Course Organization

CPSC 433: Artificial Intelligence
Fall 2024

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University of Calgary

Tuesday, September 3, 2024

UNIVERSITY OF CALGARY

Organization

Welcome!

Jonathan Hudson, Ph.D

Lectures: CPSC 433

L01 TueThu 12:30-13:45 ENA 101

Office: ICT 712

Office hours: MonWed 11:00-11:50 or by email-scheduled appointments. (Zoom possible by pre-arrangement)

jwhudson@ucalgary.ca

https://cspages.ucalgary.ca/~jwhudson/CPSC433F24/

Tutorials

Tutorials will begin on Monday/Wednesday, September 9/11th, 2024

In-person, point is active interaction with TA for material and assignment help.

Your enrollment tutorial TA will help you prepare for exams and projects and they are only responsible for the students enrolled in their tutorial.

Participation in first lab absolutely required!
(teams process will be started)

Why CPSC 433?

Many of you will have seen news stories, or used an application, that does some cool and have wondered how it did that.

This course will establish both a broad understanding of the area of AI but also concrete definitions and tools to allow you to create your own unique AI solutions to unique problems. (More than plug and play AI)

Course Goal

From the calendar:

- “An examination of the objectives, key techniques and achievements of work on artificial intelligence in Computer Science.”

Course Outcomes

From the outline:

- By the end of the course students will be expected to explain the basic search paradigms used in AI systems using appropriate terminology
- By the end of the course students will be expected to evaluate the usefulness of a given search paradigm for a given application problem
- By the end of the course students will be expected to apply a given basic search paradigm to a given application problem
- By the end of the course students will be expected to explain the basic knowledge representation methods used in AI systems using appropriate terminology
- By the end of the course students will be expected to evaluate the usefulness of a given knowledge representation method for a given knowledge representation application problem

Lectures

You will be free to use any programming language in this course

We will cover:

- History of AI
- Definitions within AI
- Search Models
- Search Processes
- Search Controls
- Knowledge Representation (including Neural Networks)
- Bias in AI

Out of lecture?

There is no attendance at tutorials but they are highly recommended

- Start next week
- TAs will use tutorials to go through exercises related to lectures in a more in depth (and often slower manner), these exercises prepare you for exams
- Material will be covered and there will also be project help

You will work on group project together with team-mates and one individual assignment

You will study for exams. Final is registrar scheduled.

Grading

Component	Weighting %
Project Proposal	20%
Assignment	5%
Project Final	30%
Midterm	15%
Final	30%

- Each of the above components will be given a letter grade using the official University grading system. The final grade will be calculated using the grade point equivalents weighted by the percentages given above and then converted to a final letter grade using the official University grade point equivalents. (A+ are 4.3 for in-class component weighting)
- You will get letter grades for each item above:
  Course grade = (2a + 0.5b + 3c + 1.5d + 3e)/10

Grading

- Project (50%)
  - Paper proposing two models/processes to find answer to search problem
  - Final demonstration and code of system created based on one of prior models/processes
  - Team
- Assignment(5%)
  - Individual
  - Neural networks
- Midterm (15%)
  - In-class, in-person
  - Written (long answer)
  - Topics up until midterm
- Final (30%)
  - Registrar scheduled, in-person
  - Written (long answer)
  - Cumulative
  - Topics up until final (including those on midterm)

Course Policies

- When you email include your first name, and last name.
- Please use “CPSC433F24” as the prefix in the subject line

- The individual assignment submitted within 24 hours of the initial deadline will receive 10% off, within 48 hours 20% off. After that the assignment will be an F. Any request for an altered deadline should come the Friday a week before the assignment deadline.
- Later emergency long-term requests will be reviewed on a case by case basis by the instructor. Students will be required to provide evidence such as through the FoS missed term work form, office hours, or by email. Any documentation collected will be handled according to university policies and regulations around its collection.

Course Policies

- The project proposal paper and final submission are group work and missed work will not be accepted without prior instructor agreed upon plan with group for a missed deadline. Any request for an altered deadline should come the Friday a week before the project deadlines.

