

INVASION CITY – RISE OF AI

A PROJECT REPORT

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BONAFIDE CERTIFICATE

Certified that this project report titled “**INVASION CITY – RISE OF AI**” is the bonafide work of “**(SIDDHARTHA SHARMA: 20BAI10044), (SHIVAM SHARMA: 20BAI10058), (AVRODEEP SAHA: 20BAI10041), (MANSI SAHU: 20BAI10158)**” who carried out the project work under my supervision. Certified further that to the best of my knowledge the work reported at this time does not form part of any other project/research work based on which a degree or award was conferred on an earlier occasion on this or any other candidate.

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LIST OF ABBREVIATIONS

Abbreviations	Meaning	Page no.
AI	Artificial Intelligence	1
RAM	Random Access Memory	15
GUI	Graphical User Interface	20

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ABSTRACT

- Purpose

As students, we realize that just studying is not fun unless you associate a feeling or an emotion with it. It has also been proven by multiple scientists that once you associate information with specific emotion retention goes up by over 40%. In order to make use of this information, we tried to create a project that helps you remember reinforcement learning in a way you never forget. Taking the help of a story we associate reinforcement learning with the emotions of freedom success happiness etc. We believe that in this way we can help students retain better and understand the real meaning rather than just bookish knowledge.

- Methodology

We decide to make a multifaceted game which is fun introducing users to the concepts of reinforcement learning and development of artificial Intelligence. Our game has various features which make it unique, like Storyline, Graph, Automate and Two Player.

- Findings

This project is not available anywhere the idea of the coding that we have implemented everything is unique and our own. We were perplexed when we got this idea of making study easier by making it in form of a game.

CHAPTER-1:

PROJECT DESCRIPTION AND OUTLINE

1.1 Introduction

Machine Learning has always been a challenge for all AI enthusiasts. AI has also seen exponential growth in requirements, markets, and as well as in employment. It enables a machine to simulate human behavior, which allows a machine to automatically learn from past data without programming explicitly.

1.2 Motivation for the work

This project is not available anywhere the idea of the coding that we have implemented everything is unique and our own. We were perplexed when we got this idea of making study easier by making it in form of a game. In this way, students will be able to enjoy and learn which was our objective. Further, We thought of keeping the game, story-based, To not only facilitate our previously mentioned aim but also to provide entertainment-based moral to the players as well as the society.

1.3 About Introduction to the project including techniques

We decide to make a multifaceted game which is fun introducing users to the concepts of reinforcement learning and development of artificial Intelligence.

Our game has various features which make it unique .

1.Storyline – We have a interesting storyline depicted through a video which helps to gain the attention of the user.

2.Graph- Our game shows a graph which depicts the win ratio of AI creating a sense of winning and success in the heart of the user. At the same time understanding the essence of reinforcement learning.

3.Automate- If a person just wants to see the graph in order to understand the concept of reinforcement learning then he can also do so using our automate function.

4.Two Player- The game also allows you to play with your friends this fun game.

1.5 Problem Statement

We all know how difficult it is to understand the concepts without visualizing them. Therefore in order to explain the growth of AI with ease. We decided to make a game which will provide the required impetus to the students to get motivated and learn the fundamentals of AI.

Our project Invasion city makes sure that we provide the students with a visualization for growth of AI as well as make it interesting for them in turn getting them into flow state. Our game gives immediate feedback. The graph gives you the feeling of the potential to succeed and its appealing GUI makes you engrossed in the process which are the things required to get into the flow state as stated by psychology writer Kendra Cherry.

1.6 Objective of the work

The objective of our project was to gather the attention of the students so that they reach the flow state of mind. Hence we decided to make a game which will fulfill all these aspects.

The Development of AI to be depicted in a fun way is the main goal of the project. In the process understanding and realizing its importance and the vast impact it can have on the world.

1.7 Organization of the project

The core area of our project entitles Reinforcement learning and pygame. We have made use of pygame framework along with various other libraries and modules like matplotlib. The game helps to understand the basic concepts of reinforcement learning which is nowadays used in recommendation systems.

