CS 725 Machine Learning Project Proposal

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1 Topic

Deep Reinforcement Learning using Neural Networks with Memory

2 Project description

The project involves using a neural network with memory to be able to perform well on games which require the agent to remember things from the past.

3 Approaches

The main idea is to use traditional reinforcement learning methods like Deep Q network (DQN) supplemented with memory. There will be a few CNN layers in the beginning and a network for Q learning in the end. In between, we will explore different methods of adding a memory layer. Initially, we aim to implement the architectures given in the below papers and see how it performs in the game that we have chosen. Later, we may make improvements to it if possible.

4 Research papers

- Control of Memory, Active Perception, and Action in Minecraft
  [http://proceedings.mlr.press/v48/oh16.pdf]

- Neural Map: Structured Memory For Deep Reinforcement Learning
  [https://arxiv.org/pdf/1702.08360.pdf]

- Neural Turing Machine
  [https://arxiv.org/pdf/1410.5401.pdf]

5 Data sets

In our case it would be a game instead of dataset. The game should be such that memory would be useful in playing well which means, ideally, the game should be a partial information game and an observation in past will be useful in making a decision at present. Strategy games with fog of war are ideal but they have a huge action space which may make it too hard to train the agent with the hardware resources that we have. Hence, as of now, one of the games we are considering is Montezuma Revenge Atari game. Other option could be creating custom tasks like it is done in "Control of Memory, Active Perception, and Action in Minecraft"

6 Project Details

6.1 Implementation

The implementation of the project will be in stages. First task would be importing a game (like an atari game) which requires explicit memory to openai gym. Next task would be coding explicit memory. For first we will reproduce the memory architecture given inthe first paper [Control of Memory, Active Perception, and Action in Minecraft] and then look into other memory architectures.

6.2 Programming Languages

The implementation will be done in Python. We have decided to use Tensorflow for coding the neural network and memory architectures. Also we would use openai gym for the purpose of importing the game.

6.3 Contributions and Implementation for each member

We haven't yet decided who would do what. We will break up the task so that 2 members are responsible for one task. The first tasks decided are to import the game and the other is to look up efficient memory architectures.