

# Image Processing for Discovering the Rules of Video Games

Erik Culberson, Neil Ferman, and Viljo Wagner



## 1 INTRODUCTION

There are many examples of machine learning algorithms being able to play video games when the algorithms are integrated directly with the game. This is a costly process and needs hours of development work as well as needing more access to resources such as the source code of the video game. This approach also give algorithms more in-game knowledge then a normal player would have. By removing this advantage from the algorithms we will be able to see how well the algorithms can compare to human players given an equal playing field. General Video Game Playing AI is a little newer, but has been approached in [2]. Given the same inputs as a human player, a screen image as an input and a set of key controls as output, can the algorithm discover the set of rules of the game as well as the rules of the game world.

## 2 PROBLEM

Current research into artificial learning in games focus heavily on algorithms' ability to discover the optimal or fastest solution to the current level or problem. The algorithms are given the rules and knowledge of the game and the environment before hand. This forces the algorithm to only be able to be used for one specific game. To create a general algorithm that can play multiple games, the first step is to allow the algorithm to learn the rules of the game on its own.

## 3 ALGORITHM STRUCTURE

There are several approaches to solving this problem. For our purposes we will focus on two possible solutions. First solution requires a human to play the video game and capture the correct inputs to the corresponding image. In this first solution there is more of a requirement on the human to provide accurate image to key combinations. This method is more of a learn by watching scenario where a computer would watch a human play to learn the proper image to key combinations. The expectation of this approach is that, given the correct inputs to image, an algorithm can learn what to do in an unknown case where the algorithm has not seen a particular part of the game.

In the second solution we will look at using a genetic algorithm to teach the image processor the correct weights to use to get the corresponding correct outputs. This method is a learn by doing method. By giving the algorithm a fitness score of how well the algorithm did each generation the algorithm will keep the best scoring weights while getting rid of the less successful weights. The expectation of this approach is that the more the algorithm plays the game the better it will be. This will also allow the computer in unknown situations to keep trying until it finds the best, not necessarily the most optimal, solution.

It is worth noting that the two algorithm structure stated above are not the only solutions that would fit this problem but for the purpose of this project we will focus just on these two

algorithm structures to start.

## 4 SOLUTION

Given the same inputs as a human player, a screen image as an input and a set of key controls as an output, can the algorithm discover the set of rules of the game as well as the rules of the game world. Using an algorithm to read in the image the algorithm will press a key corresponding to the image. By doing this the process will create a feedback loop that allows the algorithm to see what that key does in the frames that precede it.

## REFERENCES

- [1] S. Sabour, N. Frosst, and G. E. Hinton, Dynamic Routing Between Capsules, Neural Information Processing Systems, 2017.
- [2] D. Perez-Liebana, S. Samothrakis, J. Togelius, T. Schaul, S. Lucas, "General Video Game AI: Competition, Challenges and Opportunities," Proceedings of the Thirtieth AAAI Conference on Artificial Intelligence, 2016.