Project Proposal

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1 Introduction

The project that we are to implement will perform a machine learning task via three different methods that we learn in the statistical learning and data analytics course, EEE 485. The task to be performed has to fit the general format of predicting a desired output from a given set of data-set.

2 Task

We will be using an environment from the ones provided in OpenAI's Gym. Specifically the Taxiv2 available on their site. The object of the game is to pick passengers from one point on a grid and drop off to another point. There are 500 discrete states, 25 possible locations for the taxi and 5 possible locations on the map for the passenger to be in. There are 6 possible actions that can be carried out [1].

The task we will be accomplishing in this project is to train a model to perform the necessary transportation of the passenger in the least possible time. Each action has a penalty of one reward point. There is +20 point reward for performing a successful drop off and a -10 point penalty if the drop off or pickup is performed illegally [1].

We will be using a vector of the aforementioned environment as our data-set. This will be comprised by the position of the taxi and the position of the passenger as well as the destination. This choice of data-set and the task at hand informed our decision to choose our models. From our understanding, we had to choose all models to be compatible with the type of data-set we will be using and be flexible enough if we need to pivot at any point in this project. Therefore, we will likely choose a combination of Reinforcement Learning and Neural Networks as our models. For Reinforcement learning we will use the Genetic Evolution Algorithm and a variation of the Q-learning to create and train our model.

We will use Python as our programming environment given its wide use in machine learning as well as its compatibility with OpenAI.

3 Expected Challenges

The expected challenges will depend on the model we are using to derive our result. There are 25 different places that the taxi can be in. Additionally it can perform 6 different actions [1]. This makes it a complex problem to choose the right action at a particular state.

There are many challenges when implementing the Q-learning offshoot method. These include choosing the right method. This could be a choice from either an on-policy or an off-policy method or a model-free or model-based method.

In the Genetic Algorithm we need the right fitness function that can be used to ”evolve” or train the model. Choosing the right crossover function as well as the selection function is also vital to this method.

The neural network will require us to create different layers. This will depend on multiple factors that will be determined as the problem is further evaluated.

References

[1] Greg Brockman, Vicki Cheung, Ludwig Pettersson, Jonas Schneider, John Schulman, Jie Tang, and Wojciech Zaremba. Openai gym, 2016.