Computer Science CPSC 322

Introduction To Artificial Intelligence

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Artificial Intelligence in the Movies
Artificial Intelligence in Real Life

NASA: Deep Space One spacecraft

It's one small step in the history of space flight. But it was one giant leap for computer-kind, with a state of the art artificial intelligence system being given primary command of a spacecraft. Known as Remote Agent, the software operated NASA's Deep Space 1 spacecraft and its futuristic ion engine during two experiments that started on Monday, May 17, 1999. For two days Remote Agent ran on the on-board computer of Deep Space 1, more than 60,000,000 miles (96,500,000 kilometers) from Earth. The tests were a step toward robotic explorers of the 21st century that are less costly, more capable and more independent from ground control.
Artificial Intelligence in Real Life

A young science (≈ 50 years old)

- Exciting and dynamic field, impressive success stories
- Lots uncharted territory left
- “Intelligent” in specialized domains
- Many application areas
The AI Landscape

See the AI timeline and more at www.aaai.org/AILandscape
AI in the News

• Stanford University is hosting a study Examine Effects of Artificial Intelligence
  • One Hundred Year Study on Artificial Intelligence (AI100).

• The study, funded by Microsoft research is to examine impacts of AI on society, including on the economy, war and crime, over the course of a century
  • 2016 Report
This Course

- **Foundations** of artificial intelligence
  - Focus on *core concepts*
    - ✓ Apply to wide variety of applications
    - ✓ Will mention example applications but they are not the focus
    - ✓ 422 covers applications in more detail
  - There are many specialized subfields (each of them is a separate course - often graduate course)
    - ✓ Machine learning
    - ✓ Computer vision
    - ✓ Natural language processing
    - ✓ Robotics
    - ✓ Intelligent User Interfaces
    - ✓ ....
Today’s Lecture

Administrivia

- What is AI?
- What is an Intelligent Agent?
- Representation and Reasoning: Dimensions
Teaching Team

Instructor
• Cristina Conati ( conati@cs.ubc.ca;  
  office ICICS/CS 107)

Teaching Assistants
• Abed Rahman (abed90@cs.ubc.ca)
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Course Pages

- Course website:
  

CHECK IT OFTEN!

- Syllabus
- Schedule and lecture slides
- Other material
Course Material (1)

• Main Textbook
  • Artificial Intelligence: Foundations of Computational Agents. by Poole and Mackworth. (P&M)
  • Available electronically (free - http://artint.info/html/ArtInt.html) and at the Bookstore
  • We will cover Chapters: 1, 3, 4, 5, 6, 8, 9

• Lecture Slides
  • I'll try to post a version of each lecture's slides by 9:00am that day
    ✓ Usually not the very final version
  • I’ll post an updated version by the end of the day, with possible changes and annotations from the lecture

• Additional Reference
Course Material (2)

• You are responsible for all the material in the assigned readings, regardless of whether it has been explicitly covered in class.

• You are also responsible for all the material covered in class, whether or not it is included in the readings/available on-line.

• It is strongly recommended that you read the assigned readings/ before each class. It will help you understand the material better when I lecture.
Other Resources

• **Alspace**: online tools for learning Artificial Intelligence [http://aispace.org/](http://aispace.org/)
  - Developed here at UBC!
  - Includes practice exercises (ungraded) that will be assigned to you during the course

• **Connect** (Learning Management System)
  - Assignments
  - Check it often

• **Piazza** (Just for discussion board)
  - Sign up at: [piazza.com/ubc.ca/winterterm22016/cpsc322](piazza.com/ubc.ca/winterterm22016/cpsc322)
  - Find our Piazza class page at: [https://piazza.com/ubc.ca/winterterm22016/cpsc322/home](https://piazza.com/ubc.ca/winterterm22016/cpsc322/home)
How to Get Help?

