

The Rest of AI and Summary

CS472/CS473 – Fall 2005

What have we done?

- **Learning**

- Theory: Generalization Error Bounds, Overfitting, CV
- Algorithms: Decision Tree, KNN, Perceptron, NN, SVM

- **Acting**

- Theory: Markov Decision Processes
- Reinforcement Learning: TD, ADP
- Planning: Situation Calculus, STRIPS, Partial-Order Planning

- **Reasoning**

- Logic: FOL and Propositional
- Reasoning: Resolution proofs

Search

- Uninformed Search: DFS, BFS, IDS, Bi-Directional
- Heuristic Search: Greedy, A*, IDS*
- Local Search: Hill-Climbing, Sim. Annealing, Genetic
- Constraint Satisfaction
- Adversarial Search

What have we NOT done?

- **Applications**

- Acting:
 - Production planning in factories
 - Automated assembly
- Learning:
 - Spam filtering
 - Credit card fraud detection
 - Market basket analysis
- Reasoning:
 - Embedded diagnosis systems
 - Interactive help systems
 - Software verification

- **What is lacking?**

- Achieving everything together! A learning system that has knowledge and can plan and act under uncertainty.

What have we NOT done?

- **Perception**

- Natural Language Understanding
- Speech Recognition
- Image Understanding
- Etc.

- **Robotics**

- Speech Generation
- Mechanics
- Touch Sensing
- Etc.

Natural Language Understanding

Goal: To create *computational models* of language in enough detail that you could write computer programs to perform various tasks involving natural language.

Ultimate Goal: To be able to specify models that approach human performance in the linguistic tasks of reading, writing, hearing and speaking.

Information Retrieval

Goal: Choose from a set of documents the ones that are relevant to a query.

Approach: Understanding via statistics.

Example: Find me important WWW pages on SVMs.

Harder Example: Find me all articles on leveraged buyouts involving more than 100 million dollars that were attempted but failed during 1986 and 1990.

Information Extraction

Goal: Read a text and derive from it some assertions that can be put into a structured database.

Approach: Restricted domain so that one can learn rules for individual assertions.

Example:

BOGOTA, 9 JAN 90 (EFE) – RICARDO ALFONSO CASTELLAR, MAYOR OF ACHI, IN THE NORTHERN DEPARTMENT OF BOLIVAR, WHO WAS KIDNAPPED ON 5 JANUARY, APPARENTLY BY ARMY OF NATIONAL LIBERATION (ELN) GUERRILLAS, WAS FOUND DEAD TODAY, ACCORDING TO AUTHORITIES. CASTELLAR WAS KIDNAPPED ON 5 JANUARY ON THE OUTSKIRTS OF ACHI, ABOUT 850 KM NORTH OF BOGOTA, BY A GROUP OF ARMED MEN, WHO FORCED HIM TO ACCOMPANY THEM TO AN UNDISCLOSED LOCATION.

→

Date: 05 JAN 90

Location: COLOMBIA: BOLIVAR (DEPARTMENT): ACHI (TOWN)

Type: KIDNAPPING

Weapon: *

Victim: "RICARDO ALFONSO CASTELLAR" ("MAYOR OF ACHI")

Perpetrator: "GROUP OF ARMED MEN"

Organization: "ARMY OF NATIONAL LIBERATION (ELN)"

Machine Translation

Goal: Translate from one natural language to another.

Examples:

- The spirit is willing, but the flesh is weak.
- The extension of the coverage of the health services to the underserved or not served population of the countries of the region was the central goal of the Ten-Year Plan and probably that of greater scope and transcendence.
- Welcome to Chinese Restaurant. Please try your Nice chinese Food With chopsticks, the traditional and typical of Chinese glorious history and cultural. PRODUCT OF CHINA.

Speech Recognition

Goal: Recognize spoken language and transcribe it to written language.

