http://www.cs.rutgers.edu/~lou/530
Prof. Louis Steinberg
401 Hill, 445-3581, lou@cs
Office hours: Thursday 1-3pm
and by appointment
401 HILL, 445-3581, lou@cs

TA: Xiaojie Xi (xiaojiexpaul)

CS 530
Objective:
• Learn principles and methods that are central to a broad range of modern AI

Prerequisites
• Preparation for advanced AI courses in specific topics
• Preparation for advanced AI courses in specific topics

Preparation for advanced AI courses in specific topics

If you had Prof. Matthew Stone for 520, you have in effect already had 530; you
Topics

• Decision Analysis – How to decide what actions to take in an uncertain world
• Perception and Bayesian Inference – How to reason about the state of the world from imperfect sensory data
• Time – How to reason about sequence and cause and effect
• (continued...)

Topics
Planning – Choosing a sequence of actions

Evaluation – How to evaluate an AI system

Topics (cont.)
CS 530

Lecture notes
- Announcements, information, assignments,
- http://www.cs.rutgers.edu/~lou/530

Course home page:
- midterm, final
- Reading, problem sets, programs

Expected work:

CS 530
• Buy:

• Maybe buy; On Reserve in the Math Library
What is AI

A set of goals

A class of problems

Useful subgoals

Build an artificial intelligence

A set of methods

Characteristics common to these goals

A set of people

Commonly useful in solving problems like these
A Set of Goals

• A machine that can do anything a human can do (and requires a brain / mind)
• A machine that can do anything a human
• Subgoals of this that are useful in their own
  - Learn from experience
  - Plan
  - Understand natural language
  • Right
A Class of Problems

- Problems that require search:
  - Non-example: Sort a class roster.
  - Example: Schedule courses.
  - Example: Schedule professors.
  - NP-Hard problems all have this property.
  - Must use "trial and error."
  - No deterministic algorithm is known.

Problems that require search:

A Class of Problems
A Class of Problems

Problems that are poorly specified:

- We don't know what knowledge is needed to solve the problem.
- We don't have the knowledge needed to solve the problem.
- Our knowledge is imprecise or inaccurate.
- We don't know a concise, exact problem specification.
- Example: Explain integration to a human.
- Non-example: Factor an integer.
A Class of Problems

- Open ended in amount / kinds of knowledge
- All models are approximations
- Uncertainty in perception and action
- Understanding and acting in the real world
A Set of Methods

• Use of general inference methods such as heuristic search, constraint propagation, or resolution theorem proving.

• Representation of knowledge in declarative (explicit) form such as search spaces, constraint networks or systems of logical axioms.

• "How to think" is generic, "what to think about" is specific
A Set of Methods

- Decision Analysis
- Formal Logic
- Iterative Programming
- More task-specific methods, e.g., for learning or planning
- Tend to cross tasks
- "AI-complete" problems

A Set of Methods
A Set of People

- John McCarthy, Marvin Minsky, …
- Saul Amarel, Cordell Green, Terry Winograd, …
- Me
- You?
What is AI

- People
- Problems
- Methods
- Goals
Bias of This Course

• Bias for Real World
  – Emphasize uncertainty
  – De-emphasize search, games

• Bias for Experimental
  – Less emphasis on theoretical

• Bias against Logic / Theorem Provers
  – More specialized algorithms rather than use of theorem-prover as primary algorithm

• Bias of This Course
Much of current AI can be summarized as:

- **Engineering of Agents**

  These artifacts are sometimes called agents.

  - An engineering approach to constructing computational artifacts to act in the real world.
Sample real-world tasks

- Control a physical robot moving around a populated office
- Carry one end of an information-seeking dialogue, in natural language, with a human partner
- Cull useful information from web pages that people have designed for one another
Essential Tension

- Uncertainty about everything
dynamics
- Unbounded state, unknown structure and
But represents the world, which is not
- State and dynamics are definite - no
State evolves according to known rules
structuring relationships
- State is finite, with a few simple, known
A program is a closed formal system

•
Engineering Approach

- Model the problem
- Implement a solution
- Understand / Evaluate the solution