• Piazza Discussion Board (CHECK IT OFTEN)
  - Post questions on course material
    ✓ We will not be answering these questions via email
  - Answer others’ questions if you know the answer
  - Learn from others’ questions and answers
  - Expect a 24h turnaround time from the teaching team

• Go to office hours (Discussion Board is NOT a good substitute for this) - times will be finalized next week
  - Can schedule by appointment if you have a class conflict with the official office hours
Evaluation

• Final exam (50%)
• 1 midterm exam (30%)
• Assignments (20 %)
• Practice Exercises (0%)
• Clickers 4% bonus (2% participation + 2% correct answers)

But, if your final grade is 20% higher than your midterm grade:

• Midterm: 15% 
• Final: 65 %

To pass: at least 50% in both your overall grade and your final exam grade
Assignments

- There will be **five** assignments in total
  - Counting “assignment zero”, which will be posted in Connect by this afternoon
  - They will not necessarily be weighted equally
- Submit via Connect by the appointed deadline.
- You get four late days 😊
  - to allow you the flexibility to manage unexpected issues
  - additional late days **will not be granted** except under exceptional circumstances (see next slide)
  - if you've used up all your late days, you lose **20% per day** (see details in course page)
- The cover sheet for each assignment will specify how many late days can be used for that assignment, **if the number is less than 4**
  - Due to scheduling issues, it may not always be possible to allow for using all four days at once for an individual assignment
- **Not applicable to assignment 0, midterm, final**
Missing Assignments / Midterm / Final

• Hopefully late days will cover almost all the reasons you'll be late in submitting assignments.
  • However, something more serious like an extended illness may occur

• For all such cases: you'll need to provide a note from your doctor, psychiatrist, academic advisor, etc.

• If you miss:
  • an assignment, your score will be reweighted to exclude that assignment
  • the midterm, those grades will be shifted to the final. (Thus, your total grade = 80% final, 20% assignments)
  • the final, you'll have to write a make-up final.
Collaboration on Assignments

• You **may** work with one other student, unless otherwise indicated (e.g., see assignment 0)
  • That student must also be a CPSC 322 student this term
  • You will have to officially declare that you have collaborated with this student when submitting your assignment

• What constitutes **plagiarism**
  • Talking about the assignments with anybody other than an official teammate
  • looking at existing solutions
  • submitting solutions not worked out by the team members

• See **UBC official regulations** for more details on what constitutes plagiarism (pointer in syllabus)
Let’s test them

Which of the following is a form of plagiarism with clickers? (more than one applies)

A. Use of another person’s clicker
B. Having someone use your clicker
C. Forgetting your clicker at home
Plagiarism with Clickers

• Use of another person’s clicker
• Having someone use your clicker

is considered plagiarism with the same policies applying as would be the case for turning in illicit written work.
Assignment 0

• Part A of this assignment asks you to
  • Find existing AI applications
  • explain some high-level details about how they work
  • Already in Connect today
    ✓ To be done alone
    ✓ Due Tuesday, January 10, 9am
    ✓ Submission via Connect
      - Submit a single PDF file
      - List your name and student id in the text (submissions missing this info will not be marked)
      - Read carefully the instructions on coversheet: in you don’t follow them we will not be able to mark your assignment
  • Be ready to discuss your findings during Tuesday’s class!

• Part B of assignment 0 asks you to declare that you have read and understood the course syllabus
To Summarize

• All the course logistics are described in the course syllabus

• Make sure to read it and that you agree with the course rules before deciding to take the course
  • And complete the related part of Assignment 0
Today’s Lecture

• Administrivia

What is AI?

• What is an Intelligent Agent?

• Representation and Reasoning: Dimensions
What is Artificial Intelligence?

• Some definitions that have been proposed
  1. Systems that think like humans
  2. Systems that act like humans
  3. Systems that think rationally
  4. Systems that act rationally
Thinking Like Humans

Model the cognitive functions and behaviours of humans

• Human beings are our best example of intelligence
• We should use that example!

