

Utilizing A.I. technologies for Self-Learning Behaviour with a Video Game

ENGG74020: Advanced Technical Elective Proposal

Ramtin Alikhani (8185704)
Nishant Kaushik (8137606)
Josh Halvorsen (7862162)

Table of Contents

Table of Contents	2
Introduction	3
Literature Review	3
Flappy Bird	3
Dino Game	3
Hardest Game	4
Project Details	4
Project Feasibility	4
Resources	5
Python Programming Language	5
Keras A.I. API Python Package	5
PyGame	5
Impact on Society	5
References	7

Introduction

The purpose of this document is to serve as a detailed explanation of Utilizing A.I. technologies for Self-Learning Behaviour with a Video Game as it pertains to the guidelines defined in the Capstone Project Guideline 2020-v.2.0 document.

This project is used to make an A.I that would be able to self learn to play a game. The game we have chosen is a reskinned version of the dino game. We would be learning the intricacies of A.I and game design to develop a fully functioning A.I

For the development of this we would have an A.I module which would be based on Keras A.I package, the game would be based on PyGame and would be coded in Python programming language.

Literature Review

Flappy Bird

Flappy Bird is a popular mobile game developed by Dong Nguyen in 2013. Players tap the screen to navigate the bird, which has to jump at the right moment to get through a set of Mario-like pipes. The game can be played by an A.I using the NeuroEvolution of Augmenting Topologies (NEAT) algorithm[1]. Flappy Bird is a reasonable choice for beginners interested in building a game from scratch because the game's mechanism is straightforward and the only gameplay action is to jump. Also, creating an IA won't be too complicated, since we just need a few inputs to get a binary output[1].

Dino Game

Dino game is a game that pops up when your internet connection is down and we would be using a reskinned version of this game for our project. This game was been modified to be played using an A.I. The first step is would to teach the A.I about the game through Reinforcement Training[2]. The A.I would try to achieve a certain numerical result by performing an action and A.I works with unlabelled data which means it learns with randomly selecting actions to check if it get the desired results[2]. This might lead A.I to stick to certain selected paths and not branch out to different other possible outcomes that might hinder it's learning capabilities[2]. There would also be a function to make sure A.I understand it cannot change decisions mid execution. This will make sure A.I keeps learning while following the rules of the game.

Hardest Game

It is a game that consists of a grid which has three areas, the first area is the starting area where the players originate from, they go through an area which has obstacles and then finally they go to the finishing area to complete the game[3]. The uses incremental learning to slowly increase the number of moves each A.I player takes before it dies. It starts from 5 moves and then slowly increments by 5 moves with each generation[3]. By generation all A.I players have found a way to reach the edge of the starting zone and move towards the collision zone and start experiencing collisions[3]. One thing to note is that the A.I model always learns from the best player and discards the rest of them.

Project Details

The purpose of this project is to develop a simple flash style game and also develop an AI to effectively play the game. For this project, we will be using as few premade assets as possible to ensure that this project is as unique to us as possible. This will also allow us to be in complete control of the project and will be responsible for all its parts. We will also have a better understanding of how everything goes together as we are the ones who did it.

For this project, the simple flash style of game we chose to develop is a reskin of an existing game. The game we chose is the game found in the Chrome browser when there is no internet connection, often called the “Dino Game” where you play as a pixelated dinosaur who has to dodge incoming obstacles such as cactus or flying Pterodactyl by either jumping over obstacles or ducking underneath them. This simple game has only the 2 inputs to jump or duck and the decision of which to use is fairly simplistic. We will most likely go with some form of Santa/Christmas based skin for the game.

For the AI, we will be developing an AI that can effectively play the game we create. We will be using the Keras AI API as it is a derivative of TensorFlow from Google. This API is free to use and is meant for fast experimentation and has a shallow learning curve so it is perfect for beginners like us.

Project Feasibility

The feasibility of the project is very easy to distinguish. A simple project like this to create a flash style of game and have a simple AI play the game has been done hundreds of times across the internet. There are even downloadable packages that contain both the game and the AI along with a document describing how everything works and how the AI “plays” the game and learns through its failures.

To help differentiate our project from the others on the internet and to prevent us from just downloading one of these pre-made packages, we will be developing our game from the ground up. While we will be using another game as the design framework for our project, we will be using it as a design inspiration only and will be putting our own skin on the game and developing it all ourselves. The AI we have chosen is also open source and is labelled as having a low learning curve so it is perfect for beginners like us.

Resources

Python Programming Language

Python is the programming language to be used to design the game and implement the A.I. package.

Keras A.I. API Python Package

Keras is a Python A.I. and Machine Learning package that was developed from Google's TensorFlow AI package. Keras was developed mainly for purposes of fast experimentation and has a shallow learning curve designed for beginners.

PyGame

PyGame is the Python Package that will be used to create the video game on the Windows platform. It is easy to learn and can be used for simple games development in Python.

Impact on Society

The scope of the project spans to the ability for the group to study, apply and integrate the processes behind A.I. systems. The basis of this project was initiated as a means to understand how A.I. learns and teaches itself strategies to conquer obstacles over time. Hence this project is not meant to be released to the public for usage, there is minimal impact at industrial, economical and societal scales.

The estimated cost of developing this system is relatively low hence most of the resources to learn, design, create and integrate would be free to use for non-enterprise purposes. The scope of the project encompasses the design and integration of A.I. algorithms to learn to play a simple video game without any human interference, therefore, this project will not have ethical nor safety concerns beyond the involvement of the development personnel; at most, the dangers encompassing the project, from development to its final release, poses very little hazards. The

Hazards expected are computer freezing or crashes during the development process of the project, and the performance decreases of the computers used by the development team during the time of learning processes.

References

- [1] D. Zhu, "How I Built an AI to Play Flappy Bird," Medium, 26-May-2020. [Online]. Available: <https://medium.com/analytics-vidhya/how-i-built-an-ai-to-play-flappy-bird-81b672b66521>. [Accessed: 02-Jun-2021].
- [2] R. Munde, "How I build an AI to play Dino Run," Medium, 26-Feb-2020. [Online]. Available: <https://medium.com/acing-ai/how-i-build-an-ai-to-play-dino-run-e37f37bdf153>. [Accessed: 02-Jun-2021].
- [3] C. Bullet, *AI Learns to play the Worlds Hardest Game*. 14-July-2018. [Accessed: 01-Jun-2021]