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The effectiveness of learning artificial intelligence in video games.

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# Abstract

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# Terminology

# Chapter 1: Introduction

# Chapter 2: Literature Review

## 2.1 Introduction into Artificial Intelligence in video games

Artificial Intelligence is a collection of tools and algorithms that attempt to imitate intelligence Gordon, B. M. (2011). Artificial intelligence are used in video games to create non-player characters (NPCS) which interact with the world and player(s). In Real Time Strategy games such as Planetary Annihilation ( Star Theory Games, 2015) the NPCs use Artificial intelligence to battle each other in a global battle for dominance, in these styles of games the player will control where the units go but battles are usually automated.

Video game, artificial intelligence uses two main techniques, goal-driven behaviour and behaviour trees. These intelligence algorithms are designed to imitate realistic patterns set out by the programmers and are not designed to be realistic.

In most video games artificial intelligence is meeting gamers standards with some recent modern games creating challenging AI for players to combat in their objectives in the game. Such games like Heat signature use techniques like procedural generation and goal driven behaviour to create a dynamic and challenging game.

However, the AI can only adapt to a certain calibre of player level, and if players try new and untried tactics the AI may not be able to respond, often is the case that players find the AI weakness’s and exploit that be it game mechanics or bugs within the intelligence of the NPC.

* Artificial Intelligence is the simulation of intelligence in video games, these AI use systems such as state machines, goal driven behaviour trees and pathfinding to simulate an intelligence.
* Artificial intelligence is not indeed to be a 1 to 1 simulation of real people’s behaviours
* Artificial intelligence is doing a good job of these simulations and most AI in video games is effective against the player and possess little to no issues
* However, these Artificial intelligences only have a set number of ‘Strategies’ they can choose from and a smart player can easily adapt after enough time.
* They also have the issues of breaking often and ‘glitching’ causing a disconnect from the realism

## 2.2 Introduction to Neural Networks in video games

Neural networks is the simulation of a human brain using artificial intelligence, these networks can essentially be trained and learn from their actions and can recognise patterns from data inputted into them and select certain strategies. They can also adapt more easily to player personalities and can model the player behaviour and experience.

Neural Networks or machine learning is currently used in most fields of research to answer question which would commonly take humans years of work. Neural Networks however are relatively new and hence have less research and techniques to implement them into video games.

This is largely due to the performance requirements of these artificial intelligence compared to standard AI techniques.

There is also the issue of balancing. How do you balance something that learns? What if it’s too powerful for new commers? What happens if the players learn how it trains and abuse the data input? These questions are just the beginning of issues that can arise from neurological networks

Another reason is simply that standard AI is easy to implement, neurological networks require training and data to be built and that comes with its own issues. Simple games like Pacman would not benefit in any way from a neurological network.

For the purpose of this study the effectiveness of neurological networks for small simple games is void. The study is focusing more on larger games with more complex inputs to truly give an answer to the question of are Neurological networks currently effective for video games.

* Neural Networks are a set of algorithms loosely modelled after human brains that are designed to recognise patterns.
* These networks can be used for multitude of purposes and are currently used in most fields of research
* They essentially learn from data inputted into them and adapt and create new strategies and technology and develop their understanding of what is being asked by them.
* They are usually kept within set limits by the programmers, and are trained by data which is the longest process of creating these systems

## 2.3 Neural Networks current capabilities within video games

Neurological networks do exist in video games. Forza Horizon uses them for its driver profiles to adapt dynamically to players techniques and create more dynamic AI for their game. Alpha star is a modded ai system for Star craft 2, Alpha star is a Deep Mind AI that learns from its matches and training data and is currently battling the professionals of the game.

* Forza’s Driving system
* Alpha Star
* RTS strategy games
* Assessing players tactics and adapting to them
* Neural network as the agent

## 2.4 Main Differences between AI and Neural Networks

* AI Systems are easier to implement
* AI systems are more researched and have better performance and standards
* Neural networks require training
* Neural networks are more realistic

## 2.5 Current Issues with Artificial intelligence in modern games

* Get stuck often
* God like eye sight
* Ability to see through objects
* Can only perform set tasks
* Only can be as dynamic as programmed
* Cannot learn from any mistakes or players personalities

## 2.6 Hardware limitations of Neural Networks

* CPU processing powers
* Storage needed for data
* Networking needed for communication
* Without networking the AIs data will be at different stages foreach players
* This might be a good thing however as it means each players game has an ai that’s adapted for their play style

## 2.7 Applications of Neural Networks within video games

* Hive mind and strategy games / Commanders
* Standard AI agents that learn
* NPCS
* Puzzle making
* Other
  + Asset creation
  + Level generation
  + Auto translating voices and text for multiplayer games

## 2.8 Agents vs hive mind

## 2.9 Introduction to my Research paradigm

# Chapter 3: Methodology

## 3.1 Participants

## 3.2 Software

## 3.3 Training Data

Implementation difference, performance difference and players interaction difference

# Chapter 4: Creating the Learning AI

## 4.1 Building the AI

## 4.2 Training the AI

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## 4.4 Initial analysis of the effectiveness

## 4.5 Performance

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# References

**There are no sources in the current document.**

# Appendences