• But ... how do we measure thought?
  ✓ We would have to spend most of our effort on studying how people’s minds operate (Cognitive Science)
  ✓ Rather than thinking about what intelligence ought to mean in various domains
Acting Like Humans

• Turing test (1950)
  • operational definition of intelligent behavior
  • Can a human interrogator tell whether (written) responses to her (written) questions come from a human or a machine?

• No system has fully passed the test yet
  • Yearly competition: http://www.loebner.net/Prizef/loebner-prize.html

• Is acting like humans really what we want?
  • Humans often think/act in ways we don’t consider intelligent
  • Why?
So, Why Replicate Human Behavior, Including its “Limitations”?

• **AI and Entertainment**
  
  • E.g. *Façade*, a one-act interactive drama  
    http://www.quvu.net/interactivestory.net/#publications

• **Sometime these limitations can be useful, e.g.**
  
  • Supporting Human Learning via teachable agents
    

  • Simulations for military training
    
    (http://www.alelo.com/)
Thinking Rationally

- **Rationality**: an abstract ideal of intelligence, rather than “whatever humans think/do”
  - Ancient Greeks invented **syllogisms**: argument structures that always yield correct conclusions given correct premises
  - This led to **logic**, and **probabilistic reasoning** which we'll discuss in this course

- Is rational **thought** enough?
  - A system that only thinks and doesn’t do anything is quite useless
  - Any means of communication would already be an **action**
  - And it is hard to measure thought in the first place ...
Acting Rationally

We will emphasize this view of AI

• Rationality is **more cleanly defined** than human behaviour, so
  - it's a better design objective
  - in cases where human behaviour is not rational, often we'd prefer rationality
    - Example: you wouldn't want a shopping agent to make impulsive purchases!
  - And once we have a rational agent, we can always tweak it to make it irrational!

• It's easier to define rational action than rational thought
Today’s Lecture

• Administrivia

• What is AI?

What is an Intelligent Agent?

• Representation and Reasoning: Dimensions
AI as Study and Design of Intelligent Agents

- **Intelligent agents**: artifacts that act rationally in their environment
  - Their actions are appropriate for their goals and circumstances
  - They are flexible to changing environments and goals
  - They learn from experience
  - They make appropriate choices given perceptual limitations and limited resources

- This definition drops the constraint of *cognitive plausibility*
  - Same as building flying machines by understanding general principles of flying (aerodynamic) vs. by reproducing how birds fly
Robots vs. Other Intelligent Agents

- In AI, artificial agents that have a physical presence in the world are usually known as robots
  - Robotics is the field primarily concerned with the implementation of the physical aspects of a robot
    - I.e., perception of and action in the physical environment
    - Sensors and actuators
- Agents without a physical presence: software agents
  - E.g. desktop assistants, decision support systems, web crawlers, text-based translation systems, intelligent tutoring systems, etc
  - They also interact with an environment, but not the physical world
- Software agents and robots
  - differ in their interaction with the environment
  - share all other fundamental components of intelligent behavior
Intelligent Agents in the World

Knowledge Representation
Machine Learning

abilities

prior knowledge
past experiences
goals/values
observations

Agent

Reasoning +
Decision Theory

Natural Language
Generation

+ Robotics
+ Human Computer
/Robot Interaction

Natural Language
Understanding

+ Computer Vision
Speech Recognition

+ Physiological Sensing
Mining of Interaction Logs

Environment

Actions
Today’s Lecture

• Administrivia
• What is AI?
• What is an Intelligent Agent?

Representation and Reasoning: Dimensions

NEXT TIME
For Tuesday: Assignment 0

- Asks you to find examples of fielded or experimental AI agents, and to explain some high-level details about how they work.
- The assignment is available in Connect. To be done alone
- Submit electronically and you can't use late days
- Come prepared to discuss the applications you found

For Thursday: Read Chapter 1 of textbook

TODO for next classes