- A student with a missed midterm exam can request its weighting be transferred to the final exam (not recommended due to challenge of final exam and already larger weighting).

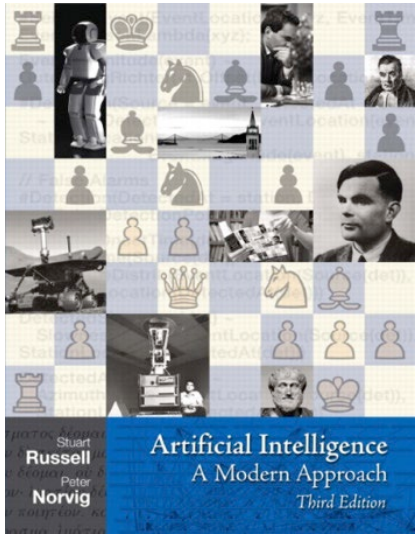
- The deferred final exam policies for the university apply to a missed final exam.

Academic Dishonesty

- *See course outline for policies.*

Textbook

- Not required, but for students who want to read more we recommend
  - Russell & Norvig, AI: A Modern Approach



  - Warning: Not a course textbook, so our presentation does not necessarily follow the presentation in the book.

Warning?

A warning (I)

If you do not like or have problems with the following topics and examples, then you should consider dropping this course:

1. Logical formulas, logical thinking (we use logic to show basic applications)
2. Mathematical modeling (we want you to clearly define your models)
3. Very abstract thinking (away from applications, concrete programs)

A warning (II): Logic

- Formulas like

$$\forall x\, \exists y \left(P(x) \rightarrow \neg Q(y)\right)$$

$$p \wedge (q \vee \neg r)$$

$$\forall x\, \forall y\, EQ\big(f(x), g(x,y)\big)$$

- Calculus rules like

$$\frac{C \vee P\ ,\ D \vee \neg P'}{\sigma(C \vee D)} \qquad \text{If } \sigma(P) \equiv \sigma(P')$$

A warning (III): Mathematical modeling

Traveling salesman problem with n cities.

$Prob = \{(1, c_2, \ldots, c_i) \mid c_i \in \{2, \ldots, n\}, 1 \leq i \leq n\}.$

$Erw\left(((1, \ldots, c_{n-1}), ?), ((1, \ldots, c_{n-1}), yes)\right).$

$Erw\left(((1, \ldots, c_i), ?), ((1, \ldots, c_i), yes)\right),$

if $f_{bound}((1, \ldots, c_i))$ is larger or equal to the best solution to the problem instance found so far

$$Erw\left(((1, \ldots, c_i), ?), \left((1, \ldots, c_i), ?, \left((1, \ldots, c_i, c'_{i+1,1}), ?\right), \ldots, \left((1, \ldots, c_i, c'_{i+1,k}), ?\right)\right)\right),$$

$if\ k = n - i, \{c'_{i+1,1}, \ldots, c'_{i+1,k}\} = \{2, \ldots, n\} - \{c_2, \ldots, c_i\},$
$c'_{i+1,j} < c'_{i+1,p}$ if $j < p$.

and so on

A warning (IV)

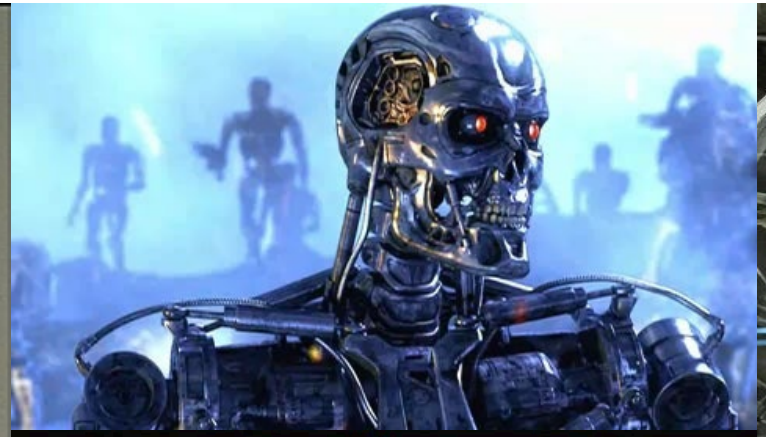
You will not only have to be able to understand formulas and formal definitions like the ones on the last slides, but you will also have to create such formal structures yourself!

