CSI 4106. Introduction to Articial Intelligence – Fall 2024

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Course info

	Day	Time	Location
Lecture 1	Monday	13:00-14:20	FSS 2005
Lecture 2	Wednesday	11:30-12:50	FSS 2005
Office hours	Wednesday	15:00-16:20	STE 5106

Description (official)

The roots and scope of Artificial Intelligence. Knowledge and knowledge representation. Search, informed search, adversarial search. Deduction and reasoning. Uncertainty in Artificial Intelligence. Introduction to Natural Language Processing. Elements of planning. Basics of Machine Learning.

Approach

Machine learning first. Unlike other artificial intelligence courses, this one is structured so that deep learning is presented as early as possible. This serves two purposes. First, this is because deep learning is such a dominant technology now that it would be difficult to grab students attention without studying this subject. Second, deep learning serves as a framework through which we can introduce and define key topics in artificial intelligence. In some cases, we will see how deep learning has displace other technologies, or replace parts of it. Whereas in other cases, this will be an opportunity to discuss the limitations of deep learning and see how previous technologies had been developed for solving specific problems. Finally, it

is important to note that learning itself represents one of the earliest and most extensively understood milestones in the evolution of intelligence.

Learning outcomes

Upon completion of the course, you will be able to:

- **Explain** the fundamental concepts and historical development of Artificial Intelligence (AI)
- **Apply** problem-solving strategies using AI techniques
- **Critically analyze** and **compare** different AI approaches
- **Demonstrate** independent learning and exploration

Outline

Given the widespread influence of deep learning in current Artificial Intelligence advancements, my aim is to incorporate it into the course curriculum at an early stage. Establishing this groundwork will facilitate our understanding of its significance, particularly as we delve into subjects such as Monte Carlo Tree Search (MCTS) or Reinforcement Learning (RL) later in the course. Below is a preliminary and ambitious course outline.

1. Machine learning

    1. Introduction
    2. Linear regression and logistic regression
    3. Neural networks

2. Deep Learning (2)
3. Solution spaces

    1. Heuristics
    2. Constraint satisfaction/optimization: scheduling, TSP
    3. Case study: knapsack, population-based search
    4. Games and adversarial searches

4. Reinforcement Learning
5. Reasoning

    1. Propositional and predicate logic
    2. Logic and uncertainty
    3. Knowledge representation and reasoning (2)

6. Natural Language Processing (2)

7. Generative AI (2)
8. Large Language Models (LLMs)

Grading

The final course grade will be calculated as follows:

Category	Percentage
Assignments	40% (4 x 10%)
Quiz	20%
Final examination	40%

Consult the schedule for the dates.

Material and resources

- Lecture notes (slides) and complementary resources will be posted on the course Web site: turcotte.xyz/teaching/csi-4106/

Monographs

I will draw upon insights from the two comprehensive textbooks listed below, as well as relevant scientific publications. All sources of information will be cited. For most people, I expect that my lecture notes will be sufficient.

- Russell, S., & Norvig, P. (2020). *Artificial Intelligence: A Modern Approach* (4th ed.). Pearson.
- Poole, D.L., & Mackworth, A.K. (2023) *Artificial Intelligence: Foundations of Computational Agents* (3rd ed.). Cambridge University Press. (Freely available online in HTML format)

The Campus Store has ordered a small number of copies of these books, for those interested.

Acknowledgement

I extend my gratitude to Caroline Barrière for granting access to her comprehensive course materials.

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Here are some examples of academic fraud:

- Plagiarism or cheating of any kind;
- Present research data that has been falsified;
- Submit a work for which you are not the author, in whole or part;
- Submit the same piece of work for more than one course without the written consent of the professors concerned.
- Please consult this webpage: it contains regulations and tools to help you avoid plagiarism.

An individual who commits or attempts to commit academic fraud, or who is an accomplice, will be penalized. Here are some examples of possible sanctions:

- Receive an "F" for the work or in the course in question;
- Imposition of additional requirements (from 3 to 30 credits) to the program of study;
- Suspension or expulsion from the Faculty.
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- www.uottawa.ca/study/academic-support/academic-writing-help

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