CMPUT 607 W17: Applied Reinforcement Learning

Final Project Guidelines

Components and Timeline

Proposal Due:	March 12, 2017
Presentation Day:	March 27 & 29, 2017
Critique Deadline:	April 2, 2017
Term Paper Deadline:	April 9, 2017
Demo Days:	April 10 & 12, 2017

Written aspects are to be handed in by email to pilarski@ualberta.ca by 11:59pm on the due date.

Objectives

- Your final project is your chance to demonstrate what you have learned during the course, and to refine your understanding of one specific topic or set of topics covered during the term.

- As such, using your robot as a base, your final project *must do one of the following*:
    - Link together two topics studied during the course (e.g., merging GVFs with ACRL);
    - Greatly extend your investigations into one area (e.g., creating a large-scale or precisely organized Horde, or apply ACRL/Pavlov to a challenging robotic problem);
    - Extend a topic in a frontier direction (e.g., GVFs in PSR, ACRL with human reward, or a curious ACRL learner).

Proposal

- 10% of final course mark.
- 1-2 pages in length.
- Your proposal needs to include the following sections, which can be in paragraphs or in point form as long as they are complete:

    - **Abstract**
        - In one paragraph, describe what you hope to work on, why it is interesting to you / what you will learn, what final outcome you expect, and what tangible demonstration you hope to create and present to the class.

    - **Conceptual Goals (include whiteboard sketches, etc., as required)**
        - State whether you are you going to link together two topics studied during the course, greatly extend your investigations into one area, or extend a topic in a frontier direction.
        - State what specifically you hope to explore or show in this line of study.

    - **Technical Goals (include whiteboard sketches, etc., as required)**
        - What does your robot and experimental platform need to look like to achieve your conceptual goals?
        - What do you have right now as a starting point (hardware and software)?
        - What do you need to build to succeed (hardware and software)?
        - What additional robotic or other parts do you need?
        - What technical hurdles to you expect along the way / what areas of the project might cause you grief?

    - **Measure of Success**
        - In one sentence, what does success look like for your project?
        - How will you know that you have succeeded in achieving your conceptual goals? What data or other proof will you need to declare success?
        - How will you know that you have succeeded in achieving your technical goals? What data or other proof will you need to declare success?

    - **Plan and Milestones (include a table, chart, etc., if required)**
        - What is your plan to go from where you are now to a final demonstration of success and a term paper describing your work?
        - In rough terms, what milestones do you plan to hit along the way so that you are able to gauge your progress? When do you expect to complete each of these milestones?
        - If a milestone cannot be achieved, what is your fallback plan?

Presentation

- 5% of final course mark.
- 8 minutes in length, with 2 minutes for questions during the transition.
- May use keynote/powerpoint slides, overhead projector, or whiteboard (whatever you think will be most effective for your topic.)
- Presentations should be high-level and not get lost in the details.
- Your presentation should addresses the following questions / points; if you are using slides, then think about using only 1-2 slides per section, for a maximum of eight slides.

    - **Subject**
        - What is your topic of choice for your project and term paper?
        - Describe your topic in plain language.
        - State whether you chose to link together two topics studied during the course, greatly extend your investigations into one area, or extend a topic in a frontier direction.

    - **Impact**
        - Why is your topic exciting? Why is it interesting to you?
        - What specific areas of reinforcement learning does your topic relate to?
        - What non-RL areas does you topic relate to or promise to impact? *(e.g., practical utility outside the RL community, or other academic / industrial fields)*

    - **Approach and Goals**
        - What are your conceptual goals?
        - What are your technical goals?
        - How will you measure or declare success?

    - **Progress and Outcomes**
        - What have you done so far? (Feel free to share preliminary results, video, demo, etc.)
        - What is going smoothly for you so far?
        - What barriers or hurdles are you facing?
        - What is left to do?

