AI for Artificial, Intelligent Game Opponents

Interim Project Report

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# Abstract

This project investigates the development of intelligent game opponents using a hybrid artificial intelligence (AI) approach that combines traditional rule-based systems with adaptive learning techniques. The aim is to create opponents capable of exhibiting both strategic and reactive behaviours, allowing them to adapt to player actions and provide a more immersive gameplay experience.  
  
The research explores existing methods in game AI, including behaviour trees, decision-making systems, and reinforcement learning, with a particular focus on how these can be integrated effectively within the Unreal Engine 5 environment. By combining classical AI structures with adaptive models, the project seeks to balance control and unpredictability in non-player character (NPC) behaviour.  
  
Ultimately, this work contributes to the growing field of intelligent and responsive game design by proposing an implementation framework for hybrid AI opponents in the original game project Soulforge: Echoes of Power. The system aims to improve player engagement, replayability, and the perceived intelligence of virtual opponents.

## Introduction

Artificial Intelligence (AI) has become a fundamental component of modern game development, influencing how non-player characters (NPCs) behave, react, and engage with players. Over the years, game AI has evolved from simple, rule-based systems such as finite state machines and scripted behaviours to more sophisticated models capable of learning and adapting to player actions (Millington and Funge, 2016). This evolution reflects a growing demand for immersive and believable gameplay experiences, where AI opponents can provide both challenge and realism.  
  
This project investigates the development of intelligent game opponents through a hybrid AI approach that combines traditional decision-making techniques, such as behaviour trees, with adaptive learning methods like reinforcement learning. By integrating these systems, the goal is to create opponents that not only demonstrate strategic reasoning but also improve their performance over time, enhancing replay ability and player engagement (Yannakakis and Togelius, 2018).  
  
The literature review will therefore examine key developments in game AI, from classical algorithms to modern machine learning applications, identifying their strengths, limitations, and relevance to this project. It will also explore how these methods can be implemented within the Unreal Engine environment to guide the design of adaptive opponents in Soulforge: Echoes of Power.

# References

Millington, I., & Funge, J. (2016). Artificial Intelligence for Games (3rd ed.). CRC Press.  
Yannakakis, G. N., & Togelius, J. (2018). Artificial Intelligence and Games. Springer.