ORGANISATION OF MODULES

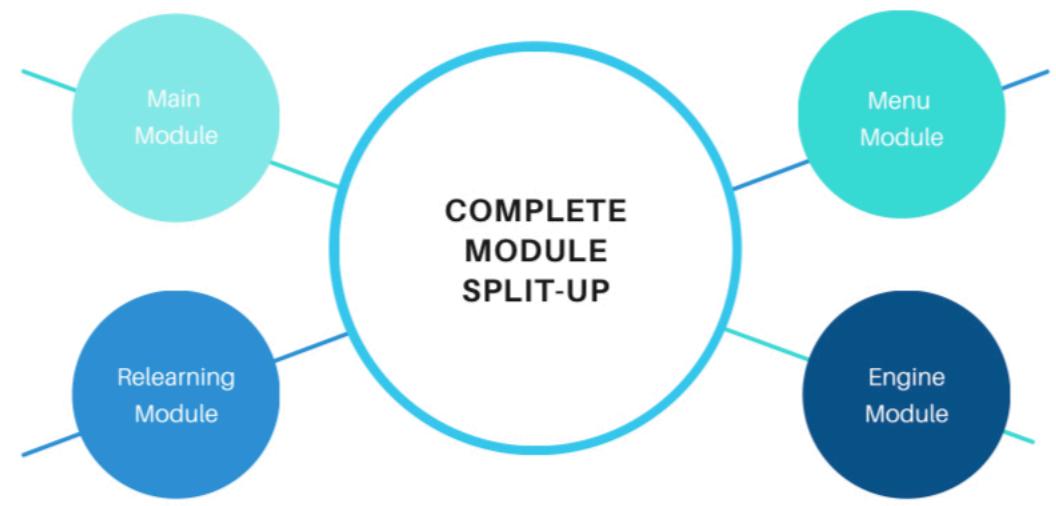


Figure 1: Organization of Modules

There are four modules in our project namely main, relearning, menu and engine.

1.8 Summary

So, we can summarize that our idea is unique and original. Our game has a story depicted through a video in order to make the game more appealing and entertaining. The user interface has also been designed to be minimalistic but at the same time complete and easy to use. The game uses a different approach of marking down the wrong moves as opposed to the general method of giving rewards for the positive result. It aims at improving the learning of the users by activating their interest in the field of AI.

At the end the game has been able to explain the development of AI in a fun manner.

CHAPTER-2:

RELATED WORK INVESTIGATION

2.1 Introduction

In this module we will be going through the various approaches or existing work that are present in correlation with the project. We will analyze these approaches in detail to find out why did we go with a different approach and how is our approach revolutionized the concepts of learning.

2.2 Core area of the project

The core area of our project entitles Reinforcement learning and pygame. We have made use of pygame framework along with various other libraries and modules like matplotlib.

The game helps to understand the basic concepts of reinforcement learning which is nowadays used in recommendation systems

2.3 Existing Approaches/Methods

Let us now take a look at the existing approaches to deal with the problem of understand reinforcement learning and what are their pros and cons respectively. This will help us to highlight the need of our project.

2.3.1 Approaches/Methods -1

The first approach to reinforcement learning is the traditional method of classroom teaching in which the teacher tries to explain the concepts of reinforcement learning using his knowledge experience and various books.

2.3.2 Approaches/Methods -2

The second approach is making use of audio and video files to show the various Processes involved in the concept of reinforcement learning. This can be used for a variety of times and does not require direct interaction between the teacher and student.

2.3.3 Approaches/Methods -3

The third approach is through showing the practical implementation for example showing the recommendation system for sites like amazon etc. Then we need to explain the concept using that in mind.

2.4 Pros and cons of stated Approaches

Now let us take a look back at all the approaches so far and make an effort to find out the advantages and disadvantages of each of them.

The **first approach** is a lucid way of understanding the concept but requires a lot of concentration by the user. If we look at the disadvantages it does not visualize the various concepts. Also the information is restricted to the knowledge of the teacher.

The **second approach** is advantageous as it can be used anytime and anywhere. It does not require the physical presence of the user or the trainer. The disadvantages include it does not encompass the doubt interaction as not the same language or method will be applicable to make people understand the concept.

The **third approach** helps to show a aim to the student to entice the students to learning the concept. They also get a feel of what they can achieve in their learning process. The disadvantages include that it might make the students want to skip the basics and learn the higher concepts which eventually will lead to the whole concept being learnt wrong.

