CS 331: Artificial Intelligence
Introduction
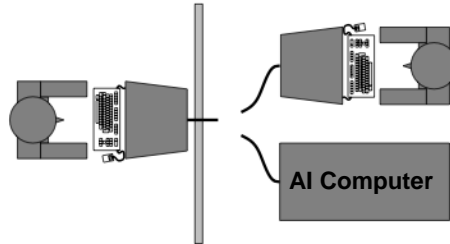
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What is AI? (4 categories of defns)

	Human performance	Rationality
Thought process	Systems that think like humans	Systems that think rationally
Behavior	Systems that act like humans	Systems that act rationally

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Acting like humans (Turing Test)

AI Computer

Can a human interrogator, after posing some written questions, tell if the responses come from a human being or a computer?

Requirements for computer: natural language processing, knowledge representation, automated reasoning, machine learning, vision and robotics (the last two are for the "total Turing Test")

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Problems with the Turing Test

- Not reproducible

- Can't be analyzed mathematically

- Tends to focus on human-like errors, linguistic tricks, etc.

- Does not produce useful computer programs

AI researchers believe it's more important to study the underlying principles of intelligence than duplicating how humans act

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Thinking Humanly (Cognitive Modeling)

- Models of the internal workings of the human mind
- Validation:
  - Compare models with actual behavior of human subjects (cognitive science)
  - Compare models with neurological activity in the brain (cognitive neuroscience)
- AI is now distinct from both cognitive science and cognitive neuroscience

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Thinking rationally (Laws of Thought)

Facts and rules in formal logic	←→	Theorem Prover
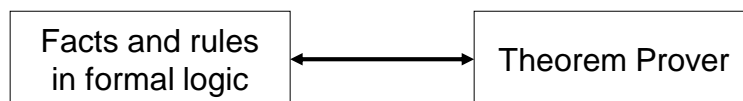
- Rational = conclusions are provable from inputs and prior knowledge
- Ensure all actions by a computer are justifiable (ie. "rational")

Problems:
- Hard to represent informal knowledge formally, especially when not 100% certain
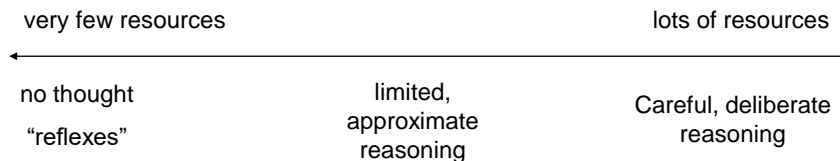- Computationally expensive

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Acting Rationally (Rational Agents)

- "Agent": something that acts
- "Rational" means more than just logically justified. It also means "doing the right thing"
- "Rational agent": an agent that acts to achieve the best outcome given its resources

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Rational Agents

very few resources   lots of resources

<--->

no thought   limited,   Careful, deliberate
                              approximate   reasoning
"reflexes"   reasoning

- Adjust amount of reasoning according to available resources and importance of the result
- This is one thing that makes AI hard

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AI Timeline

1943-1956	The gestation of AI
1956	The birth of AI
1952-1969	Early enthusiasm, great expectations
1966-1973	A dose of reality
1969-1979	Knowledge-based systems
1980-present	AI becomes a successful industry
1986-present	The return of neural networks
1987-present	AI adopts the scientific method
1995-present	The emergence of intelligent agents
2001	Big Data

AI Today

- Deep Blue: first computer program to defeat the world champion in chess
- NavLab: minivan drove itself across the US on its own 98% of the time
- HipNav: robot assistant in hip replacement surgery
- Proverb: crossword puzzle solver
- Google news: assembles "live" newspaper

Other AI applications in the real world

- Credit card fraud detection
- Medical diagnosis programs
- Search engines
- Collaborative filtering
- Spam filtering
- Disease outbreak detection
- Opponents in video games

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Surprises in AI Research

- Tasks difficult for humans have turned out to be "easy"
    - Chess
    - Checkers, Othello, Backgammon
    - Logistics planning
    - Airline scheduling
    - Fraud detection
    - Sorting mail
    - Proving theorems
    - Crossword puzzles

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Surprises in AI Research

- Tasks easy for humans have turned out to be hard.
  - Speech recognition
  - Face recognition
  - Composing music/art
  - Autonomous navigation
  - Motor activities (walking)
  - Language understanding
  - Common sense reasoning (example: how many legs does a fish have?)

