COMP 5801G/4900I (Fall, 2025)

Multi-agent Aspects of Deep Reinforcement Learning

Instructor: Zinovi Rabinovich

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Office Location: Room 5410, Herzberg Labs

Best Ways to be in Touch: in class, via email, or during student hours

Teaching Assistant: N/A

Class Location: Please check Carleton Central for the room location.

Lecture Times: TR, 08:35-09:55

Tutorial Times: N/A

Course Website: Brightspace Course Page

Graduate students only:

- Brightspace access for University of Ottawa Students; please see information here: https://gradstudents.carleton.ca/faculty-of-graduate-and-postdoctoral-affairs-access-to-brightspace/
- University of Ottawa Students who need access to SCS IT resources such, as OpenStack and Nextcloud, must submit a request to SCS Tech Support SCS.Tech.Support@cunet.carleton.ca. The request must be sent from their @cmail.carleton.ca email address and the email should say which resource is required and for which course (including section).

Important dates and deadlines can be found here: Dates, Deadlines, and Regulations—Registrar's Office, including class suspension for fall, winter breaks, and statutory holidays.

Course Calendar Description

Deep (Reinforcement) Learning has been successfully applied in a variety of domains, but the presence of multiple learners (potentially with distinct purposes/optimality criteria) engenders critical non-stationarity in the system. We will study a variety of approaches that deal with, acknowledge and exploit this effect: cooperative learning and its federated point of view, learning to communicate, and behaviour/strategy manipulation. The course will have the format of a reading seminar with a mini-project (we'll aim for publication potential). Every effort will be made to have lecture recordings available, however we cannot guarantee the timely availability or quality of these recordings.

Precludes: N/A

Prerequisite(s): (for UGs) COMP 3105 or COMP 3106

Learning Material(s) and Other Course/Lab-Related Resources

Learning Material	Options for Purchasing *(e.g., Bookstore, Used, etc.)*	Approximate Cost
MARL Book by Albrecht et al	MIT Press	Free Download
Exercise Set	Barcelona Summer School 2024	Free Online
Barcelona Summer School Recordings	YouTube	Free Online
MARL Code Base	MARL Book Official GitHub	Free Online
Extended Python MARL	UoE Agents Group GitHub	Free Online
MARLLib	MARLLib Project Docs	Free Online

Students are not required to purchase textbooks or other learning materials for this course.

Topics Covered and Learning Outcomes

The course will largely divide into three portions.

First portion is introductory: we will review some basic and up-to-date multi-agent learning algorithms, striking at the issues of cooperative learning, basic learning to communicate, and learning in games.

Second portion is participatory (seminar-style): students of the course will be provided with a choice of recent papers on the above topics and asked to present them in class. It will be necessary to expand the reading beyond the papers themselves, as the presentation will have to contain the necessary background for the paper. This second portion will allow students to discover research-edge topics, such as emergent communication, federated learning, manipulation and machine teaching, and others.

Third portion is applied (project): students will be asked to organise into groups of up-to 3 people, choose among a set of suggested subjects (or introduce one of their own accord, as long as it aligns with the course) and implement it. It is suggested that the graduate students of the course should aim at a publishable result.

The idea behind this course structure is to provide students both with information on recent advances in MultiAgent (Reinforcement) Learning, and foster soft and specific research skills, including (but not limited to) project design, literature review, presentation skills and practical experience in coding and training multi-agent algorithms. Notably, however, the course will not teach coding, but rather give an opportunity to further the skill.

Exact scheduling will depend on the number of students signed up for the course. However, there will be in any case the following periods:

- Overview and introductory lectures
- First batch of seminar talks
- Project Design Presentations and Defence
- Second batch of seminar talks
- Project Outcome Presentations and Defence

We will also endeavour to invite guest speakers, though it depends on their and time-slot availability.

Week	Topic/Content	Readings/Prep for Class
0	RL Basics, Games: Models and Solution Concepts	MARL Book Chapters 2-4
1	Intro, MARL: Basic Games and Foundationals	MARL Book Ch: 1,5,6
2	MARL Foundations, Deep RL	MARL Book Ch: 5,7
3	MARL Foundations, Deep RL	MARL Book Ch: 7,8
4	MARL Foundations, Deep RL	MARL Book Ch: 9
5	Seminars 1-4	TBD
6	Project Theme Defences	
7-11	Seminars 5-24	TBD
12-13	Project Final Presentations	

Assessment Scheme

Grade Breakdown

COMPONENT	**GRADE VALUE**	**DATE**
Participation	15 %	Weekly + online
Seminar Presentation	35 %	As cooperatively scheduled Weeks 5,7-11
Project Defence Presentations (x2)	15 %	Week 6 and Weeks 12-13
Project RnD	35 %	Weeks 12-13

Late and Missed Work Policies

Late Work and Missed Work (Short-Term accommodations)

As our **projects** aim at a paper-level research, their schedule will echo the same process. In particular, all relevant materials will have to be delivered as per schedule without delays. As with real papers,

technical problems do not exempt you from timeliness, so if you wait until the last minute and then have issues with your connection or code or your computer, you will still receive a mark of zero.