Written Critiques

- 5% of final course mark.
- One goal of these critiques is to provide you with a way to think about and synthesize the diverse topics explored in the course and shared by your classmates.
- A second goal of these critiques is to showcase your understanding of RL in a broader sense, highlight your ability to integrate RL topics with non-RL topics, and demonstrate you ability to think clearly and carefully on the relationships therein.
- Please complete the sections on the following page for each critique. You may wish to print copies of the page that follows and use these as a place to jot down notes during your classmates' presentations.
- Critiques need not be lengthy. One paragraph on each question should be enough. Critiques should be clear, informative, and perhaps even thought provoking.
- *There is no correct answer*. You will be evaluated on how well you demonstrate your understanding of RL topics, your ability to think at a high level, and your ability to link your classmates topics to your own interests and a broader perspective.
- With the above points in mind: it may be helpful to think on the questions addressed in the critique when designing your presentation materials.

What is this presenter's topic?

What area/aspect of RL does this presenter's topic address?

Why is this presenter's topic important or exciting (to RL, to science, to society, to you)?

How does this presenter's topic relate to your own topic?

TO BE SHARED WITH PRESENTER: Do you have any feedback, hints, or suggestions for the presenter to help them on the final push toward completing their project (unless you tell me otherwise, this feedback will remain anonymous; I will collect and send these to each presenter shortly after the presentations are complete)?

Term Paper & Demonstration

- 40% of final course mark.

- The goal of your ***final written term paper*** is for you to demonstrate your understanding of the applied reinforcement learning topics you have studied over the course of the term and to showcase the outcomes of your final term project.

- Your ***in-class demonstration*** will serve in the same ways your videos did in your robot modules: in cases where your written report lacks clarity, rigour, or detail, your demonstration will serve as supporting evidence that you have completed the objectives of the term project.

- As in your robot modules, you will be evaluated on your ***detail, rigour,*** and ***clarity***, w.r.t:
    - the level of research and thought you have put into your topic;
    - the clarity of your writing and thinking;
    - the comprehensiveness of your description of your project and its outcomes;
    - your level of contact with key aspects of the relevant literature;
    - and, importantly, your perspectives on your topic, its relevance, and its potential for future growth and development.

- ***Length****:* while there is no set minimum word or page limit for your term paper, please try to be succinct and clear, while also capturing the key elements of your topic in enough detail. Between 8 and 12 pages is a reasonable target. Figures and pictures are considered helpful and refreshing. (If you are excited about your topic, you may find it hard to write a short paper; however, please do not exceed 12 pages in length, *including figures* but *excluding references*.)

- Please follow the same approach to submitting and annotating your code as in your robot modules. If you like, you may also submit a short video of your project working in ideal circumstance, in addition to your in-class demonstration (robots are known to fail with greater probability on demo day, so it's always good to have a backup option to show everyone.)

- With these points in mind, one approach for your term paper is to take the structure of your project plan from earlier in the term and expand it into a full report, adapting it to accommodate the changes that have occurred in your project plan.

- For an example term paper layout, please see the outline on the following page.

Sample Term Paper Outline

- **Title and Abstract**
  - In one paragraph, describe what you worked on, why it was interesting to you / what you learned, what final outcome you achieved, and what tangible demonstration you created and presented to the class.

- **Conceptual Goals (include figures, algorithms, diagrams, etc., as required)**
  - State whether you linked together two topics studied during the course, greatly extended your investigations into one area, or extended a topic in a frontier direction.
  - State what specifically you hoped to explore or show in this line of study.
  - What did your project aim contribute in a conceptual sense and/or what hard problems did you aim address?

- **Technical Goals (include figures, algorithms, diagrams, etc., as required)**
  - What did your robot and experimental platform (hardware and software) look like to achieve your conceptual goals? Describe your experimental setup in detail.
  - What did you start with (hardware and software) and what did you build, fabricate, or acquire to succeed (hardware and software)?

- **Measures of Success**
  - What does success look like for your project in terms of conceptual and technical outcomes? *Did you achieve success and to what degree?*
  - *Present your data or other proof* that you need to declare success in terms of your conceptual goals. Be detailed and specific.
  - *Present your data or other proof* that you need to declare success in terms of your technical goals. Be detailed and specific.

- **Conclusions and Future Work**
  - If you were to continue working on this project, what would you do next?
  - What impact do you feel your project has on the field of RL?
  - What is the main thing you showed or learned over the course of this project?

- **References and Links**