CS 3600 B
Introduction to
Artificial Intelligence

Tuesdays & Thursdays, 11am - 12:15pm

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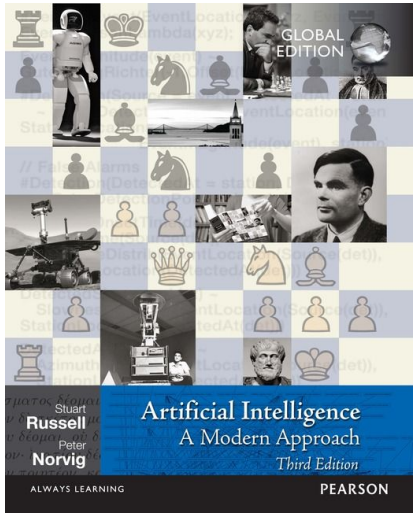
Office hour: 10am - 11am, Thursdays

Logistics

- Lecture
  - Tue, Th 11:00am-12:15pm
- Reading
- Programming assignments
  - 4 assignments, 15% of grades



- Project Wrappers
  - 4 short written assignments, 10% of grades

- Exams (2)
  - Take-home written exams, 15% of grades each

- Practice exercises
  - Not graded, but recommended to do

Collaboration Policy

- Assignments turned in individually
- Collaboration is not allowed
- Plagiarism detection will be used
- Recommended: github.gatech.edu
  - Private repo

```
# George Burdell helped me figure out how to terminate my loop
#   in main_loop_function() correctly.
# I based my tree traversal on stack overflow http://stackoverflow/xyz
```

Late policy

- Assignments are late 1 minute after the due date

- 4 free late days
  - After late days are used up: grade = grade - (0.2*max)

- Medical and other excused absences do not count toward late days

ChatGPT Policy

- Don’t
- But if you do:
  - Never hit ”copy”
  - Never have ChatGPT and your assignment open at the same time
- For exams and wrappers:
  - 50% of all ChatGPT responses contain an error
  - We know what ChatGPT answers look like
- This pertains to all other large language models including but not limited to: GPT-4(o), Claude, Bing Chat, Gemini

Prerequisites

- Data structures (CS 1332)
  - Linked lists, tree traversals, etc.
- Computational complexity
  - Big-O, NP (nondeterministic polynomial) problems, etc.
- Coding
  - Mainly in Python3
- Statistics

Preliminaries

- Computing Science: Study of what is computable or not, & how to compute it

- Artificial Intelligence: Study of how to replicate intelligence with computing

- What is Artificial Intelligence?
  - The capacity of a machine or a computer system to perform functions that would typically require human intelligence.
  - Learning, reasoning, perception, adaptation, …

This class

- Broad survey of a broad field
- Focus on stuff that is used in the real world
- Get our hands dirty
- Include some gentle intro to ML
- Broad synthesis

Types of AI

- Broad AI
  - Strong AI
  - Does every (non-physical) things humans can do

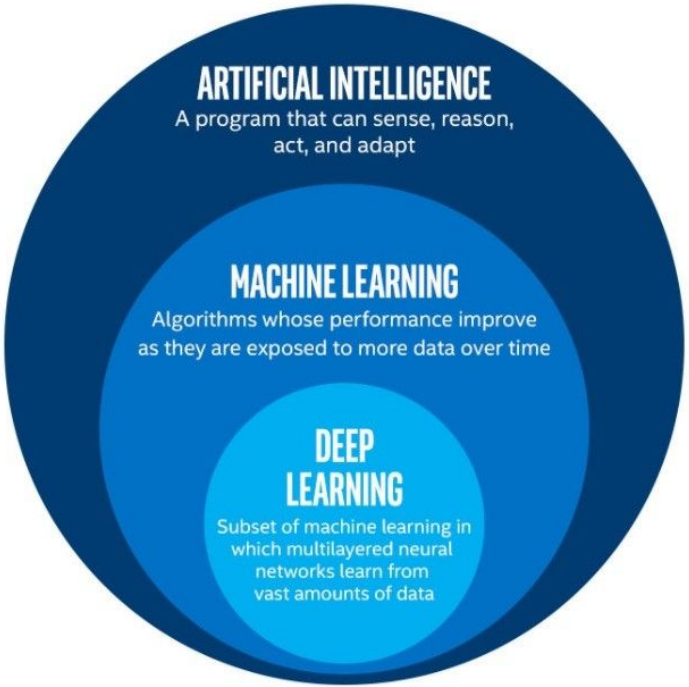
- Narrow AI
  - Weak AI
  - Handles only specific tasks
    - Driving a car
    - Correcting grammar
    - Answering domain-specific questions

Types of AI (cont'd)

- Human level AI:
  - Doing things that humans can do with comparable performance as average humans

- Super-human AI:
  - Doing things at expert level or better

Relationship to Machine Learning

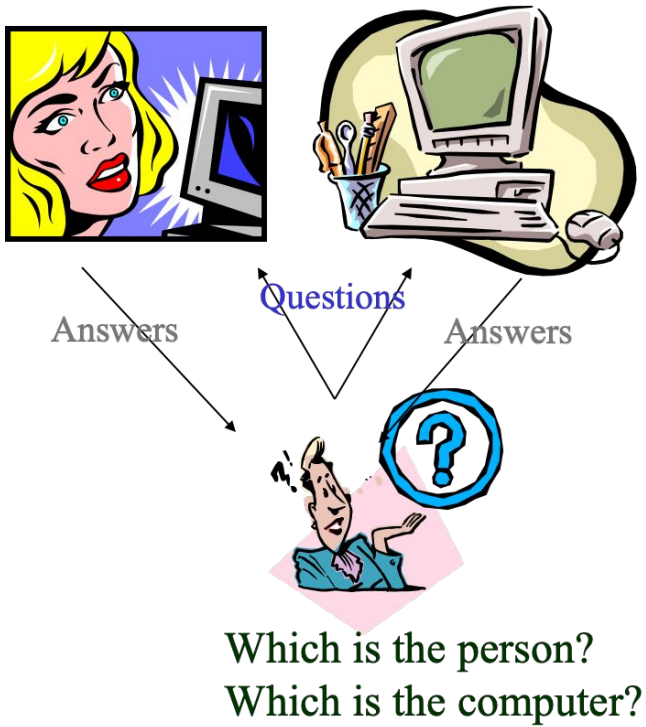


Will this class cover ChatGPT?

