

METU, Department Of Computer Engineering

Graduation Project Proposal Form

Project Information

Title

MasteRookie Player

Target

Public ☐

Restricted ☒

Proposer Information

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IP (Intellectual Property) Information

Intellectual property belongs to the project proposers.

Project Description and Background Information

Description

Up to today, different systems, mechanisms and applications were developed to provide a platform that play games to ease the player's work, develop new strategies or to compete with the player. Majority of game AIs developed by the developer of the game for in-game use or AIs developed to mimic players uses predefined logic to achieve the goals of the game. Our goal is to use AI, machine learning and deep learning algorithms to the date, to minimize predefined logic as much as possible. Therefore, the scope of our project is making a general AI that can play specifically 2d games.

The AI will use API of the game where provided, otherwise process the screen visuals of the game for inputs. To illustrate, these inputs can change from the obstacles that can kill the character of the player, to the number of enemies in a strategy game. After deciding what to do, AI will use API if provided, else virtual input devices in order to generate outputs to apply the decision.

Similar Products/Projects

DeepMind's DQN ^[1]

Learning to Play 2D Video Games ^[2]

Playing Atari with Deep Reinforcement Learning ^[3]

A Neuroevolution Approach to General Atari Game Playing ^[4]

Marl/O ^[5]

CengBall ^[6]

Justification of the proposal

As mentioned, the purpose of the project is to provide an AI that use related AI concepts to make the game played according to the directives or commands of the AI without predefined logic, because predefined logic can be sometimes insufficient for some situations like finding a good strategy in uncommon conditions. In addition, the association of the algorithms provided in the project can support and contribute to the related AI and machine learning research areas.

Games provide well defined goals, unambiguous interfaces for communicating with the player, yet the quantity and dissimilarity of the games make it hard to define a generic solution to proceed with them. Having an unambiguous interface provides an easy environment to develop AI, on the other hand the range of the games makes it a challenging topic.

Processing and interpreting 2d projection of 3d objects are much harder and more complex task than 2d ones. In addition to that, since the detail level in 3d games are much higher than their 2d counterparts and to keep the focus of the project on AI and related algorithms, we will limit ourselves with 2d games and as a result we believe we can avoid subtle problems that can be caused by 3d.

Contributions, Innovation and Originality Aspects of the Project

On a national scale, we are not aware of any general purpose project or a system that has been developed to play games. We only know of another past CENG 490 project (CengBall, supervised by Selim Temizer again) which aimed to lay some foundations in developing an API controllable soccer game. CengBall also had some built in AI. We might borrow ideas from CengBall as a starting point and extend them to other games. In this respect, our idea is a truly original one. We will also need to work on scene understanding and input emulation in addition to the AI solutions.

Technical Aspects of the Project

If there is any provided API, it will be used, otherwise image processing techniques are going to be used for understanding the scene. For solving problems, we will take advantage of AI, machine learning and deep learning algorithms.

In the case of an API-less game, we are thinking about using a screen capture application, and utilize standard computer vision algorithms (such as those provided in the OpenCV library). We may need to do some game-specific customizations to the algorithms. The input emulation could be achieved using a system like the **Robot** interface in Java programming language. We will also conduct a research on other flexible libraries for that purpose. For the AI part, Weka system provides both an IDE-like environment for easy testing, and an API for performing embedded machine learning in Java. We plan to start with the mentioned software tools, and enrich our repository along the way as needed.

Targeted Output, Targeted User/Domain Profile

The final product will be an application that can be run synchronous with the game which we want AI to learn how to play. AI will try to reach the goal of the game and after each try, it is going to learn and improve better strategies.

The range of the proposed end users of the product can change from regular players who want to ease their work and find good strategies, or game developers that tries to test different parts of the game including AI quickly or basically use the final product as in-game AI, to the scientists that work on related areas about the project.

Project Development Environment

The languages planned to be used are Java, Python, C, C++, and Rust. We plan to use language-provided FFI, JVM, standard Linux C ABI and pipes for communication between different parts of the program. OpenCV, Java Robot interface and Weka software will also be used for image processing, input emulation and AI requirements of the project.

External Support

Selim Temizer will be supervisor of the project.
Mobility Research Laboratory will provide working space.

References

1. <https://deepmind.com/research/dqn/>
2. <http://cs229.stanford.edu/proj2012/JohnsonRobertsFisher-LearningToPlay2DVideoGames.pdf>
3. <https://www.cs.toronto.edu/~vmnih/docs/dqn.pdf>
4. <https://www.cs.utexas.edu/~mhauskn/papers/atari.pdf>
5. <https://www.youtube.com/watch?v=qv6UVOQ0F44>
6. <http://senior.ceng.metu.edu.tr/2014/projectcontorium/index.html>
7. <https://www.google.com/patents/US20150100530>
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