CompSci 370

Artificial Intelligence
Introduction

Ron Parr
Duke University
Department of Computer Science

Course Staff
(See Class Web Page)

• Ron Parr – instructor
• Graduate TAs
  – Zhehan Qu
  – Sai Smaran Shanka Balaram
• Undergraduate TAs
  – Ishaan Maitra
  – Luke Tripletet
  – Pei-Yi Lu
  – (more may be added)
About me

• Learned to program on my 8-bit Atari computer
• Sent a print out of my Othello (reversi) playing code (in BASIC!) w/my college application
• Majored in Philosophy
• Switched to CS for graduate school
• Started at Duke in 2000

A Note About Masks

• As of 1/22/23, masks are not required

• You may see me wearing a mask until/unless things settle down

• I do not plan to impose additional mask requirements on anybody else outside of Duke’s official requirements
Am I Prepared?

• Good programming skills:
  – We assume that you can write, debug your own programs
    *(If you need help programming, this class is too hard for you!)*
  – We will use python for programming assignments
  – We expect you to figure out how to use Python and the command line

• Other expectations
  – Ability to do short proofs
  – Basic probability concepts (though we will review this)
  – Basic algorithmic concepts
    • Complexity - O()
    • Analysis of algorithms
  – Math: Basic calculus, basic linear algebra
  – CompSci 230 is no technically required, but really really helpful
  – CompSci 330 also helpful

What is AI?

• For centuries, perhaps longer, people have wondered how to reproduce the smarts that people have...
• Even though we really have *no idea* how to define such things

• Defining intelligence has, itself, been a career-long endeavor for many scholars
Machine Intelligence Over the Centuries

- As long as people have had machines, they've wondered if they could exhibit human-like intelligence
- von Kempelen's (fraudulent) Turk (1700s), Babbage's analytical and difference engines (1800s), Turing's Turing machine (1900s)

Turing Test

- Computer must be indistinguishable from a human based upon written exchanges
  - Does this imply intelligence?
  - How could the computer cheat?
  - Does intelligence imply a certain type of computation?
  - Could an intelligent machine still fail the test?
- Does our notion of intelligence transcend our concept of humanity?
What Intelligence Isn’t

• It’s not about fooling people

• For many years, many have made ongoing efforts to fool people: http://chatbots.org/

• ChatGPT has shown us that convincing text without genuine understanding is entirely possible

AI after Turing

• Modern AI is ~60 years old
• “AI” term proposed at 1957, Dartmouth Conference
• Has been a subject of intense study since then
  – 1960’s: Logic, search, theorem proving, perceptron
  – 70’s: Robotic & perception
  – 80’s: Expert systems, 1st industrial interest, neural nets
  – 90’s: agents, uncertainty, “AI Winter”
  – 00’s: growth of ML, NLP, usable AI systems
  – 10’s: Deep learning, industrial/commodity AI, robotics
  – 20’s: Up to you!
AI in Your Life

- Game playing - chess, Go, jeopardy, Starcraft
- Voice recognition and dialog – Siri, Alexa, Google Assistant
- Recommender systems – Netflix, amazon
- Scene, object, face recognition: Face ID, MS seeing AI, image search (objects and faces)
- Automated logistics – UPS, US military
- Space exploration
- Automated science & medicine
- Robotics & Autonomous Vehicles

Example: AI at Amazon Warehouses

- Amazon uses **robots to move products** within its warehouses (deploys 200,000 robots)
- Amazon uses AI to **predict demand**
- May use AI to deliver products
- Consequences:
  - Pay fewer workers
  - Warehouses are packed more densely
  - Less space wasted on unpopular products
  - Combine to **increase value per sq. unit** of space

From IEEE Spectrum 7/2/08
But Where’s the General Intelligence?

• AI didn’t get traction until it focused on more specific problems
• Hard to provide “general intelligence” if you don’t know what it is
• Are we mimicking intelligence or getting closer to it by focusing on specific problems?

The sad (reassuring?) truth about modern AI

• **Good news:** Fears about the robot apocalypse are (for now) overblown

• **Bad news:**
  – Not because we’re clever about preventing it
  – Because we aren’t tackling:
    • Awareness
    • Deep understanding
    • High level reasoning
    • Robustness
  – Danger of deadly mistakes (if not intelligent ones) remains
What is covered this semester?

- See syllabus on class web page
- Note changes for this year:
  - More popular topics emphasized more
  - Less popular topics pushed to end of the semester

Major Topics Not Covered

- Natural Language
- Vision, except as application of machine learning
Class Mechanics

- **Textbook:** *Artificial Intelligence, A Modern Approach*, Russell & Norvig (*fourth* edition – third is probably OK)
  - Semi-required
  - Electronic versions available
  - Please don't steal my advisor’s textbook!

