COMP 6721 Applied Artificial Intelligence

***Lectures*: Online (pre-recorded, asynchronous)** ***Labs:* Online (Zoom)**
***Instructor*: Dr. René Witte (Associate Professor)** ***Office:* Online (Zoom)**
***Email:* rene.witte@concordia.ca** ***Office hours*: scheduled on Moodle**

Calendar Course Description

The course covers heuristic and adversarial searches for concrete applications. It then discusses automated reasoning, advanced knowledge representation and dealing with uncertainty for Artificial Intelligence applications. Finally, it introduces autoencoders, recurrent neural networks and sequence to sequence models. A project is required. Laboratory: two hours per week.

Objectives

The purpose of the course is to provide a broad technical introduction of the core concepts of Artificial Intelligence (AI). Topics include: state-space search (uninformed and informed/heuristic search), adversarial search, machine learning (ML), natural language processing (NLP), artificial neural networks, deep learning, knowledge graphs & intelligent agent design. It is intended as an overview or first introduction to AI, as there are dedicated courses covering ML, NLP, Intelligent Systems and other areas introduced here in more detail.

Prerequisite Knowledge

For the lab sessions, assignments and course project, you must be familiar with general programming in *Python* (we will provide a brief introduction to Python as part of the first lab session). Several course topics require a solid grasp of mathematical foundations, in particular probability theory and linear algebra.

General Information

This course has weekly lectures and lab sessions. For each week, lecture slides will be made available through the course Moodle web site. Additionally, pre-recorded lectures will be published on Moodle for each week. That is, lecture recordings are available in an asynchronous fashion and you can go through them on your own schedule.

For most lectures, *worksheets* will be provided that you must go through while following the lecture material. You should then post your answers on Moodle to receive feedback (detailed instructions will be provided on Moodle).

Additional online activities and office hours will also be announced and scheduled on Moodle.

Textbook

There is no single textbook that will be used for this course. For each lecture topic, required and recommended readings will be posted as part of the lecture information on Moodle. Generally, these readings will be available online or as an electronic resource through the Concordia Library.

Moodle Web Site

Amendments to this syllabus, if any, as well as other important information will be made available through the course's Moodle site. The Moodle site also provides additional reading material, as well as discussion forums for asking questions on lecture topics, the project, quizzes, etc. Note that you must be registered for the course to access the Moodle site (there is typically a one-day delay between registering and receiving Moodle access).

Evaluation

Your grade will be based on both individual assignments, as well as a team project (split into multiple submissions). Additionally, there will be three timed quizzes on the Moodle platform, held during the scheduled lecture time slot. The distribution of these deliverables is as follows:

15%	Assignments (individual work)
40%	Course Project (team work, split into multiple submissions)
45%	Exams (Online Moodle Quizzes)

There is no standard relationship between percentages and letter grades assigned for this course. In order to pass the course you must receive at least 50% of the overall possible marks.

Should you fail to write one of the quizzes ***and*** you have valid justification (e.g., doctor's note) then the weight of the missed quiz will be added to the other quizzes.

Note: It is your responsibility to adhere to the ***university's code of conduct*** as detailed in the calendar.

Conditions Specific to Remote Teaching and Assessment

1 All students are expected to have access to a computer with the following capabilities:
   - 1.a reliable internet connection
   - 1.b camera and microphone (your computer and/or cellphone)

2 All students should install VPN for remote desktop access to Concordia University computer labs https://www.concordia.ca/it/support/connect-from-home.html
Once you have VPN connection to Concordia University, you can access all available software in Gina Cody School labs by following the process described in:
https://www.concordia.ca/ginacody/aits/support/faq/connect-from-home.html

3 Course specific software: You should install the *Python* programming language, together with a suitable IDE. Further details on the required course software will be available on the course Moodle web site.

4 All students are required to do online, timed exams:
   - 4.a Exams will be done through Moodle Quiz.
   - 4.b The exams will take place during the lecture time period on dates that will be announced on Moodle at least a week in advance.
   - 4.c You will be responsible for ensuring appropriate, properly functioning technology (webcam, a microphone, appropriate browser and an ability to download any necessary software, as well as a reliable internet connection with a minimum of a 3G connection).
   - 4.d You will need a quiet place within which to take the quizzes. Earplugs or noise-canceling headphones that are not connected to a device may also be used to allow you to focus for the duration of the exam.
   - 4.e The course instructor reserves the right to conduct an individual oral examination to verify student's response to online exam, project, or assignment questions.