- No, since
  - The ChatGPT family is a collection of text or text-image DL models while this course focuses on more generic algorithms (breadth > depth)
  - ChatGPT models are closed-source, not good for practice
- But
  - We will explore reinforcement learning algorithms - ChatGPT models rely on such training
  - Our exercises involve text-based models

Turing Test

- 1950 – Alan Turing devised a test for intelligence called the Imitation Game
  - Ask questions of two entities, receive answers from both
  - If you can't tell which of the entities is human and which is a computer program, then you are fooled and we should therefore consider the computer to be intelligent



Is Turing test obsolete?

- GPT models are already able to generate human-like language, despite special word preferences
  - Models know models better - GPTZero, etc.
- Even current models struggle with reasoning
  - Reasoning-specific Turing test

History of AI

- Automatons
- The Writer 1200s

1950s

- 1950 – Turing “computing machinery and intelligence”

- 1956 – Dartmouth Conference
  - Establishment of AI as a research field

Early vision (pre 1960s)

- Model the human and everything they do
  - Language
  - Motor planning
  - Vision
  - Prediction
  - Learning
  - Art
  - Humor
  - Emotions
  - Etc.

- Artificial neural network invented

Early successes (late 1950s – mid 1960s)

- GPS
- Eliza
- Logic, symbolic reasoning
- Theorem provers
- Checkers and Chess
- Why?
  - Well-defined games with strict rules

Expert systems (1970s – 1980s)

- Expert systems (rule-based systems)
  - Decision trees
  - For very specific tasks, e.g., medical diagnosis

- Brittleness

AI Winter (1987 – 1993)

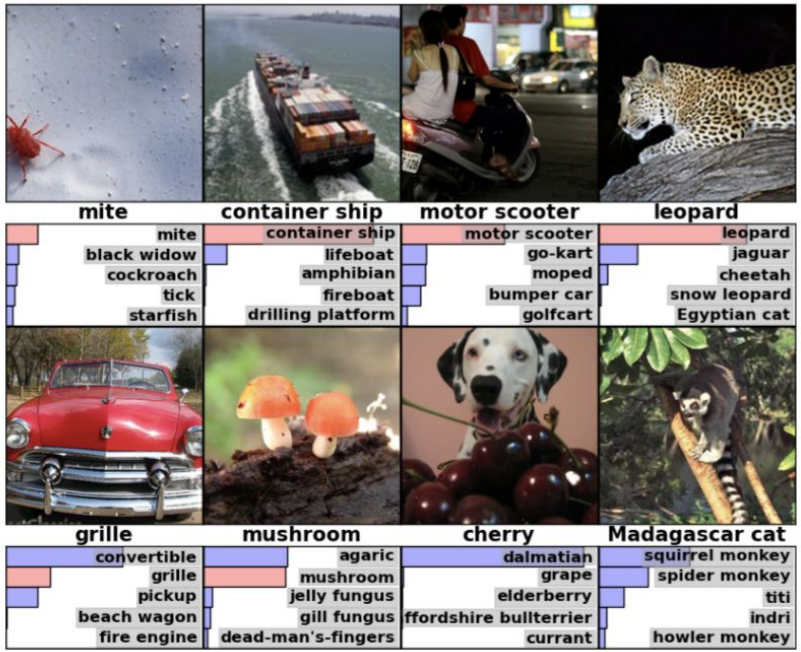
- Funding dries up leading to the AI Winter
  - Too many expectations were not met
  - Expert systems took too long to develop, too much money to invest, the results did not pay off
- Neural Networks to the rescue!
  - Expert systems took programming, and took dozens of man-years of efforts to develop, but if we could get the computer to learn how to solve the problem…
  - Multi-layered back-propagation networks got around the problems of perceptrons
  - Neural network research heavily funded because it promised to solve the problems that symbolic AI could not
- By 1990, funding for neural network research was slowly disappearing as well
  - Neural networks had their own problems and largely could not solve a majority of the AI problems being investigated
  - Panic! How can AI continue without funding?

Machine learning revolution (1990s – now)

- Address brittleness with learning
- Learn the rules
  - “Reverse-engineer” the rules based on data
- Statistical systems
  - Introduction of uncertainty

Deep learning revolution (2014 — now)

- Neural networks return
- ImageNet Challenge
  - 2011: 75% accuracy
  - 2012: 85% accuracy w/neural nets
  - 2019: > 98% accuracy



2017: Large language models

- Language model:
  - A function that computes the probability of a word given a sequence of previous words
  - Certain words co-occur with other words
  - Neural networks can be trained to guess the next word

2017: Large language models

- The Transformer neural architecture
- A particular deep neural network that is especially good at learning to emulate language
- Large Language Model
- GPT-3:
  - 175 billion parameters
  - Trained on hundreds of billion words
  - Estimated to have cost $4.6 million to train