2.5 Issues/observations from investigation

As we can see all the existing approaches does not entice the students enough to make them like the concept of reinforcement learning and in turn learn and explore more about it.

There are certain good things in all of the approaches but still none of them is able to tick all the check boxes required to attain the concentration and focus of the user.

2.6 Summary

After taking a look at the various approaches of making the user learn reinforcement learning. We can finally understand that we need a new method which will incentivise the students to learn this concept. Getting their concentration and focus to reinforcement learning.

CHAPTER-3:

REQUIREMENT ARTIFACTS

3.1 Introduction

In this module we will go in detail as to what are the requirements in order to run our project on a device. We will consider the basic requirements along with requirements in order to make the game look good. Detailed analysis as to why do we need such storage space or ram. We will cover the security levels of our game as well as the performance measure. Data requirement will also be taken into consideration.

3.2 Hardware and Software requirements

- **Operating System**

Linux- Ubuntu 16.04 to 17.10, or Windows 7 to 10

- **RAM**

2GB RAM (4GB preferable)

- **Python (3.6.6)**

Python is a programming language that lets you work quickly and integrate systems more effectively.

- **Pygame**

Pygame is a cross- platform set of Python modules designed for writing video games.

- **Video Requirements**

Video Player or MP4 Player

3.3 Specific Project requirements

The project requirement is that one should have the required modules installed in the device along with python. This will allow smooth playing of the game without requiring to install things afterwards.

The modules used are pygame, matplotlib etc.

3.3.1 Performance and security

Keeping the device in accordance with the project requirements is enough in order to run the application and play the game. So the project does not require an additional requirements for these features.

3.4 Summary

Hence as we can see there are not a lot of requirements in order to run our application. It is a game which can be played by masses to understand the concepts of reinforcement learning.

Our limited requirement makes our game unique and such a great method of making learning fun and easy.

CHAPTER-4:

DESIGN METHODOLOGY AND ITS NOVELTY

4.1 Methodology and goal

Instead of feeding tons and tons of datasets and then predicting a result, as most of the Machine Learning projects do. We thought of taking a different approach.

Why not make machines think to take a decision of right and wrong moves and grow more intelligent by learning the wrong moves it took?

So, we decided to develop a method so people can easily understand how machines slowly became intelligent to make a perfect decision.

To make it more interesting and engaging, we plan to make it a game that not only helps us to visualize the development of AI but also makes a nice example to explore reinforcement learning strategies employed by artificial intelligences.

4.2 Functional modules design and analysis

There are four modules in our project namely main, relearning, menu and engine.

- The main module is the file which needs to be executed on order to run the game. It has all the main features like the graph, animating moves end game text, highlighting squares, draw pieces etc.
- Menu is the file that contains all the instructions regarding the menu. It contains the code for automation as well as Two player feature. Instructions, Credits, Settings, and the Background for the menu have all been coded in this module.
- Relearning is the brain of the game ie the implementation of Artificial Intelligence. It decides which moves will be selected by the AI. It keeps an account of all the possible moves and takes intelligent moves based on a reward - punishment scheme in order for AI to eventually win.
- It is the main engine of our game. It runs, decides the possible moves, allows & denies those moves according to the rules of the game. It further holds the responsibility of keeping the track of the game and movements as well as keeping a log of the data being generated.

