

Introduction to Artificial Intelligence

CSCI 3202

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Fall 2016
Lecture 1

Artificial Intelligence sounds really cool

- What is Intelligence? What is artificial intelligence?
 - What is behavior of intelligent person?
 - Should artificial intelligence be the same?
- Lots of disagreement
 - Even amongst AI professionals about what it means to be artificially intelligent.

Sci-Fi AI

- Humanoid form, actions



Good guys, helpful



Bad guys, not Helpful



What is AI?

- Distinguish between
 - Think and act human vs. think and act rationally
- Think like humans:
 - Sci-fi robots
 - Just like us, only in silica.
 - Thoughts and actions are human
- Not what we do in this class

What is AI?

- Act like humans:
 - Human behavior, even if not human thought
 - Actions to achieve a goal
 - Turing Test: Is it indistinguishable from a person?
 - Eliza: one of first AI programs
 - Chatbot psychotherapist
 - My head hurts. Why do you think your head hurts?
 - My mother hates me. Who else hates you?
 - Google Eliza for example
 - Humans make errors. Intentional errors in actions
 - Variability in human behavior
 - Responding to new experiences
 - Also not what we're covering in this class

What is AI?

- Think and act rationally
 - Think right, even if not like human
 - If A then B, follows a set of steps for given input
 - Logical, deductive reasoning (very un-human)
 - Difficult in practice: what inputs, deductions generate desired outcome
 - Stochastic environments and behavior
 - Achieve a goal as well as possible
 - Intelligence specific to task
 - Spam classification. Intelligence in algorithms to filter spam
 - Chess play. Intelligence in algorithms to win game
 - Concerned with actions, not concerned with whether it's human
 - Design process to produce actions
 - Rules for filtering spam
 - Search and response to make a chess move
- Focus of class

What is rational?

- Emotionally balanced?
 - It's a computer
- Maximally achieving predefined goals
 - Ex: robot vacuum cleaner
 - Goal: pick up as much dirt as possible
 - Needs to scan floor, looking for dirt, path over a space with minimal repeats.
 - Could pick up dirt, spit it out, pick it up, ...
 - How goal defined is important

Maximally achieving predefined goals

- Goals expressed as utility of outcomes
 - Ex: One path through room for vacuum achieves X utility, another path achieves Y utility.
- Being rational means maximizing your expected utility
 - Maximize: evaluate all options and select the best
 - Utility: what do you value? Ex: dirt picked up, points in a game.
 - Expected: don't know consequences of actions, don't have complete knowledge of world. Consider what we do know to make decision. Look at evidence, history.
 - Ex: Is it raining? Consider: earlier in day, time of year.

History of AI

- 1940's
 - Turing Test: machine is “intelligent” if human interrogator can't tell the difference
- 1950's – 1960's
 - Key discoveries
 - E.g. Samuel: First computer playing board game (checkers)
 - Lots of promise. Robots in next few year. Early AI
- 1970's – 1980's
 - 1970's: Expert systems (Knowledge-based systems)
 - 1980's: Expert systems promise unrealized
 - AI “Winter”
- 1990's
 - Probability to deal with uncertainty
- 2000's
 - Watson. Self-driving cars. Robot vacuum cleaners

AI Today

- Still lots of robotics research
 - No cyborgs
 - Fear of cyborgs probably gone
 - AI in robotics: sensing, vision, coordination of single and multi-agent systems
 - Responding to uncertainty
 - Autonomous vehicles driving on open road is solved, driving in city is hard
- Classification systems
 - Object recognition
 - Find faces in an image
 - Speech recognition
 - recognize word and/or speaker
- Detection systems
 - Fraud detection
 - What is spending pattern of user? Is current spending pattern unusual?

Why are there unsolved problems?

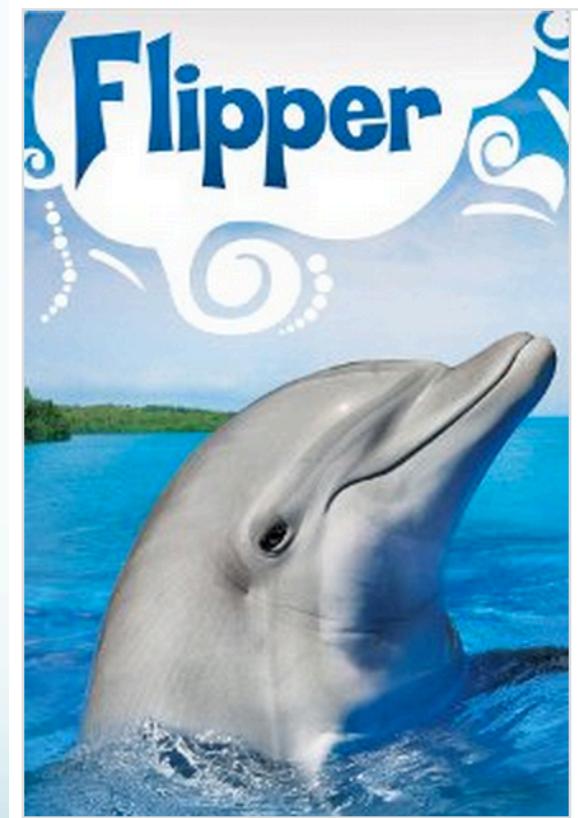
- The real world make AI difficult.
- Why is city driving hard for autonomous vehicles?

