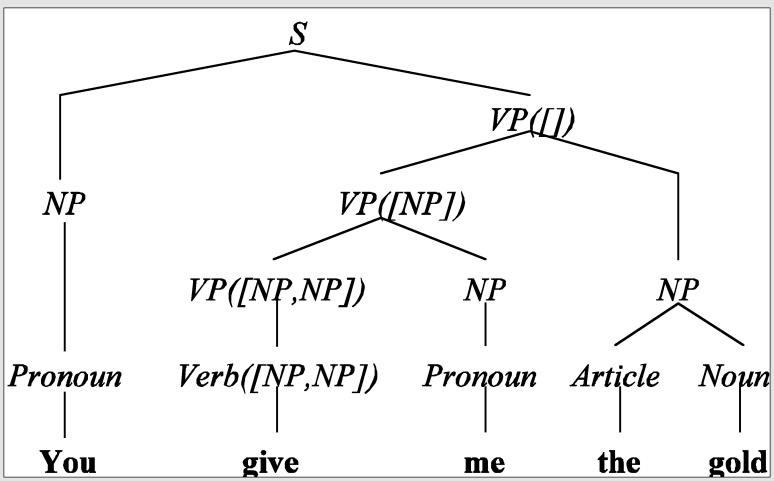
U: I'd like to fly from Austin to Newark August fifth in the morning.

S: I've got you leaving Boston on Sunday, August fifth in the morning and arriving in Newark airport. What is your preferred airline?

U: Change the departure city to Austin, Texas.

S: O.K., I'm changing the departure city to Austin. I've got you leaving Austin.

Natural Language Processing



- Finding structure, relations in text
- Chapter 22
- Learning more: CSE 5525 (Prof. Fosler-Lussier), Ling 5801,5802, 5803 (Profs. Schuler, White, Elsner, de Marneffe)

Ritter

Course requirements

- Participate!
- Homeworks
  - 4 homeworks 4 x 5% = 20%
- Two exams
  - Exam 1: probability theory + machine learning 20%
  - Exam 2: machine learning + applications + mistakes 20%
- No final exam
- Final project

Project

- Task: apply one of the machine learning algorithms (either from this class or elsewhere) to some non-trivial task
- Examples:
  - “spam” detector
  - Learn to play a game
  - Find patterns in financial data
  - Compare two algorithms on a standard data set
  - Finding stoplights in photos, Where’s Waldo

Project

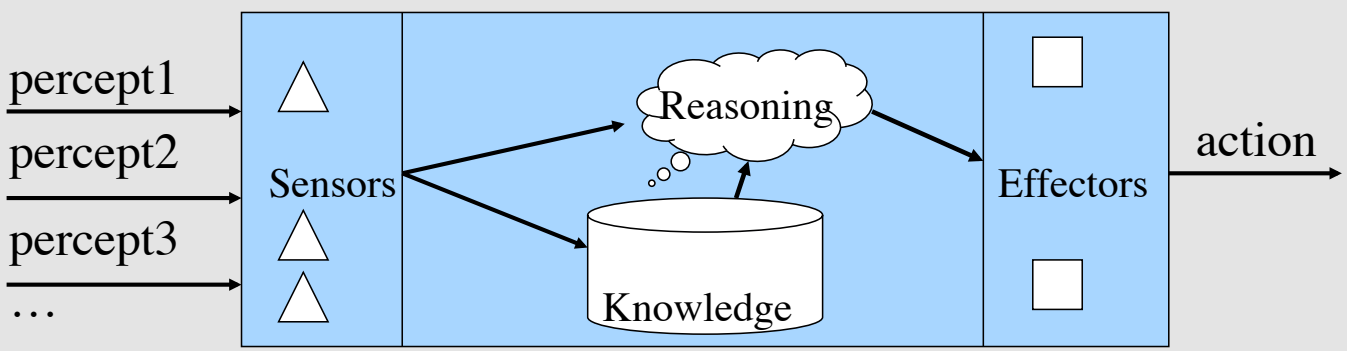
- Teams: work in teams of 3+
- Team proposes a project
  - Work with me to refine ideas
- 2 page proposal due mid term
  - Can be revised to improve grade
- Initial paper draft due November 16
- Papers reviewed by classmates -> Nov 22
- Final paper due December 4
- Presentations during three class sessions

Solving problems in AI

- AI is sometimes described as the study of "hard" problems
  - Reasoning
  - Perceiving
  - Interacting with uncertain environments
- AIMA/CSE 630/5521: Agent-based approach
  - We want an agent to "do the right thing"

Rational Agents

- Agent: an entity that *perceives* and *acts*
  - Rational agent: perceives and acts rationally
  - Agents try to achieve goals given percepts
- Functional abstraction: f: Percept* → Act



Defining a problem

- First, examine the scenario
- Determine three things:
  - The types of variables that describe the scenario
  - The values these variables can take on
  - The range of actions that an agent can do

Traffic light scenario

Traffic light scenario

Hypotheses

- A hypothesis is a guess at what an appropriate action (or set of actions) is
  - Some actions are obvious
  - Some require experimentation to find the best fit
- Traffic light hypothesis?
- In this course, we will talk about different ways to make hypotheses

Pick a number

- Let's play a game…

16N 1N 43N 9N 45Y 3N 6MN
8N 0N 4N 63N 36Y -6N 60N
1N 42Y 44N 21N 6Y 84Y 60X
18Y

- What are the variables?
- What is your hypothesis about the game function?

Evaluating hypotheses

- It is important to validate your hypothesis
- May develop hypothesis by training on some data
  - Very important to have different testing data
- Quantitative evaluation
  - I got x% of the test scenarios correct
  - The average car takes x seconds to go down the street
- Qualitative evaluation
  - My hypothesis explains such-and-such phenomenon, where the competing hypothesis doesn't