CSC2626: Imitation Learning for Robotics
Project Guidelines

Introduction

CSC2626 involves a course project in which you will implement a research idea on the topic of imitation learning specifically related to robotics (e.g. control, human-robot interaction, computer vision) or related areas. Any of the broad topic descriptions on the course website, under which weekly readings are listed, can act as a good starting point for picking a project. The purpose of the final project is to give you the chance to spend a significant amount of time focusing on a single research direction. The types of projects that we envision include the following:

- Implement the main algorithm described in one of the papers listed on the course website, try to replicate the results, and run it in 2-3 new scenarios.
- Provide an empirical evaluation and comparison of at least three algorithms from the papers in the reading list, on 1-2 illustrative scenarios.
- Extend the main algorithm described in one of the papers listed on the course website in a non-trivial way, and evaluate it on 1-2 new scenarios.
- Invent a new algorithm, and provide sufficient evaluation to demonstrate the merit of the idea, at minimum 1-2 scenarios.

You can get full marks for the project component by selecting any of these types of projects. You are not expected to produce a novel research idea, although courses like this are meant to create the conditions for students to attempt it. We encourage you to try.

Policy on Collaboration

You need to form groups of 2-3 for the course project. Exceptions to this rule can be made only in rare cases provided there is good reason to do so. Email the instructor if this applies to you. If you do not know anyone in class feel free to post a message on Piazza. We will also set aside some time after class before the project proposal deadline for students who are looking for collaborators to find each other and discuss forming a group.

Project Proposal (10%)

You are expected to describe a well-defined research goal in the proposal. When choosing this goal try to identify the minimum viable objective that you think is likely to work and you can accomplish, just to get you started, some nice-to-haves that you will do provided there is time, and a short review of related work. The definition of your research project may change during the course of a month and a half that you will be working on your project, but your proposal should be as specific and well-defined as possible, otherwise we cannot provide helpful feedback. If you are unsure about your plans, contact the instructor well before the proposal due date. **Proposals should not be based only on papers covered in class by the due date. Students are encouraged to look further ahead in the schedule and to start planning their project definition well ahead of the due date**.

Proposals are limited to 2 pages, with the following suggested structure: 1/4 page for abstract/introduction 1 page for the problem, 1/2 page for related work, 1/2 page for the proposed method, 1/2 page for proposed evaluation, 1/4 page for references. Proposals should follow the template provided by the Conference on Robot Learning (CoRL) https://bit.ly/38wLgmU.

Upload your proposal in pdf form on Quercus. Student co-authors should be listed alphabetically in the proposal.

Can I extend a project I completed in a previous class? Yes, you are welcome to do this as long as you provide your final report from that class and include an appendix to the proposal that clarifies what is being added to the previous project.

Can I extend a project I completed or am working on as part of my research/thesis? Yes, you are welcome to do this as long as you include an appendix to the proposal that clarifies what is being added to the research you have done so far outside this course.

Which simulator or dataset should I use? Use the one that is going to allow you to quickly try ideas and prototype. I would not recommend starting with game engines like Unreal Engine 4 and Unity, unless you know what you are doing. Similarly, choose the easiest dataset to get started. Toy data is fine. So are simple scenarios. Start with the easiest and most predictable setting/environment, and only increase complexity if you are making progress. I do not suggest starting from the most complex environment and gradually moving to simpler ones.

I need a GPU but I don't have access to one. What should I do? Email the instructor early on if this is a problem. You should also look into Google Colab, and any GPU desktops provided by your department (if any).

Midterm Progress Report (5%)

This is a three page document. The first two pages contain a copy of your project proposal. The other page includes: 3/4 page status update, presenting what you have accomplished so far (include figures and results), and 1/4 page describing your next steps. In your next steps indicate if you intend to use a real robot. Submit your proposal on Quercus in pdf form.

Presentation (5%)

This is a 5-10min presentation during class, during which you will present the main idea of your project and the progress you have made until that point. It is not required that you have finished your project by this point.

Final Report and Code (30%)

The final report needs to have at least five pages that include: 1/4 page abstract, 1/2 page introduction, 1/2 page related works, 1.5+ pages describing your method, 1.5+ pages describing your results and evaluation, 1/2 page limitations. The final report may include as many references and appendices as you need. Figures and tables are encouraged. Final reports should follow the same paper template as the proposal. Submit your final project report in pdf form, and a zip file with your code or a link to a github repository to the instructor. Student co-authors should be listed alphabetically on the final report. The document should contain an appendix outlining what each team member contributed to the project.

Marking rubric for the final project report

1. Abstract (2 pts) that summarizes the main idea of the project and your contributions.
2. Introduction (3 pts) that states the problem being solved and any applications / implications.
3. Figure or diagram (2 pts) that shows the overall idea.
4. Related work (2 pts) and bibliography. Highlight how your method is different from other approaches. Present other approaches in the proper light without diminishing their contributions.

5. Methodology (10 pts) Describe your method in detail as well as any assumptions it relies on. Explain prerequisite concepts clearly and succinctly. Include algorithm descriptions, figures, and equations as you wish.
6. Evaluation (8 pts) Include any figures or tables that illustrate your experimental results. Do not forget to include error bars if applicable. Analyze your findings, and comment on their statistical significance. In your evaluation please take into account the reproducibility checklist https://www.cs.mcgill.ca/~jpineau/ReproducibilityChecklist.pdf.
7. Limitations (2 pts) Describe some settings in which your approach performs poorly, and list a few ideas for how to adddress them. Describe opportunities for future work, as well as open problems.
8. Conclusions (1 pts) A summary of what you accomplished.

Final remarks

Do not forget to enjoy your project and have fun with it!