

Project Proposal

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The goal of this project is to implement a reinforcement learning model that we will train to successfully play and complete a video game. The model will be created and trained in python. The game will be interfaced using the python [Gymnasium API](#). Gymnasium has a built-in Atari emulator which allows easy interfacing with various games such as [Tetris](#), [Space Invaders](#), [Asteroids](#), and [Breakout](#). Gymnasium also allows the usage of the [nes-py](#) package to enable emulation of various NES games, such as [Super Mario Bros](#).

To limit the initial scope of the project, we will stick to very simple Atari games such as Tetris, where the model can only do 5 inputs {noop, left, down, right, rotate}. If we are able to successfully train a model to perform well in Tetris, then we can move to more complex games such as Super Mario Bros.

This project would also allow us to experiment and compare different reinforcement learning algorithms, their parameters/hyperparameters, as well as differing reward structures. For example we could compare the Advantage Actor Critic ([A2C](#)), Trust Region Policy Optimization ([TRPO](#)), and Proximal Policy Optimization ([PPO](#)) reinforcement learning algorithms. We do not intend on implementing these models from scratch, we expect to apply existing implementations to our video game problem and see how the differing models compare.

We expect to be able to measure metrics such as how quickly a method converges, how well the given model does for a given game (ex: how many layers it can solve in Tetris, or how quickly it can complete a level of Super Mario Bros.), as well as how sensitive a given model is to perturbations in its hyperparameters.

A lot of research has already been completed for this project, and from our perspective we expect this to be a feasible project. To evenly delineate the remainder of the work, we plan to pair program for all the coding required for this project, and to evenly distribute the work required for the final paper and presentation video.