TDT4265 - Computer Vision and Deep Learning Project Proposal

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Goal of the project - Deep Reinforcement Learning

For the project I initially wanted to some sort of object detection to recognize objects of interest in frames in video games. I played a point-and-click game called RuneScape as a kid, and thought this could be a fun project, but then I noticed the proposed DRL project and immediately changed my mind.

For all the other projects I already knew a bit about how the underlying method and models would work, but I have absolutely *no experience* with RL, besides reading a few papers. So my goal for this project is to expand my knowledge on RL and Q-learning, and to apply what I already know about DL.

More concretely, I will start off according to the project proposal, using the OpenAI gym with simple FC architectures to learn the fundamentals. Then I will move on to simple Atari games, as this is a very common platform for RL. Hopefully I will also be able to use my implementation to beat some of my own 2D games (e.g. a Space Invaders clone I made a very long time ago). Further, when I've the basics under control, I will try to move on to SOTA methods (I've not quite decided what I will implement here yet).

Relevant literature

There is an abundance of literature on the relevant topics available. The *Further Reading* section presented for this project is a great introduction. In addition, I think I will get the most out of reading through previous implementations in different RL environments (e.g. on Medium or relevant code repositories), and to try to maneuver through the massive amounts of papers arXiv has to offer (of which I will probably read quite a lot as I'm working and come up with questions that need answering).

An example of a list of relevant literature can be found at the bottom of the README here `https://github.com/keras-rl/keras-rl`.

Model architectures

I'll follow the recommendations of the proposal, and start simple with FC networks. Eventually I'll likely have to move on to CNNs and experiment to find out what works. I would also like to have a look at how transfer learning would work with DRL (e.g. `https://arxiv.org/abs/1806.07377`), to adapt to small visual changes.

Datasets

Perhaps not that relevant, but the datasets required are the environments of the agents. For this project this will start of being simple environments in the OpenAI gym, and

then move on to more complex environments as I see fit. Hopefully I will be able to find some novel environment that has no write up (with all the hard questions already answered), such that I can put what I've learned to a real test.

Existing implementations

`https://github.com/keras-rl/keras-rl` is a nice starting point to see how DQN can be implemented with the use of Keras. The repository also contains a bunch of examples. My goal is to create my own code base, and not use any of the code contained in the repository above. However, I will not completely re-invent the wheel, and thus of course I will use DL frameworks (I've found e.g. both Keras and PyTorch to be quite enjoyable to work with, but I'm leaning slightly towards PyTorch).