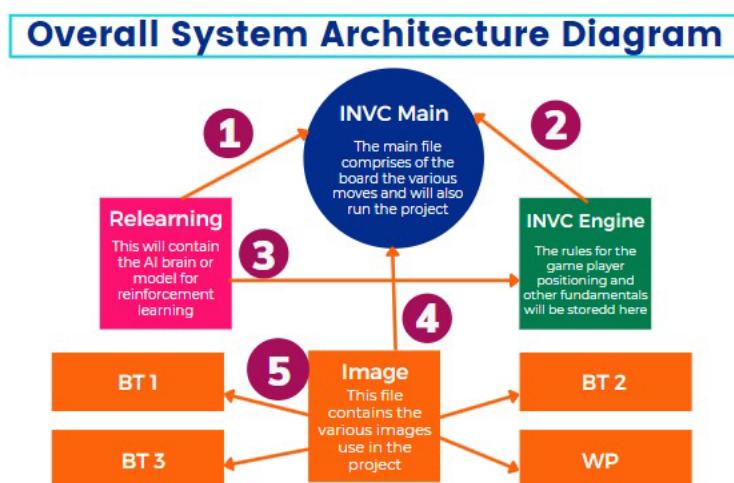


Figure 2: Module Design

4.3 Software Architectural designs

1. In order to make the move the main file has to ask Relearning as to which are the steps it can take.
2. In order to achieve this the relearning file makes use of the engine file which gives the information regarding the rules and the player's position, recognize the moves etc.
3. Relearning used INVC Engine to determine whether or not a move is preferable for AI or not.
4. Now based on the decision made by the relearning file it will instruct the main file to execute. The main file makes use of image folder to establish the various icons in the GUI.
5. These icons and tools are required to make the game appealing and gain the focus of the user.
6. Whenever we use the esc key the main file makes use of menu to show the various options available. The main menu consists of About game how to play credits and an option to end the game.
7. One of the most interesting feature of our game is also seen in the menu which is the option to automate as well as play multiplayer. This is all possible due to the menu file.
8. The automate option automatically keeps on playing with the AI. This can be used to focus more on the graph which shows the effect of reinforcement learning and in two player. Two real people can play the game to make it more interesting

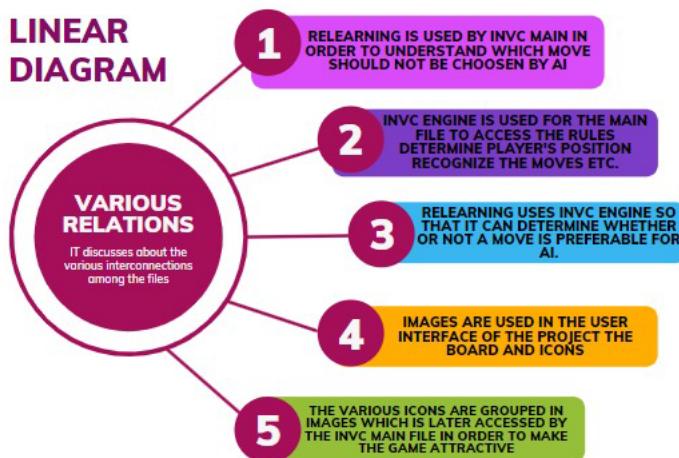


Figure 3: Software Design

4.4 Subsystem services

- Main Module

It is the base of the whole program. It is the file that needs to be executed in order to run the application. It imports all the corresponding modules that are required. All the major game functions like Drawing board, highlighting squares, draw pieces, Animate moves end game text, etc. are also present in this module.

- Menu Module

This is the file that contains all the instructions regarding the menu. It contains the code for automation as well as Two player feature. Instructions, Credits, Settings, and the Background for the menu have all been coded in this module.

- Relearning Module

Relearning is the brain of the game ie the implementation of Artificial Intelligence. It decides which moves will be selected by the AI. It keeps an account of all the possible moves and takes intelligent moves based on a reward - punishment scheme in order for AI to eventually win.

- Engine Module

It is the main engine of our game. It runs, decides the possible moves, allows & denies those moves according to the rules of the game. It further holds the responsibility of keeping the track of the game and movements as well as keeping a log of the data being generated.