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AI Courses at OSU

1. CS331: Introduction to AI (Spring quarter)
   - Search
   - Games
   - Knowledge Representation
   - Bayesian Networks
2. CS434: Machine Learning and Data Mining (Fall quarter)
   - Supervised Learning
   - Unsupervised Learning
   - Reinforcement Learning

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1. Search

8-puzzle: Beginning with the start state, slide tiles
horizontally or vertically until you get to the goal state.

7	2	4
5		6
8	3	1

Start State

	1	2
3	4	5
6	7	8

Goal State

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1. Search

We will discuss:

Uninformed search
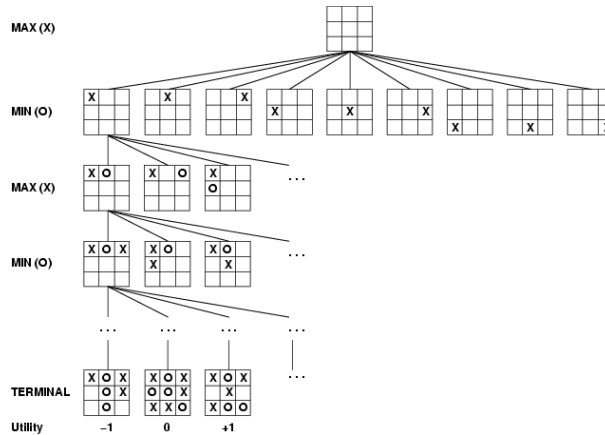
Informed search

Local search

7	2	4
5		6
8	3	1
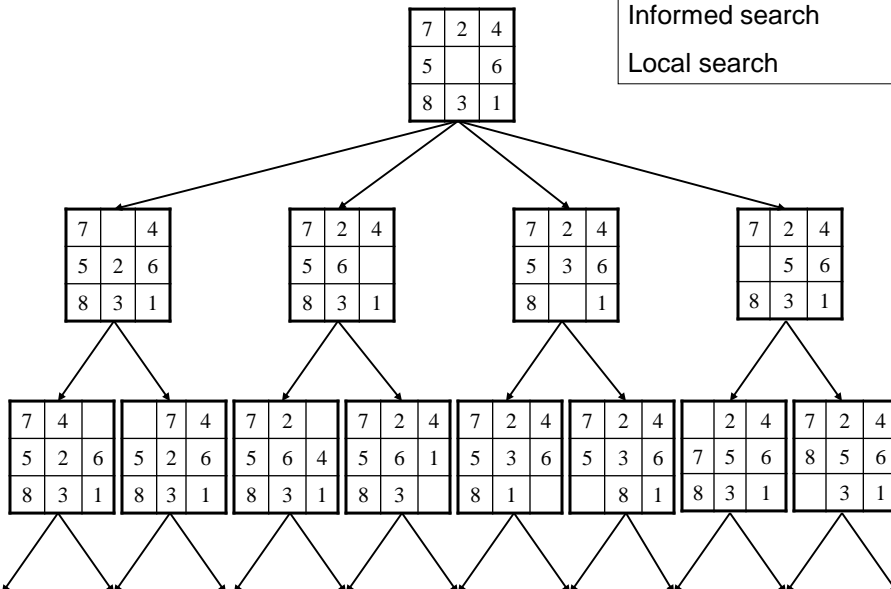
2. Games (Fully observable)

- How do you create a program to play tic-tac-toe intelligently?

- What about chess?

MAX (X)

MIN (O)

MAX (X)

MIN (O)

TERMINAL

Utility   −1   0   +1

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3. Knowledge Representation

Knowledge Base

Everyone from Wisconsin is a Packer fan

All Packer fans like cheese

Everyone from Wisconsin is evil

Your professor is from Wisconsin

Evil professors have difficult midterms

From this knowledge base, can we derive the following?

- Your professor is a Packer fan

- You will have a difficult midterm

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4. Bayesian Networks

Example: Learning to classify emails as spam or not spam

P(Spam) = 0.88

Private And Confidential

Dear Friend,

It is with heart of hope that I write to seek your help in the context below. I am Mrs. Jumai Asfatu Abacha, the second wife of the former Nigeria head of state who died on the 8th of June, 1998.

Having gotten your address through the internet, I have no doubt on your goodwill to assist us in receiving into your custody (For Safety) the sum of Forty-Eight Million, Five Hundred Thousand United States Dollars (US$48.5M) willed and deposited in my favour by my Late husband…

P(Spam) = 0.28

Professor Hutchinson,

I tried to hand in homework 1 electronically but the handin script was broken. I've attached my homework in this email…