Approach: Statistical Hidden Markov Models

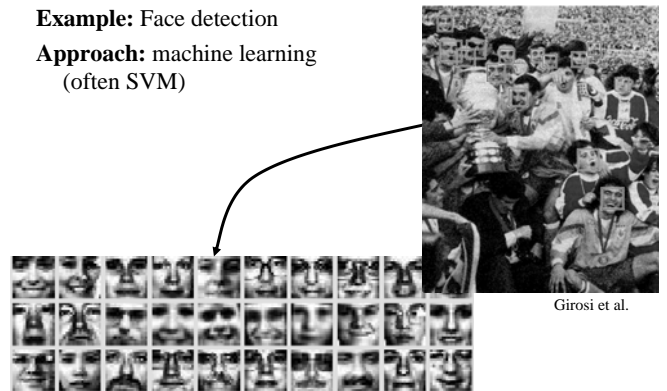
Combines:

- What did it sound like?
 - Acoustic model of phonemes
 - How plausible is this sentence?
 - Read lots of text and gather probabilities of word n-grams
- What is the overall most likely sentence given the acoustic signal?

Object Detection

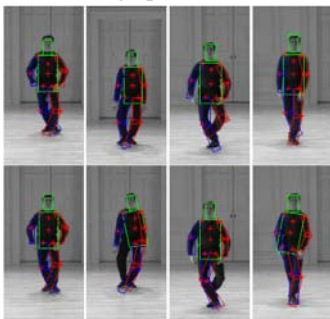
Example: Face detection

Approach: machine learning
(often SVM)



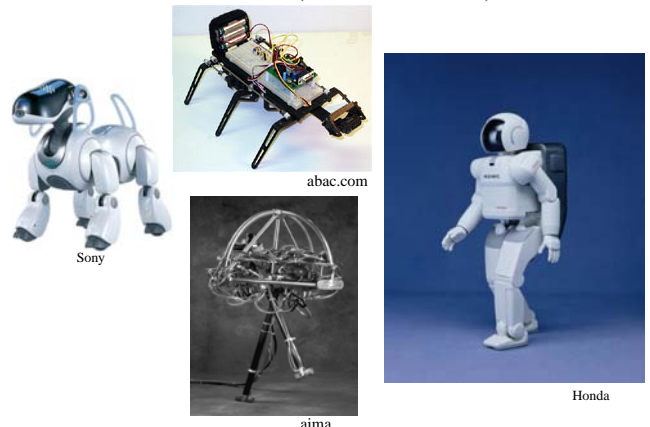
Object Recognition

- **Goal:** Human pose recovery
- **Approach:** Statistical graphical models



Huttenlocher et al.

Robots (and Softbots)



Other AI Courses

- COM S 475 Artificial Intelligence: Uncertainty and Multi-Agent Systems (Spring)
- COM S 474 Introduction to Natural Language Processing (Fall)
- COM S 478 Machine Learning (Spring)
- COM S 430 Information Retrieval (Fall)
- COM S 572 Heuristic Methods for Optimization (Fall)
- COM S 578 Empirical Methods in Machine Learning and Data Mining (Fall)
- COM S 630 Representing and Accessing Digital Information (Spring)
- COM S 664 Machine Vision (Fall)
- COM S 671 Introduction to Automated Reasoning (Fall)
- COM S 672 Advanced Artificial Intelligence (Fall)
- COM S 673 Integration of Artificial Intelligence & Operations Research (Fall)
- COM S 674 Natural Language Processing (Spring)
- COM S 676 Reasoning About Knowledge (Fall)
- COM S 677 Reasoning About Uncertainty (Fall)
- COM S 678 Advanced Topics in Machine Learning (Spring)

Final and Projects

Final Exam:

- Time: Monday, December 12, 9:00am - 11:30am,
- Location: Upson Hall B17
- Closed-book
- Review Session: TBA
- Additional reading:
 - Winston, Artificial Intelligence, 3rd edition, Addison Wesley.
 - Mitchell, Machine Learning, McGraw Hill.

Project Presentations

- Time: Tuesday, December 13, 10:00am - 12:00am, 1:00pm - 3:00pm
- Location: Olin Hall 165

Have a good break!