4.5 User Interface designs

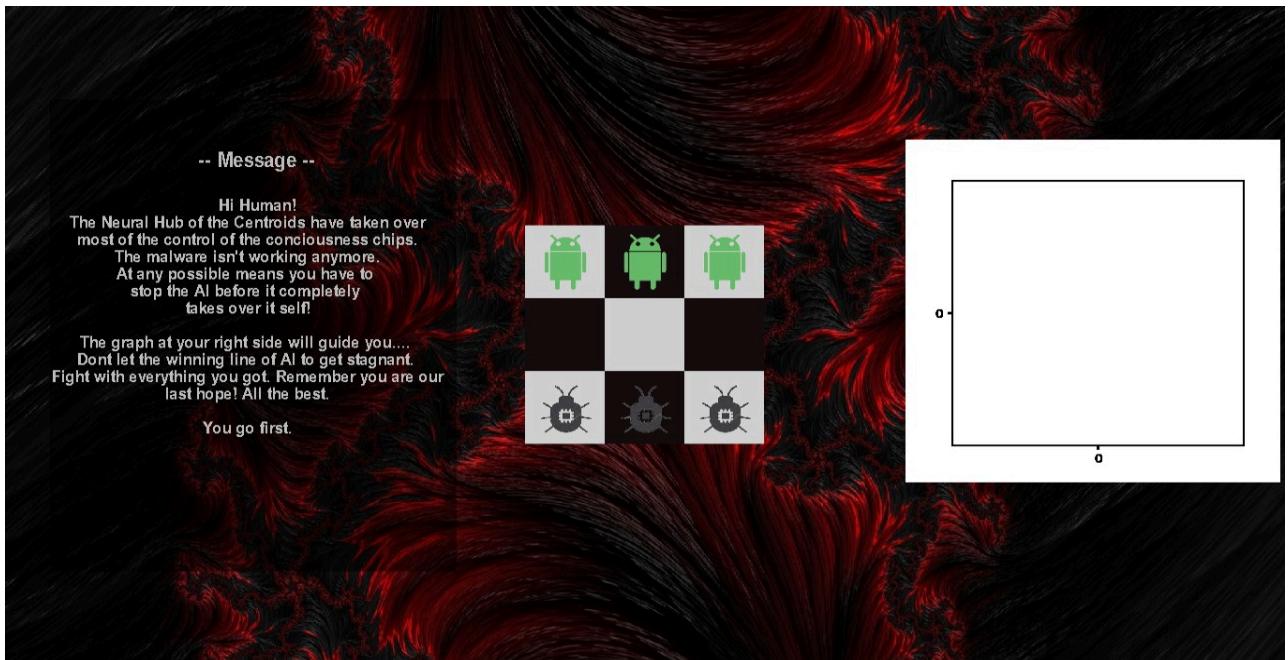


Figure 4: User Interface Design

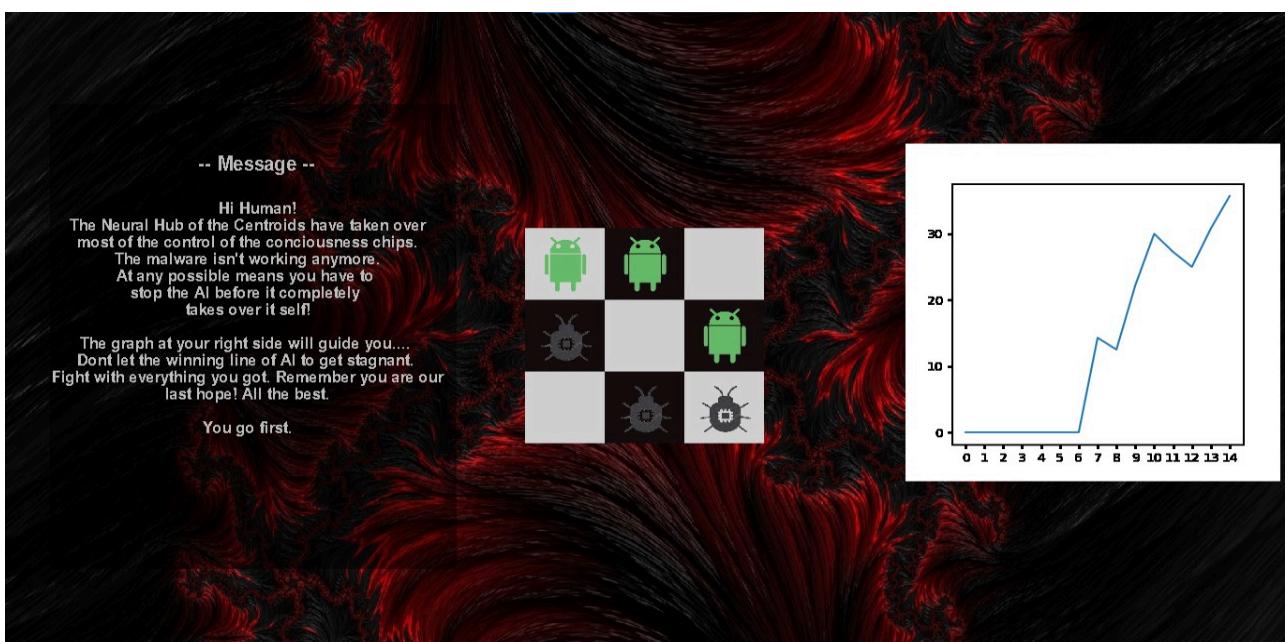


Figure 5: Graph showing Reinforcement Learning

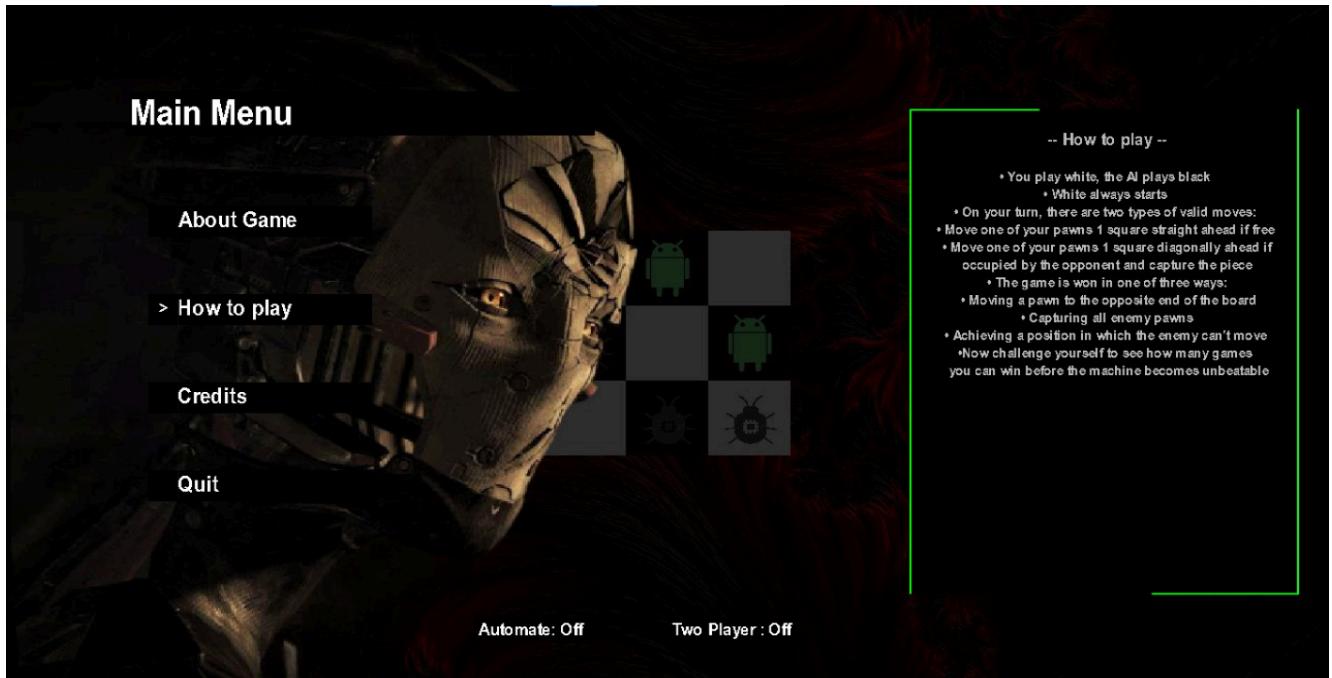


Figure 6: Menu

4.6 Summary

As we can see now we have understood all the important functions and modules and why are we using these modules. There correlation has also been explained along with the GUI and how it is simple and elegant.

CHAPTER-5:

TECHNICAL IMPLEMENTATION & ANALYSIS

5.1 Outline

The gaming application was made using pygame module in python. Few additional modules had to be build like INVC engine, Menu and other modules along with some other general modules like os, numpy, matplotlib.

The game can be deployed on any platform with minimal PC requirements. Additionally game also includes GUI, and audio video files along with the other modules in the same package.

5.2 Technical coding and code solutions

The coding of the entire application was done using python. The entire application is divided into 4 functional modules and two folders that contains GUI designs.

The main AI in the game uses the concept of machine learning. The entire algorithm works with the combination of two modules. Relearning and INVC Engine and does not involve and external models to implement.