5 Academic Integrity
Violation of the Academic Code of Conduct in any form will be severely dealt with. This includes copying (even with modifications) of program segments. You must demonstrate independent thought through your submitted work. The Academic Code of Conduct of Concordia University is available at: https://www.concordia.ca/conduct/academic-integrity.html

It is expected that during class discussions, in the online forums and in your written assignments you will communicate constructively and respectfully. Sexist, racist, homophobic, ageist, and ablest expressions will not be tolerated.

All students must read and sign the Expectations of Originality form and submit the signed copy with their assignments and project.

Course Content and Schedule

We will cover the following topic(s) in each lecture week (note that the weekly schedule may be subject to change):

(Week 1) Introduction to AI: Overview & History
(Week 2) State-Space Search: Uninformed & Heuristic Search
(Week 3) Adversarial Search: Mini-Max & Alpha-Beta Pruning
(Week 4) Introduction to Machine Learning (ML), Naïve Bayes Classifier
(Week 5) ML: Decision Trees, Evaluation & Unsupervised Learning
(Week 6) Introduction to Artificial Neural Networks (ANN)
(Week 7) Introduction to Deep Learning, Convolutional Neural Networks (CNN)
(Week 8) Knowledge Graphs & Intelligent Agents (I)
(Week 9) Knowledge Graphs & Intelligent Agents (II)
(Week 10) Introduction to Natural Language Processing (NLP)
(Week 11) NLP: Vector Space Model, Applications
(Week 12) Deep Learning for NLP
(Week 13) Conclusions

There will not be time to cover all of these topics in depth. Other topics of interest to the class may also be included. A more detailed week-by-week breakdown, as well as additional information for each topic, will be available on the Moodle web site.

Course Project

As part of the course, you will work on an AI project related to the topics covered in the lectures. In addition to submitting your project (through Moodle), you will have to demo it during dedicated online sessions. Details on the projects will be announced in class and on Moodle. The project is team work.

Lab Sessions

There will be a weekly lab session, starting Week 2. Note that lab sessions are a mandatory part of the course. All lab sessions take place online, during the dedicated lab time slots, using Zoom and are not recorded.

The weekly lab sessions generally cover the lecture material from the previous week. It is a prerequisite before attending each lab that you studies the lecture material, readings, and worked on the corresponding worksheet from the week before.

Disclaimer

In the event of extraordinary circumstances beyond the University's control, the content and/or evaluation scheme in this course is subject to change.

On Campus Resources

HEALTH SERVICES An on-campus health clinic and health promotion center with nurses and doctors. SGW 514-848-2424 ext. 3565 LOY 514-848-2424 ext. 3575	**COUNSELLING AND PSYCHOLOGICAL SERVICES** Counsellors (licensed mental health professionals) work with students to address their mental health and wellbeing needs. SGW 514-848-2424 ext. 3545 LOY 514 848-2424 ext. 3555
ACCESS CENTRE FOR STUDENTS WITH DISABILITIES Supports students with a variety of disability conditions (including temporary disabilities arising from illness or injury). Students receive academic support for their educational experience at Concordia. acsdinfo@concordia.ca 514-848-2424 ext. 3525	**SEXUAL ASSAULT RESOURCE CENTRE** Provides confidential and non-judgemental support and services to students, staff and faculty of all genders and orientations affected by sexual violence and/or harassment. Jennifer Drummond, Coordinator jennifer.drummond@concordia.ca sarc@concordia.ca 514-848-2424 ext. 3353
STUDENT SUCCESS CENTRE Support network from first-year to graduation. You'll find one-on-one tutors, study groups, workshops as well as learning and career advisors 514-848-2424, ext. 3921	**DEAN OF STUDENTS** Supports students to enhance their Concordia experience by engaging in student life outside the classroom. Terry Kyle, Manager deanofstudents.office@concordia.ca SGW 514-848-2424 ext. 3517 LOY 514-848-2424 ext. 4239
ABORIGINAL STUDENT RESOURCE CENTRE An on-campus resource for First Nations, Métis and Inuit students that helps them make the most of the many resources available at the university. Orenda Konwawennotion Boucher-Curotte, Coordinator orenda.boucher@concordia.ca 514-848-2424 ext. 7327	**INTERNATIONAL STUDENTS OFFICE** Supporting international students with immigration documents, health insurance, social events, and workshops. iso@concordia.ca 514-848-2424 ext. 3515
STUDENT ADVOCACY OFFICE Advocating for students facing charges under the Academic Code of Conduct or the Code of Rights and Responsibilities. studentadvocates@concordia.ca 514-848-2424, ext. 3992	**MULTI-FAITH & SPIRITUALITY CENTRE** Provides a home for all those wishing to celebrate the human spirit in the widest sense of the word, through programs, events and a quiet space for reflection. Ellie Hummel, Coordinator mfsc@concordia.ca 514-848-2424, ext. 3593
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