Consequently, you are advised to:

- Periodically upload/commit your progress (e.g., upload your progress/partial results at the end of day, every day). This will ensure that even if you do not manage to complete your project, at least part of the mark can be salvaged based on your partial work.
- Attempt to submit your final submission at least one hour in advance of the due date and time. This echoes the previous point, but it suggests that you should work on a time schedule that is a pinch shorter than what is allowed – you should keep a time buffer for external interferences.

You will be submitting your project source-code, and it will have to be appropriately documented and packaged. You will also be submitting a project report. You are expected to demonstrate good programming practices at all times, as experiment reproducibility is a key feature of modern research.

In contrast to the project work, **presentations (seminar or defence)** do have some affordances in their timeline. Following similar practices of the research community publications and presentations, should there be some circumstance beyond your control that prevents you from keeping the dead-line, you will be allowed to submit a recording of your **presentation** (seminar or defence) at no more than 1 week delay. Do not rely on receiving this extension.

Missed Work (Long-term accommodation)

Approved long-term accommodation, where circumstace has lifted within 2 weeks before the end of the semester, will grant the possibility to submit the missing presentation material by the end of the semester. If the circumstance persists, then only the project RnD will be taken into account. If the project RnD cannot be complete by the end of the semester, there is no recourse but to drop the course.

School of Computer Science Laptop Requirement (only applies to on-campus courses)

Every student that has been enrolled in a 1000-level (i.e., first year) course offered is required to have a laptop. This includes COMP1001, COMP1005, and COMP1006. For more information, please visit https://carleton.ca/scs/scs-laptop-requirement/ and then review the requirements at https://carleton.ca/scs/scs-laptop-requirement/laptop-specs/.

Undergraduate Academic Advisors (only for UG course)

The Undergraduate Advisors for the School of Computer Science are available in Room 5302HP; or by email at scs.ug.advisor@cunet.carleton.ca. The undergraduate advisors can assist with information about prerequisites and preclusions, course substitutions/equivalencies, understanding your academic audit and the remaining requirements for graduation. The undergraduate advisors will also refer students to appropriate resources such as the Science Student Success Centre, Learning Support Services and Writing Tutorial Services.

Graduate Academic Advisors (only for Grad course)

The Graduate Advisors for the School of Computer Science are available in Room 5302 HP; or by email at grad.scs@carleton.ca. The graduate advisors can assist with understanding your academic audit and the remaining courses required to meet graduation requirements.

SCS Computer Laboratory

Students taking a COMP course can access the SCS computer labs. The lab schedule and location can be found at: https://carleton.ca/scs/tech-support/computer-laboratories/. All SCS computer lab and technical support information can be found at: https://carleton.ca/scs/tech-support/. Technical support staff may be contacted in-person or virtually, see this page for details: https://carleton.ca/scs/tech-support/contact-it-support/.

Mental Health and Wellness

The Carleton Wellness Website is a wonderful resource link to include in the course outline for students.

Academic Accommodations and Regulations

Academic Accommodation

Carleton is committed to providing academic accessibility for all individuals. You may need special arrangements to meet your academic obligations during the term. The accommodation request processes are outlined on the Academic Accommodations website (https://students.carleton.ca/course-outline/).

Chat GPT/Generative AI Usage

As our understanding of the uses of AI and its relationship to student work and academic integrity continue to evolve, students are required to discuss their use of AI in any circumstance not described here with the course instructor to ensure it supports the learning goals for the course.

In general, you are permitted to use AI tools to assist you in creating presentations and writing code. However, you bear the full responsibility for the outcome. In particular, if you are unable to address a question wrt presentation/paper/task element, you will lose marks. If the AI tool "halucinates" a statement (and they do far more frequently than you may expect), you will bear the responsibility for its falsehood and/or lack of support. To slightly paraphrase a quote from "Harry Potter and the Chamber of Secrets": Never blindly trust anything that can think for itself if you don't know where it keeps its brain ... or how it works.

Academic Integrity

Students are expected to uphold the values of academic Integrity, which include fairness, honesty, trust, and responsibility. Examples of actions that compromise these values include but are not limited to plagiarism, accessing unauthorized sites for assignments or tests,

unauthorized collaboration on assignments or exams, and using artificial intelligence tools such as ChatGPT when your assessment instructions say it is not permitted.

Misconduct in scholarly activity will not be tolerated and will result in consequences as outlined in Carleton University's Academic Integrity Policy. A list of standard sanctions in the Faculty of Science can be found here.

Additional details about this process can be found on the Faculty of Science Academic Integrity website.

Students are expected to familiarize themselves with and abide by Carleton University's Academic Integrity Policy.

Student Rights & Responsibilities

Students are expected to act responsibly and engage respectfully with other students and members of the Carleton and the broader community. See the 7 Rights and Responsibilities Policy for details regarding the expectations of non-academic behaviour of students. Those who participate with another student in the commission of an infraction of this Policy will also be held liable for their actions.

Student Concerns

If you have any concerns regarding this course, your first point of contact is me. Please email me or visit during my student hours, and I will do my best to address your concerns. If I cannot resolve the issue, the next point of contact is the School of Computer Science at studentconcerns@scs.carleton.ca. If the concern remains unresolved, the final point of contact is the Office of the Dean of Science at ODScience@carleton.ca. Please follow this order of contact.

Note: You can also bring your concerns to Ombuds services.