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Master Thesis Proposal

Project Proposal Title

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1. Draft

1.1. Ideas

- Use model, demonstration and reinforcement in one approach.
  - Model the constraints on the task
  - learn DMP and modify it for the constraints
  - optimize and tune it using reinforcement
- Generalize for door opening, sweeping floor, cleaning blackboard and manipulating objects by dragging.

1.2. Use Cases

- Opening door
- Sweeping floor
- Cleaning whiteboard
- Cleaning window or any flat surface
- Object manipulation by dragging

2. Introduction

- In model free reinforcement learning, a agent learns the skills by exploring the environment and adopting the parameters which governs the trajectory of the agent in the environment.
- Learning all the parameters of the policy can be computationally very expensive and might require large number of interactions with the environment.
- Application of RL to robotics is limited by above reason because large number trials causes wear and tear in mechanical parts and even damage to robot and the environment apart from being time consuming.
- If we can model the environment and constraints on the motion of the robot, we can drastically reduce the number of parameters to be learn to achieve the task.
- Use of reinforcement learning to learn these reduced number of parameters can result in near optimal policy for achieving the task.
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- Manipulation tasks imply complex contact interactions with an unstructured environment and require a controller that is able to handle force interactions in a meaningful way [1].
- planning algorithms would require precise dynamics models of the resulting contact interactions. These models are usually unavailable, or so im- precise that the generated plans are unusable[1].
- A lot of times humans manipulate objects by dragging them on the surface from one place to another. This saves energy because we don't have to lift and place the object. Robots can do the same.
  - Object manipulation with less energy.
  - Pushing objects away to reach for another object in cluttered space.

2.1. Problem Statement

- What are you going to solve?
- How are you evaluating?

3. Related Work

- What have other people done?
- Why is it not sufficient?

3.1. Section 1

3.2. Section 2

4. Project Plan

4.1. Work Packages

The bare minimum will include the following packages:

WP1 Literature Search

WP2 Experiments

WP3 Project Report

Keep in mind that depending on your project, you will probably need to add work packages that are more suited to your projects.

4.2. Milestones

M1 Literature search

M2 Experimental setup

M3 Experimental Analysis

M4 Report submission

4.3. Project Schedule

Include a gantt chart here. It doesn't have to be detailed, but it should include the milestones you mentioned above. Make sure to include the writing of your report throughout the whole project, not just at the end.

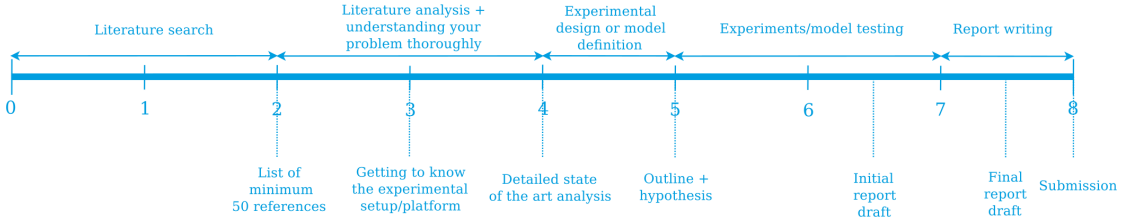

Figure 4.1:

4.4. Deliverables

4.4.1. Minimum Viable

- Survey
- Analysis of state of the art
- Simple simulated use case
- Demo on youBot or Jenny

4.4.2. Expected

- Comparation of approaches in the robot

4.4.3. Desired

- Integration to scenario

References

[1] Mrinal Kalakrishnan, Ludovic Righetti, Peter Pastor, and Stefan Schaal. Learning force control policies for compliant manipulation. In *2011 IEEE/RSJ International Conference on Intelligent Robots and Systems*, pages 4639–4644. IEEE, 2011.