CAP 4621 ARTIFICIAL INTELLIGENCE

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Course Information

- Course home page: [https://www.cise.ufl.edu/class/cap4621fa17/](https://www.cise.ufl.edu/class/cap4621fa17/)


- Grading:
  - Weekly Monday quiz (2*15 = 30 pts)
  - Class presentation (2pts)
  - Class participation (3pts)
  - Homework 0 (5pts)
  - Programming assignments (30 points) \(\rightarrow\) updated to 3*15 = 45 points
  - Exams (30 points) \(\rightarrow\) updated to ONE exam worth 15 points

- There will be an ungraded homework at the end of each week. This home assignment is intended to help you prepare for the Monday quiz and the mini projects.
Expectations

- All assignments are individual assignments – you are expected to do them on your own. It’s okay to discuss the problem statement, or concepts that you don’t understand, but the code is written by you.
- Late policy: -1 point for every 24 hrs past deadline. If you don’t submit the assignment, you get 0.
- There will be no makeup assignments. In case of a legitimate problem (e.g., medical emergencies), the points of the last assignment will be applied to the missed assignment.
- Plagiarism/Cheating: At a minimum, you and the person you copied from will get a zero on that assignment, and a decrease of one letter grade on their final course grade. This is in addition to penalties given by Student Affairs.
- I expect you to do the readings before coming to class.
Communication

• I expect formal communication, which means full sentences. Please practice this in your emails to me. Emails with incomplete sentences or spelling shortcuts (can u tell me when HW0 is due) will be ignored.

• Email: Subject should have class number followed by topic.
  – E.g. [CAP4621] Found a typo in Assignment 1
  – I use filters, so if your email does not have [CAP4621] in the subject line, it will get lost.

• Post questions to Canvas first (before you send email to me or your TA)

• You are expected to attend class. Important announcements will be made in class because I like to take your feedback into account while changing dates on exams/assignments etc.

• I have a poor memory for logistics — when in doubt, refer to class syllabus or webpage. If there is confusion, bring it up in class so that we can address it for all students together.

• I repeat — the above point is important. If you ask me the due date for an assignment over email, I will not reply because I know that I will get it wrong : )
Soft Skills

• All students need to understand the basics of time management
  – E.g., “I have two assignments due on the same day” is not a reason to not submit the assignment.

• The successful student is a self learner. Homeworks, assignments and exams will contain two categories of questions: one category will be questions related to topics we have discussed in class, one category will be advanced topics in the textbook which will require you to learn on your own. Grading will be such that if you only do the first category of questions, you will get a B. If you want an A, you need to stretch yourself and answer the second category of questions.

• We will use Python in this class. You are expected to pick it up. This is the language that is THE language of AI and machine learning today, and is a highly valuable skill when looking for jobs/internships. But we are learning the fundamentals of AI in this class. Getting to learn Python is a perk.
History

• **Introduction to Artificial Intelligence**
  - (with slides from Stuart Russell, Hwee Tau Ng, and Svetlana Lazebnick)

• The field of AI started with the Dartmouth AI conference in the summer of 1956.

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We propose that a 2 month, 10 man study of artificial intelligence be carried out during the summer of 1956 at Dartmouth College in Hanover, New Hampshire.

The study is to proceed on the basis of the conjecture that every aspect of learning or any other feature of intelligence can in principle be so precisely described that a machine can be made to simulate it. An attempt will be made to find how to make machines use language, form abstractions and concepts, solve kinds of problems now reserved for humans, and improve themselves.

Today

- https://www.youtube.com/watch?v=21EiKfQYZXc (Andrew Ng)
- https://www.youtube.com/watch?v=BfDQNrVphLQ (Jeff Dean’s TEDx lecture)
What is AI?

Views of AI fall into four categories:

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<tr>
<th>Thinking humanly</th>
<th>Thinking rationally</th>
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<tr>
<td>Acting humanly</td>
<td>Acting rationally</td>
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The textbook advocates "acting rationally"
Acting humanly: Turing Test

- Turing (1950) "Computing machinery and intelligence":
- "Can machines think?" → "Can machines behave intelligently?"
- Operational test for intelligent behavior: the Imitation Game

- Predicted that by 2000, a machine might have a 30% chance of fooling a lay person for 5 minutes
- Anticipated all major arguments against AI in following 50 years
- Suggested major components of AI: knowledge, reasoning, language understanding, learning
Thinking humanly: cognitive modeling

- 1960s "cognitive revolution": information-processing psychology
- Requires scientific theories of internal activities of the brain
- -- How to validate? Requires
  1) Predicting and testing behavior of human subjects (top-down)
  or 2) Direct identification from neurological data (bottom-up)
- Both approaches (roughly, Cognitive Science and Cognitive Neuroscience)
- are now distinct from AI
Thinking rationally: "laws of thought"

- Aristotle: what are correct arguments/thought processes?
- Several Greek schools developed various forms of logic: notation and rules of derivation for thoughts; may or may not have proceeded to the idea of mechanization
- Direct line through mathematics and philosophy to modern AI
- Problems:
  1. Not all intelligent behavior is mediated by logical deliberation
  2. What is the purpose of thinking? What thoughts should I have?
  3.
Acting rationally: rational agent

- **Rational** behavior: doing the right thing
- The right thing: that which is expected to maximize goal achievement, given the available information
- Doesn't necessarily involve thinking – e.g., blinking reflex – but thinking should be in the service of rational action
Rational agents

• An agent is an entity that perceives and acts
• This course is about designing rational agents
• Abstractly, an agent is a function from percept histories to actions:
  \[ f: P^* \rightarrow A \]
• For any given class of environments and tasks, we seek the agent (or class of agents) with the best performance
• Caveat: computational limitations make perfect rationality unachievable
  \rightarrow \text{design best program for given machine resources}
AI prehistory

- Philosophy: Logic, methods of reasoning, mind as physical system foundations of learning, language, rationality
- Mathematics: Formal representation and proof algorithms, computation, (un)decidability, (in)tractability, probability
- Economics: utility, decision theory
- Neuroscience: physical substrate for mental activity
- Psychology: phenomena of perception and motor control, experimental techniques
- Computer engineering: building fast computers
- Control theory: design systems that maximize an objective function over time
- Linguistics: knowledge representation, grammar