GPT2PPO: Auto Regressive Proximal Policy Optimization

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Abstract—**This document is a model and instructions for LaTeX. This and the IEEEtran.cls file define the components of your paper [title, text, heads, etc.]. *CRITICAL: Do Not Use Symbols, Special Characters, Footnotes, or Math in Paper Title or Abstract.**

Index Terms—**Reinforcement Learning, PPO, GPT2**

I. INTRODUCTION

In this project we explore the use of transformers in the context of Reinforcement Learning. The majority of theoretical works assume that problems follow a Markovian process, which is not always the case. Some problems need the contxt of previous states and actions to make an informed decision on the next decision. As a result, we propose an addition to the basic Proximal Policy Optimization (PPO) algorithm by using the Generative Pre-trained Transformer 2 (GPT2) model as the encoder for the critic network. This will allow the critic network to take into account the context of previous states and actions as well as apply attention to past states and actions that may be important. We will test this model on the LunarLander-v2 and Acrobot-v1 OpenAi Gym environments with discrete action spaces and compare it to the original PPO algorithm. Additionally we will test the model on BipedalWalker-v3 with continuous action spaces and compare it to the original PPO algorithm.

II. PREVIOUS WORK

PPO citation - [1]

III. BACKGROUND

All of the environments used in this project are from the OpenAI Gym library [2]. The environments are described below.

A. Lunar Lander

The lunar lander environment is a rocket trajectory optimization problem [1]. The OpenAI Gym offers two versions of the environment: discrete or continuous. In this work we only use the discrete version. The state space is a 8-dimensional vector containing the x and y positional coordinates of the agent, its x and y linear velocities, its angle, its angular velocity, and two booleans that represent whether each leg is in contact with the ground or not. The action space is a single discrete scalar with values ranging from 0 to 3. The values corresponspond to the following actions: do nothing, fire left orientation engine, fire main engine, fire right orientation engine.

Fig. 1. The Lunar Lander environment.

B. Acrobot

[2].

C. Bipedal Walker

[3].

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[1] OpenAI Gym Lunar Lander: https://www.gymlibrary.dev/environments/box2d/lunar_lander

[2] OpenAI Gym Acrobot: https://www.gymlibrary.dev/environments/classic_control/acrobot

[3] OpenAI Gym Acrobot: https://www.gymlibrary.dev/environments/box2d/bipedal_walker
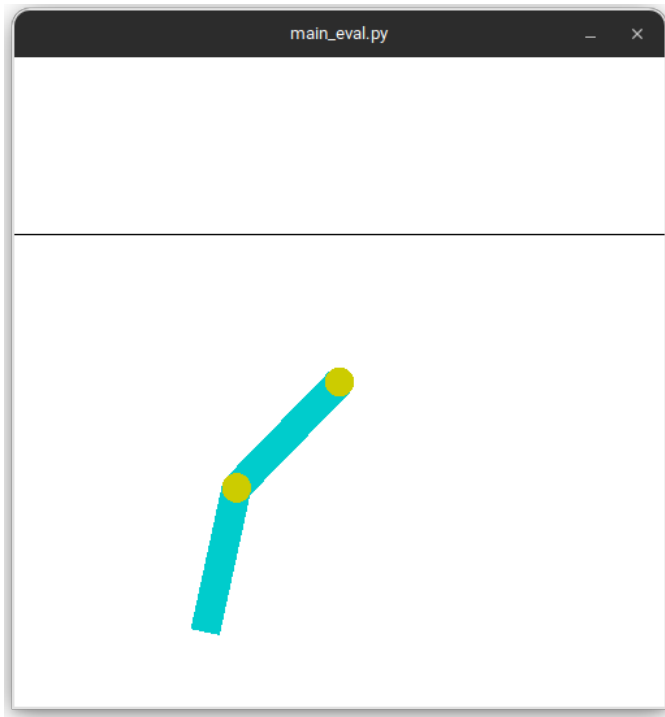
Fig. 2. The Acrobot environment.

IV. METHODOLOGY

A. Reinforcement Learning Methods

B. Code Design

C. main_train.py

D. main_eval.py

V. RESULTS

VI. CONCLUSION

REFERENCES

[1] J. Schulman, F. Wolski, P. Dhariwal, A. Radford, and O. Klimov, "Proximal policy optimization algorithms," *arXiv preprint arXiv:1707.06347*, 2017.

[2] G. Brockman, V. Cheung, L. Pettersson, J. Schneider, J. Schulman, J. Tang, and W. Zaremba, "Openai gym," *arXiv preprint arXiv:1606.01540*, 2016.