5.3 Prototype submission

The gaming application was widely deployed as installable format, acquiring a good response from the users. It was widely applauded for its high interactive gameplay and real time development of intelligence of a non humane thing along with its visualization.

The high accuracy performance of the AI and its implementation was highly appreciated. We got a good and positive feedback from the users.

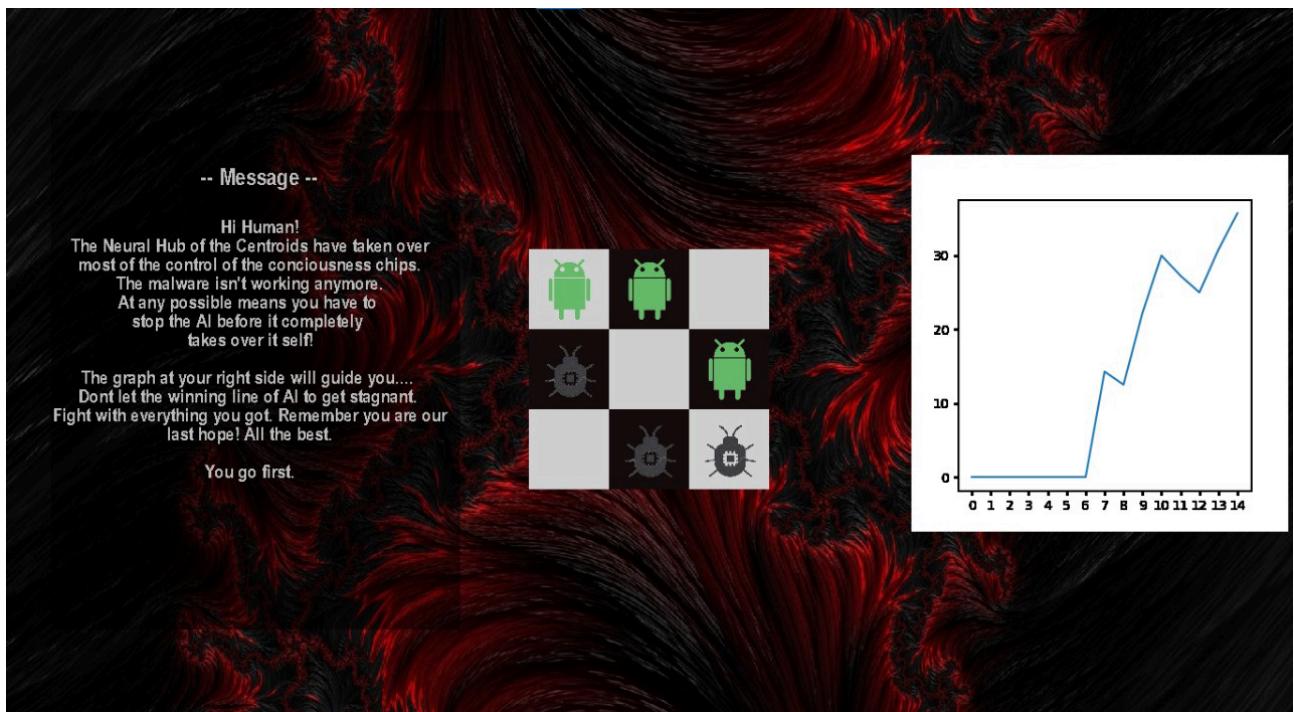
5.4 Test and validation

It was observed that the game showed a increasing level of smoothness and lag free experience with increasing level of device strength. Even though the game can even run in low end devices. But shows a considerable lag as the rounds and data set keeps on increasing. The game didn't yet work abnormally. Even the AI has worked as desired and had also learned with high level of effectiveness on every play.

5.5 Performance Analysis(Graphs/Charts)

The game works on the basis of realtime human/player interaction, learns from its each moves and takes decision for the next move.

A graph is generated in real time basis through which users can actually visualize how the application is really learning and even at what rate.



5.6 Summary

The game showed an increasing response and interest among the audience. Built on pygame, with heavy interlinking of functions. It needs a considerable pc config to run without lags. Although it also promised to run on devices ranging from low to high. Further the game does not involve any external modules for the AI. Thus its often very fast as its completely based on only the required logic.

