REPLACING TRADITIONAL AI IN VIDEO GAMES USING MACHINE LEARNING AGENTS

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The Problem

Game developers often use algorithms like the Finite State Machine to make their NPCs look intelligent. These hand-written NPCs often result in "artificial stupidity" such as repetitive behavior, loss of immersion, or abnormal behavior in situations the developers did not plan for. Despite the incredible achievements of self-learning AI in self-driving cars, computer vision, language processing and even video games, we are yet to see such sophisticated AI in commercial video games.

Motivation

Self-learning AI, namely the deep learning subset of Machine Learning, promises to create more interesting, dynamic, and realistic game experiences by training machines to perform more complicated tasks in game environments. Machine learning algorithms can offload a lot of the work that a game developer currently needs to perform; currently, perfecting AI can take days of hardcoding. NPC character control and other things like the generation of unique environments could be automated if reliable algorithms are developed.

Aim

The aim of the project is to investigate to what extent open-source machine learning toolkits such as Unity's 'ML-Agents' can be used to train autonomous agents to replace traditional Finite State Machine agents.

Methodology

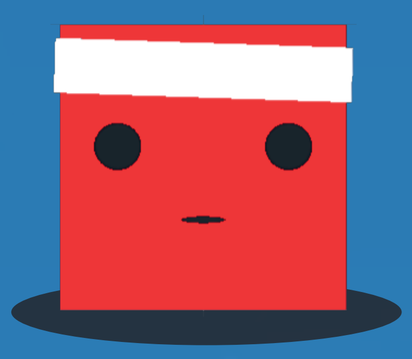
Two agents, a hider and a seeker, are trained to play a variation of the classic game of hide and seek in a number of game environments of various complexities. The hider would collect targets around the level while trying to avoid being caught by the seeker who patrols the level. Their performance is compared to traditional FSM agents that play the same game.

Technology

The popular Unity game engine was used to build the game environments and agents.
The agents were trained using Unity's open-source machine learning toolkit 'ML-Agents' which itself is built on top of the Tensorflow framework.

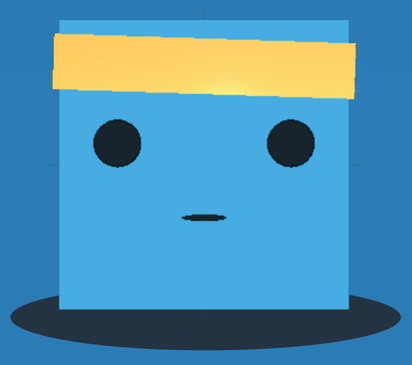
Results and Observations

TRAINED AI



- Take a long time to train
- Take less time to script
- Slower at completing tasks
- Messy and unpredictable movement

TRADITIONAL AI



- Don't need training
- Takes a long time to script
- Faster at completing tasks
- Precise and predictable movement

Future Work

The current trained models are not convincing enough to be able to replace FSM agents. However, there are more things to consider to improve their performance:

- Experiment with alternate training algorithms like SAC
- Add more sensory observations to the agents such as ray-cast sensors for obstacle detection
- Experiment with different hyperparameters tunings
- Increase training time
- Experiment with new toolkit features such as agent memory enhancement using RNN