IFT6163 Robot Learning Project

You

April 26, 2022

Abstract

Provide an report of your course project. You should reuse a lot of content from your project proposals and add more onto them. You can find an overleaf template for this assignment here. Overall, the project report should be 8-12 pages with at least 3 figures/tables. Include lots of information to show your progress with the project. You grade depends more on what you show you learned and less on method performance.

1 [4 pts] Project Introduction (2 paragraphs, with a figure)

Tell your readers why this project is interesting. What we can learn. Why it is an important area for robot learning.

2 [2 pts] What is the related work? Provide references: (1-2 paragraph(s))

Give a description of the most related work. How is your work similar or different from the most related work?

3 [2 pts] What background/math framework have you used? Provide references: (2-3 paragraph(s) + some math)

Describe what methods you are building your work on. Are you using RL, reset-free, hardware, learning from images? You want to provide enough information for the average student in the class to understand the background.

Figure 1: Explain what is in the figure.

Name	score
RL	100
SL	-100

Table 1: Explain what is in the table.

4 [6 pts] Project Method, How will the method work (1-2 pages + figure(s) + math + algorithm)

Describe your method. Again, You want to provide enough information for the average student in the class to understand how your method works. Make sure to include figures, math, or algorithms to help people understand.

Algorithm 1 DDPG algorithm

init $\phi' \leftarrow \phi$ and $\theta' \leftarrow \theta$ to random networks and $\mathcal{D} \leftarrow \{\}$
for $l \in 0, \dots, L$ **do**
  take some action $\mathbf{a}_t$ and recieve $\{\mathbf{s}_t, \mathbf{a}_t, r_t, \mathbf{s}_{t+1}\}$, add to $\mathcal{D}$
  Sample batch of data $\{\mathbf{s}_i, \mathbf{a}_i, r_i, \mathbf{s}'_i\}_{i=1}^{N}$ from $\mathcal{D}$
  $y_i \leftarrow r_i + \gamma Q(\mathbf{s}'_i, \mu(\mathbf{s}'_i, \theta'), \phi')$ {Compute Target}
  Update ϕ by minimizing $\frac{1}{N}\sum^{N} ||Q(\mathbf{s}_i, \mathbf{a}_i, \phi) - y_i||^2$ {Update critic}
  Update $\theta \leftarrow \theta + \beta \frac{\partial Q_\phi(\mathbf{s}_t, \mathbf{a}_t)}{\partial \mu(\mathbf{s}_t|\theta)} \frac{\partial \mu(\mathbf{s}_t|\theta)}{\partial \theta}$ {Update Actor}
  Update $\theta' \leftarrow \rho\theta' + (1-\rho)\theta$ and $\phi' \leftarrow \rho\phi' + (1-\rho)\phi$ {Using Polyak averaging}
end for

You can also reference figures Figure 1, tables Table 1 and algorithms 1.

5 [2 pts] What new skills have you(s) learned from this project?

List some of the technical skills you are learning from studying this method.

6 [8 pts] Experiments and Analysis

In this section

1. Describe what experiment(s) you are going to run and why? How do these show you have met your learning goals?
2. What do you think the results of these experiments will be?
3. Sketch out the figures that you will later generate from your work. Spend a few minutes drawing them out in GIMP or photoshop. Why will these be enough evidence for learning? Is anything missing?

Keep in mind these experiments are for this course project. What is expected is that you should provide evidence that your method works and it has been coded up well. Provide evidence of this via your data and learning graphs. However, this should not be restricted to learning graphs.

7 [2 pts] Video Results

Include a link to a video of the method so far. This is not intended to be a final performance video. Provide something to help me give feedback on what I would do to improve this method or debug issues.

8 [4 pts] Conclusions

What have your results indicated?

What have you learned? What would you do differently next time? Reflect on the scope of your project, was it too much? Why?

9 [2 pts] How was the work divided?

Provide a description on what each group member is working on as part of the project. I recommend each student work on most of the parts of the project so everyone learns about the content.

Student Name: Did x, y, and z.

Student Name: Did x, q, and r.

Student Name: Did q, y, and r.

10 [16 pts] Code Submission

You will also submit your code for the project. We will have independent grading sessions where students will be asked how parts of the code work.

You will also submit a *diff* of your code to show what you have added compared to the code you started with for your project.

As an example, the unzipped version of your submission should result in the following file structure. **Make sure that the submit.zip file is below 15MB and that they include the prefix `main_`, `diff_`**

```
submit.zip
├─ data
│  ├─ exp1_...
│  │  └─ events.out.tfevents.1567529456.e3a096ac8ff4
│  ├─ exp2_...
│  │  └─ events.out.tfevents.1567529456.e3a096ac8ff4
│  └─ ...
├─ ift6131_project
│  ├─ agents
│  │  ├─ ac_agent.py
│  │  └─ ...
│  ├─ policies
│  │  └─ ...
│  └─ ...
├─ ift6131_project_diff
│  ├─ agents
│  │  ├─ ac_agent.py
│  │  └─ ...
│  ├─ policies
│  │  └─ ...
│  └─ ...
├─ README.md
└─ ...
```

This example is based on your course assignments. It is okay if the file names for your experiments or classes are different. **What is important is that you include (1) your code, (2) data from your experiments for us to review (3) a *diff* of your code so we can see what you changed.**

11 [10 pts] Presentation Submission

You will also submit a copy of your presentation for grading. This will be submitted before the final presentation is given to the class on April 29th.

12 [5 pts] Peer Review

You will review one of the projects from your other students. This format will closely follow the paper summaries that you have been using for class. You will be graded on how fair and constructive your feedback is to other students.

References