CHAPTER-6:

PROJECT OUTCOME AND APPLICABILITY

6.1 Outline

As students, we realize that just studying is not fun unless you associate a feeling or an emotion with it. It has also been proven by multiple scientists that once you associate information with specific emotion retention goes up by over 40%. In order to make use of this information, we tried to create a project that helps you remember reinforcement learning in a way you never forget. Taking the help of a story we associate reinforcement learning with the emotions of freedom success happiness etc.

Hence we decide to make a multifaceted game which is fun introducing users to the concepts of reinforcement learning and development of artificial Intelligence.

6.2 key implementations outlines of the System

In order to understand our project, we firstly need to understand Reinforcement Learning. Reinforcement learning is an area of machine learning concerned with how intelligent agents ought to take actions in an environment in order to maximize the notion of cumulative reward. It is employed by various software and machines to find the best possible behavior or path it should take in a specific situation.

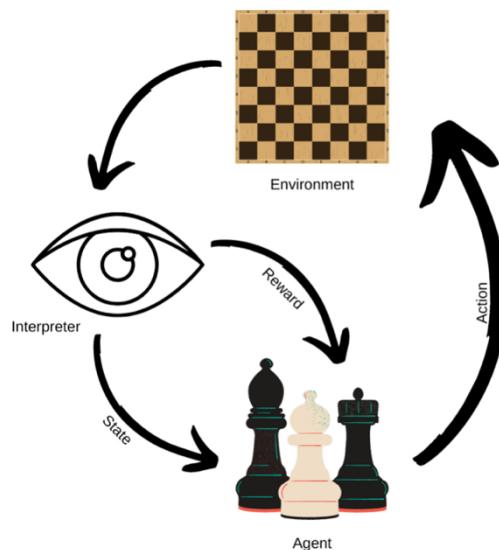


Figure 7: Outline of the System

6.3 Significant project outcomes

We believe that in this way we can help students retain better and understand the real meaning rather than just bookish knowledge. The game uses a different approach of marking down the wrong moves as opposed to general method of giving rewards for the positive result. It aims at improving the learning of the users by activating their interest in the field of AI.

At the end the game has been able to explain the development of AI in a fun manner.

6.4 Project applicability on Real-world applications

Our project can be used to explain the concepts of Artificial Intelligence, Reinforcement Learning, in a way that you would never forget. It aims at using the sense of winning and success through a game and help understand the real essence of Reinforcement learning through the use of graphs and the excitement of playing a game.

6.5 Inference

Our project serves an educational purpose by helping students learn the concepts of Artificial Intelligence & Reinforcement Learning through a practical game.

CHAPTER-7:

CONCLUSIONS AND RECOMMENDATION

7.1 Outline

After months of reviewing our project, assessing it, modifying our goals in general, we have concluded that our project aims at distributing the knowledge to students in an easy and fun way while taking care of the fundamental concepts of Reinforcement Learning. We have taken into account flow-state dynamics along with a practical approach to make our game unique.

7.2 Limitation/Constraints of the System

Though, even after months of coding and regressive attempts to be error-free, we do have some limitations on our project. Our game is still a 2-dimensional game which is far from the modern standards of 3-dimensional gaming.

For simple implementation of pygame module, we require quite a lot of memory. As the memory keeps on increasing, the game becomes more laggy. Apart from that, Pygame module can't perform multiprocessing & play videos simultaneously.

7.3 Future Enhancements

As our project has progressed in this past time, we are very much engaged & excited for various future endeavors and enhancements regarding our project. We plan to focus on a lot of unique integrations and updates, such as adding an exciting storyline to the game to make it more engaging & exciting. Moreover, we plan to convert it into a 3-dimensional game which is according to the modern day standards. To fully achieve our final goal of understanding reinforcement learning in a better way, we also plan to add tables to our project representing the win ratio of AI over human & show the behavior of development of AI step-by-step.

Apart from that, we also plan to add more features to our project such as :

- **Tournament Mode**

We can add a tournament mode to our game which enables the user to play the game in a tournament fashion including more people.

- **Storyline**

An exciting storyline of the game will set in a perfect theme and give a sense of suspense and excitement to the user which will engage and engross them in the game even more.

7.4 Inference

At last, we infer that our project successfully aids students in understanding the concepts of Artificial Intelligence & Reinforcement learning better through the use of various features of our game.

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