JOURNAL OF CRITICAL REVIEWS

ISSN- 2394-5125 VOL 09, ISSUE 04, 2022

Study on Artificial Intelligence Algorithm and Its Use in Gaming Project

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Abstract—Artificial intelligence (AI) in video games has advanced the realm of the gaming experience through the in-depth development of intelligent technology. AI is now the technical foundation for enhancing a game's playability and the key selling point of game promotion. By combining graphics, physics, and artificial intelligence, modern computer games achieve the realism of games. Realistic game experiences are difficult to quantify, but generally speaking, they allude to the immersion of the game and the sophistication of the non-player characters. Game artificial intelligence, which is at the technical heart of enhancing game playability and the selling feature of many commercial games, allows players a method to engage with non-player characters in the game and elevates the realm of the gaming experience. Based on this, this article examines the past and current state of artificial intelligence in game production and speculates on potential future developments and effects of machine learning-based artificial intelligence technology.

Keywords—Artificial intelligence, Game experience, Machine learning.

I. INTRODUCTION

The emergence of the computer gaming business has coincided with the rapid development of all types of game engines [1]. The game engine utilised by game developers is continuously upgraded due to the tremendous advancement in computer hardware level. Every year, game graphics technology is improved as the foundation for game creation. The state of graphics technology has a significant impact on game quality [2]. Yet, as graphics technology improves, consumers are less content with the magnificent audio-visual experience and are instead seeking out deeper game connotations [3]. Artificial intelligence (AI), physics, and graphics are all combined in contemporary video games to create a realistic gaming experience [4]. Realistic gaming experiences are hard to quantify, but generally speaking, they allude to the immersion of the game and the sophistication of the non-player characters [5]. In addition to stunning visual effects and enjoyable audio, a successful game that is well-liked on the market needs to include a highly realistic artificial intelligence control system [6]. In order to provide players a genuine experience, game producers will use AI in computer or console games to make the majority of players believe that the computer-controlled AI system (NPC) they are up against has human intellect. Game designers must identify novelties that further alienate players. own video games [8]. Game innovation and alienation are made possible since game AI has not advanced as much as graphics and physical simulation technology. A game is unique since insufficient use of graphics and physical characteristic simulation technology has been made [9]. Game AI provides users with a mechanism to

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generate behaviour and emotional engagement with non-player characters in the game, elevating the overall gaming experience to a higher degree [10]. It also serves as the selling point for many commercial games. A focus of gaming research and development both at home and abroad is how to provide non-player characters realistic intelligence so that they can more accurately portray human behaviour, emotion, and even self-learning to adapt to the changing game environment [11]. The history and current state of AI in game development are examined in this paper, along with potential future developments and effects that AI-based machine learning technology may have on game development. These developments include intelligent game design, intelligent iteration and subsequent development strategy generation and execution capability, highly intelligent roles, dynamic adaptation, and ever-evolving game experiences.

II. KEY TECHNOLOGIES OF GAME AI

The technology behind artificial intelligence is primarily computer-based. It investigates the process of evolving into artificial intelligence with the use of technology. Its entire design demonstrates intelligence and is capable of carrying out tasks that human intelligence is capable of. Now, there is a definite distinction between the type of artificial intelligence used in commercial games and the type used by a gamer. Humans can learn and innovate, which is one of the traits that sets them apart from other animals. While human learning has advanced to the pinnacle of multi-dimension, intellectual speculation, innovation, and invention, animal learning typically remains in the stage of conditioned reaction. Traditional qualitative AI methods like state diagram search and regular script can completely handle a lot of game development issues. Artificial intelligence technology is mostly used in video games to create realistic environments that allow players to fully immerse themselves in the action. The general computer CPU's processing power and storage capacity are often very constrained. The game's connection with players and sense of reality are both improved by using artificial intelligence technologies to programme and calculate the game's characters. The intelligent behaviour of non-player characters can be characterised by the finite state machine. The finite state machine will, however, become extremely challenging to understand and maintain due to the dramatic expansion of scale when characters must deal with more states. The fundamental goal of path search in a grid-based system is to utilise an algorithm to identify the shortest route between the current node and a specific target node. Several iterations of these technology are used in modern games. The artificial intelligence used in commercial games is, of course, much more complex than this, but the majority of them are variations on these fundamental ideas. The fact that the game may dynamically alter the challenge based on the player's level, so that players can always have a great experience, or choose different tactics independently according to the peculiarities of different players, is how the player sees the benefits of learning. Using Chinese chess as an example, the current state of AI technology can only be used to manage the state tree's search depth and assess the function's complexity [12]. By using a hierarchical state machine, which divides the behaviour of non-player characters into a number of smaller tasks, the explosion of state

ISSN- 2394-5125 VOL 09, ISSUE 04, 2022

combinations brought on by finite state machines can be somewhat mitigated. However, the hierarchical state machine still uses a lot of state transitions, which is also challenging to manage. Without regard to priority, selection nodes evaluate the conditions from the most recently performed child node rather than the first child node each time. If the conditions are satisfied, the node will keep running; if they are not, other child nodes will keep being evaluated one at a time. Visual behaviour analysis is used to determine the real driving behaviour of the NPC motion system, and a unified visual and behavioural model is created, as shown in Figure 1.