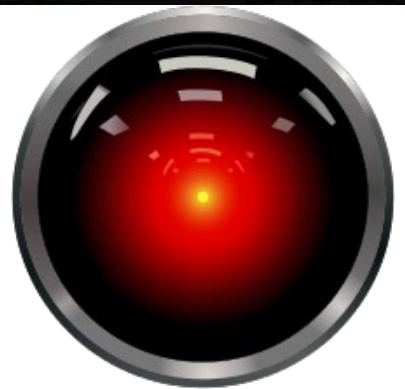
A warning (V)

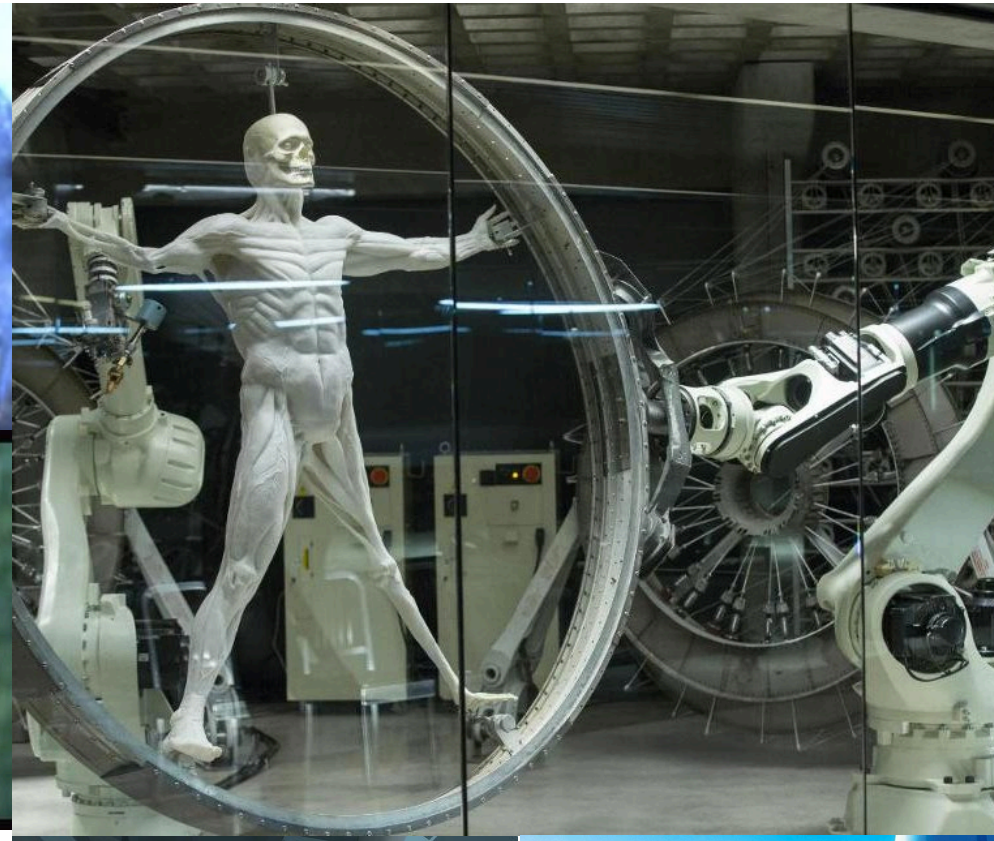
Yes! Create yourself!

AI?

