Project Proposal

Team members: Weifeng Ma (only)

# Project Information

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| **Project:** | Reinforcement Rock-Paper-Scissors AI with Image Recognition |
| **Project Time- frame:** | 2022/10/29 to 2022/12/06 |
| **Summary:** | The Rock-Paper-Scissor AI that implemented with a reinforcement mechanism. In this project, I will make the Rock-Paper-Scissors that apply the concept of reinforcement learning I learned from this class. I’ll implement the AI by using a reinforcement learning approach. To get better understanding of deep learning, I also implement image recognition that uses an image of rock/paper/scissors as input. The game itself will keep track of human choices and come up with the choice with the highest chance to win humans. |

# Background and Motivation

What is the setting and history behind this project?

Artificial Intelligence and reinforcement learning have grown to be very popular in today's world. AlphaGo is a great example of a combination of machine learning and AI technologies. Based on my preference, I want to make a computer program or game that can beat humans. Since this class is my first reinforcement learning class. With limited knowledge of reinforcement gaming, Rock-Paper-Scissors is the game that I want to integrate.

What is the problem to be addressed?

Recently, more and more technologies developed based on reinforcement learning. Like AlphaGo, human-interactive robots, and autonomous driving, all these are used reinforcement learning and machine learning approaches. I think the key here is to gain some knowledge of reinforcement learning and game development.

What are some current approaches to this problem?

The game AI can be implemented by using Markov Chian Process, or Q-learning algorithm.

Convolutional neural network is approach to implement image recognition.

[A Rock, Paper, Scissors Game using Reinforcement Learning and Q-Tables](https://www.researchgate.net/publication/360889680_A_Rock_Paper_Scissors_Game_using_Reinforcement_Learning_and_Q-Tables)

[Grounding Behavioral Hierarchies in Multi-Agent Reinforcement Learning](https://arxiv.org/pdf/1906.01470.pdf)

[Rock-Paper-Scissors Image Classification Using CNN](https://medium.com/geekculture/rock-paper-scissors-image-classification-using-cnn-eefe4569b415)

Why is this problem worth solving or worth solving better?

Rock-Paper-Scissors is game that makes random choice. I want to explore the field of artificial intelligence and gaming, and this project meets my requirements and does not surpass my skill sets. I believe this is a good proof of concept to apply and implement what I have learned from this course.

How will this product be better than previous approaches?

If I have enough time, I will improve my work by using video recognition.

[Rock, Paper, Scissors with hand gesture recognition](https://medium.com/geekculture/rock-paper-scissors-with-hand-gesture-recognition-841297a7d915)

# Goal

The goal is to design a AI that will beat human easily in the game Rock-Paper-Scissors.

# Scope

Work with common python-based Reinforcement Learning modules

Using various libraries (OpenCV, Scikit-Image, and so on)

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| **In Scope** | **Out of Scope** |
| Building a python-based game based out of Reinforcement Techniques | Building a python-based game based out of Advanced Reinforcement Techniques |
| Working the most popular IDEs and environments like- Anaconda for development phase | Working with uncommon or complicated IDEs and environments for development |
| User interface with image selection, and keep track of score | Fancy graphics, a music background, and ranking board for all players |
| A program would not save user’s information | login and logout; a system that can save the user patterns, and use data to generate next game’s choice |
| Python program or application | Involves frontend design; make a gaming website and set up your own server |

# Deliverables

Choose a develop platform and IDE

Train and test the image classifier, and save the model

Implement the first version of Rock-Paper-Scissors game. The game has N rounds, able to prompt the human player for each round’s choice, and the computer makes a random choice.

Design an reinforcement algorithm to determine the computer’s choice. This process takes a longer time since it requires comparison of algorithms and testing. Observe patterns and make summaries of them.

Implement the algorithm.

Choose/build a framework/library to integrate the user interface to the human player

Testing and integration

Documentation and Demo

# Risks and Rewards

What are the main risks of this project?

1. Image recognition could give us a wrong input, but somehow produce a high accuracy on training.
2. If human choice is very random, the AI might make wrong choice.

What are the main rewards if this project succeeds?

I’d gain more knowledge on reinforcement learning and deep learning.