- **Homework:** 40%
  - mix of short proofs, algorithm design/analysis (20%)
  - Programming projects in teams of up to 2 (20%)
  - High-level discussion OK, write-up, coding must be your own
    (see matrix on class web page)

- **Midterm:** 30%
  - Conceptual questions
  - Hopefully in person, no collaboration
  - Scheduled during class time

- **Final:** 30%
  - Conceptual questions
  - Hopefully in person, no collaboration
  - Scheduled according to registrar’s final exam schedule

Lateness Policy

- **10%** per day for w/o extensions

- **Valid reasons for extensions:**
  - Excused travel for official sporting events
  - Illness (submit a STINF)
  - Job interviews
  - Travel to present academic research

- **Not excused:**
  - Having a lot of work in other classes
  - Just “feeling stressed”
  - Extracurricular activities (clubs, startups, etc.)
Grading

- I tend to give challenging conceptual questions, and not everybody will get them
- More important for you to be *challenged* than to have a score that you can put on your refrigerator

- Don’t obsess over raw scores
- At end of semester, I will decide how many points correspond to 1/3 of a letter grade
  - Will always be $\geq 3.33$
  - Typically chosen to ensure median grade of B+ or A-

Attendance

- You are not required to attend class – though it’s a *good idea*
- Everything in class is covered in readings
- Unless COVID gets worse, classes will **NOT** be recorded
- Why? See changes from last year...
Discussion Sections

• Staffed by (U)Tas
• Attendance optional
• No new material covered
• Goals:
  – Work through common issues, e.g., “Help me fix my python installation!”
  – Work through problems/examples that wouldn’t fit in lecture
• We will usually post questions for discussions before discussion, and post solutions after discussion

Programming Assignments

• Based on the Berkeley Pacman framework

• Why?
  – It’s really well-done
  – Seeing your own code run AI algorithms is fun, motivating, and develops your intuitions
  – Even debugging is instructive

Pac-Man is a registered trademark of Namco Bandai Games, used here for educational purposes
Pacman Limitations

- Works with Python 3.6 & 3.7, **not higher versions**

- Not all algorithms make sense in this framework (life isn't a Pacman game)

- Has been around for a while
  - Pacman was new when RP was a kid
  - Temptation to cheat

Academic Honesty

- Brainstorming with friends is encouraged, but answer write up and coding must be your own work
- Don’t confuse brainstorming with letting your smart friends tell you the answers
- Don’t Google for answers!!!
- Don’t troll for answers from previous semesters
- You may Google for definitions

- What you turn in must be your own work!!! (in case of programming with a partner, it must be the work of just you and your partner)
Examples of Cheating

• Simply reading solutions to similar problems found by searching
• Submitting code written by others
• Refactoring or cosmetically modifying code written by others (this is much easier to catch than you think!)
• “Borrowing” a friend’s laptop and finding answers

• Note: Uploading to a code sharing site is also cheating

Consequences of Cheating

• One year, 8 people were caught submitting code from the internet as their own code
  – All cases were reported
  – Consequences included:
    • Zeroes on assignments
    • Suspension
    • Failure to graduate
    • Retraction of job offers

• Three students were caught cheating in Spring 2021!
Consequences of Cheating This Year

• All cases will be reported
• A grade of zero will be given for any assignment on which cheating is detected
• At least 1/3 letter grade will be deducted from the final grade for each instance of cheating in addition to any other penalties
• Other penalties may apply, at the discretion of the instructor and/or dean

Just don’t do it!

Should I worry about getting falsely accused?

• No!

• I have never had a false positive accusation
• How do I know this?
  – I don’t make frivolous accusations
  – Cheating is surprisingly obvious when it happens
  – When presented with evidence, students have always owned up
Lessons From Last Year

• My course evaluations were down last year 😊
• Thoughts about why:
  – Perception of what the hot topics are has changed
  – Class attendance was very low
    • Students interacted transactionally with recordings
      – Missed announcements
      – Missed big picture
      – Didn’t engage
      – Didn’t develop bonds with staff, classmates
• Everybody was grumpy due to COVID

Changes from Last Year

• No recordings (unless COVID gets worse)
• More emphasis on hot topics
• Programming done in pairs
Not Changing
(despite a few complaints)

• Still a class about **algorithms for AI**
  (not a software development class)

• Not a machine learning class

• “Emotional Support” is not a goal (Yes somebody complained about the lack of emotional support.)
  But we do strive to be friendly and helpful!!!

A More Positive Final Thought

• This class can be *hard and a lot of work*, but I have taught versions of it for many years and most who are *prepared and stick with it*:
  – Earn a reasonable grade in the end
  – Have fun with projects
  – Learn a lot

• We are here to help!
• We do not want to be your adversaries in this process
• Let us be your partners in learning by allowing us to help you