Artificial Intelligence – What you may think of







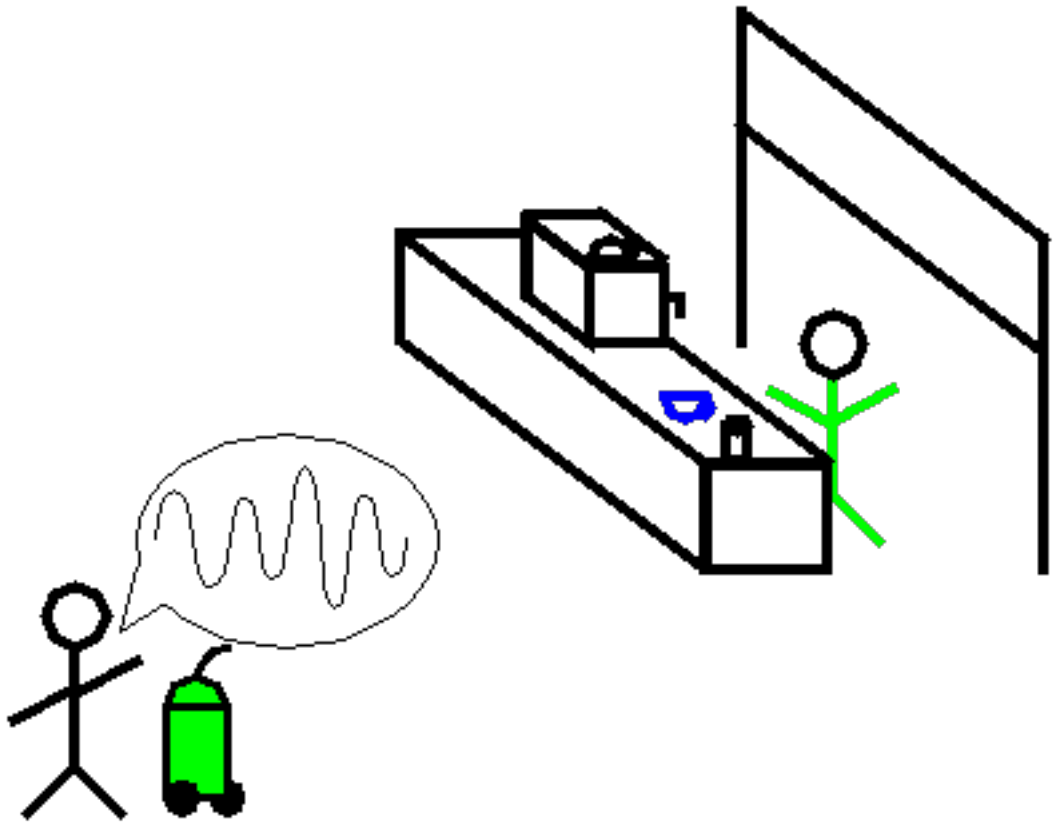

WAYMO


TUG
CAUTION
MAY CONTAIN
CHEMOTHERAPY DRUG

Artificial Intelligence – What you may think of

The challenge?

Artificial Intelligence -
An example of what we face



Example - What is involved (I)

“Can you get me a coffee, please ? (or !?)”

Tasks:

- Hear the sentence and transfer it in a written version
- Parse and “understand” the written version
  (i.e. transfer it into an internal representation)

☞Natural language understanding

☞Knowledge Representation

- Use sensory input to identify the current situation and possibilities

☞Vision

Example - What is involved (II)

- Define a goal; learned information about user (he likes his coffee with cream and sugar) is necessary

☞Machine Learning

☞Deduction

- Planning what to do:
  - Move to coffee bar
  - Interact with waiter
  - Prepare coffee (add cream and sugar; stir)
  - Bring coffee to user

☞Planning

Example - What is involved (III)

- Move to waiter

☞Robotics (but also Vision, (Re-)Planning)

- Deal with waiter

☞Natural language generation

☞Human-computer interaction

☞Multi-Agent Systems (if waiter is or has a robot)

Example -
and we do not want

Onward to … Introduction to Artificial Intelligence

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