Speech recognition systems

- Automated help system
 - Say “billing” for billing dept.
 - Billing vs. biiilllliiinnnnnggg
 - Accent, pacing, background noise
 - Need AI to deal with these issues
 - Model of word from many examples, choose most likely from known words
- Speech recognition on iPhone
 - Same issues
 - Words may not be in database
 - Weird autocomplete
 - Find most likely match
- Speech recognition part of this course

Speech recognition - bioacoustics

- Animals speak too
 - Model of animal vocalizations
 - Identify species by vocalizations
- Record speech to determine range and density
 - Migration patterns
- Distribution patterns of species when visuals not possible
 - Underwater
 - Dolphins, whales
 - Microphones in ocean, record for weeks, detect vocalizations (clicks, whistles), classify
 - Dolphin research
 - UCSD, Navy
 - Animals don't speak directly into microphone



Computer vision

- Objects in an image
 - Camera can find faces, adjust lighting
- Object and character recognition
 - Letters and numbers in document
 - Easy with clean letters, harder with sloppy writing
- Objects in nature
 - Detecting land features in an image
 - Ecology: find trees, flowers, estimate biomass

A difficult ecology AI problem

- Species identification of plants
 - Application of AI to other fields
 - Image of species
 - Features: Flower and leaf shape, color
 - Difficulties: Shadows, layering, damage
 - Usually easy for human
 - Open question in ecology research
 - Determine species range, response to stress



Silene species



Phlox species



Difficult for a robot, easy for human

- Folding towels
 - Find corners, fold, find corners, fold, repeat
 - Robot needs to find the corners
 - Object detection
 - Robot folds towels (50x speedup)

Ethics

- More than algorithmic concerns
- Ethical considerations, few simple answers
 - News feed tailored to your political views
 - Facebook makes money if you click on an article
 - Fraud detection
 - Buying patterns
 - Terrorist detection
 - Communication patterns
 - Safeway coupon buying patterns
 - Encourage healthy or unhealthy behaviors

Safeway story

Comments or Questions : Dear Safeway,

I was recently in your store and after paying, I was handed a coupon for tuna. The clerk commented that the machine thinks I like tuna. But, I never buy tuna, so I'm wondering why I was given a coupon for tuna. Is this a case of, based on other purchases, I might also like tuna? Or, are the coupons generated without considering previous purchases.

My email to Safeway – 8/23/2013

Safeway's response – 8/27/2013

Thank you for your recent correspondence regarding the unsatisfactory experience you encountered with receiving coupons from the register fro items you do not purchase. We appreciate you taking the time and effort to notify us of your concerns.

We sincerely apologize for the inconvenience you may have experienced. At Safeway, we strive for world class customer service and a positive shopping environment. The coupons that come from the register are typically offers that are based off of your past transactions and sometimes you may receive offers for items the system might think you would be interested in based off of other items you have purchased. We have escalated your concerns to the Marketing Department for further review on this matter.

This semester

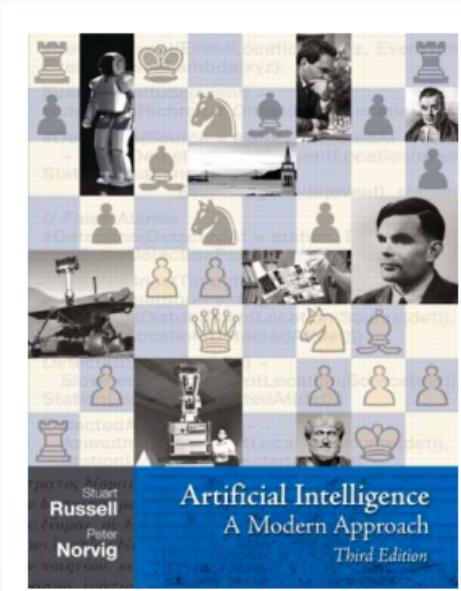
- Search, heuristic algorithms
 - BFS, DFS, Game trees, A*, Metaheuristics
- Reinforcement learning
- Reasoning under uncertainty
- Markov models
- Hidden Markov models
- Decision trees
- Supervised and unsupervised learning

Course information

- Moodle
 - Moodle.cs.colorado.edu
 - Enrollment key: ai3202
 - Grades, course content, including the syllabus
- Grading
 - Assignments (40%)
 - In-class exercises (20%) – you need to be here to get credit
 - Midterm and final exam (40%)
 - **Must have 60% on exams to pass the class**
- Content follows the Berkeley CS188 class
 - <http://inst.cs.berkeley.edu/~cs188/fa11/lectures.html>
 - Taped lectures could be useful to you
- Python – lots of implementations of AI algorithms

Course information

- People:
 - Dr. Rhonda Hoenigman
 - Course instructor
 - Contact information, office hours, in the syllabus
 - Graders
 - Sushma Colanukudhuru
 - Sharath Reddy Vontari
 - MS Students
 - Will hold some office hours to discuss your assignments, schedule will be posted on Moodle
- Textbook:
 - Russell and Norvig. Artificial Intelligence: A Modern Approach.
 - Old editions work fine



First assignment

- Posted on Moodle – Assignment 1
 - Data structures review (stacks, queues, lists, graphs, and trees)
 - Implement in Python using CodeRunner plugin on Moodle
 - Very important for this class
- Due Friday, September 2 by 4pm.

Next time

- Agents, rationality, having a plan