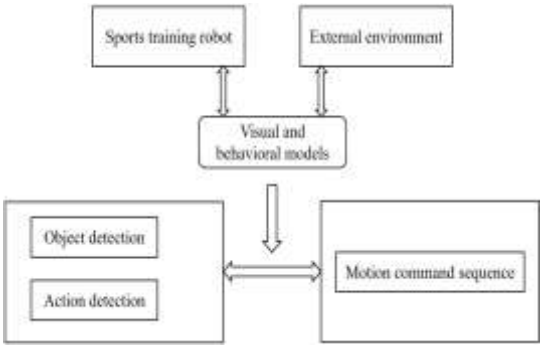

Figure 1 Vision and behavior model

The artificial intelligence in the game shouldn't be too advanced, or at least not beyond the player's level, or the player will become disinterested in it. Consequently, when artificial intelligence technology is used in games, it should, on the one hand, be limited in scope in order to protect players from harm and, on the other, it should promote the advancement and use of intelligent technology in games. But in the game, the designer scarcely pays any attention to it at all. Sophisticated artificial intelligence has superior original computing capabilities, or the machine needs to face the answer thinking, or something similar. The goal of game designers is for players to enjoy themselves. Typically, game designers want to create an enjoyable experience for players while creating a game. The experiences players will have at this stage of the game are what the designers are interested in learning. As a result, it is envisaged that an artificial intelligence will be placed and that it would be predictable. The virtual game world must be balanced when creating new games. They should both pique players' attention in the games they play and make them difficult at the same time. The complexity and difficulty of artificial intelligence creation in games has a significant impact on the overall level of playability. Consequently, it is crucial to use artificial intelligence technology while creating a challenging and balanced game.

III. APPLICATION OF ARTIFICIAL INTELLIGENCE BASED ON MACHINE LEARNING IN GAME DEVELOPMENT

A. Intelligent game design

Large studios may push the boundaries when building open world environments and developing simulations and systems that are more equivalent to the complexity of the real world. Producers will find it much simpler to create games, and they can create larger games. These open-world games will expand, and the gameplay mechanics are flexible. Every time you play, as well as between the terminal computers of other participants, the regulations are varied. The advancement of artificial intelligence technology in video games has enormous promise. When games evolve, future games may also alter. The majority of games rarely have many needs that are repeated in great detail, but they can be utilised as a guide and unified

ISSN- 2394-5125 VOL 09, ISSUE 04, 2022

in development models. The majority of games with complex scenario decision and evaluation can use this paradigm. With regard to the model's ability to learn on its own, offline learning can be utilised in game creation to extract a number of important decision-influencing parameters and train neural networks that, to a certain degree, mimic the knowledge of game specialists. Advanced artificial intelligence's current use in games does not involve acting as in-game AI, but rather replacing actual players to play and evaluate the games. When a game first launches, the behaviour of nonplayers is not predetermined. Nevertheless, as the game is played more, the game can alter itself in accordance with player progress for a better fit with player progress. The artificial intelligence detection and tracking system for video games that uses image error technology is shown in Figure 2.

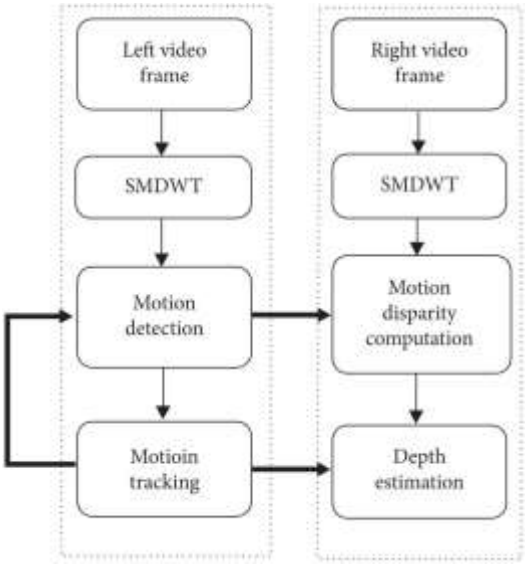

Figure 2. Game artificial intelligence detection and tracking system framework using image error technology.

Gaming software can be used to teach sophisticated artificial intelligence. The virtual world with rigorous rules and a reward system is a particularly suitable setting for training some software, therefore artificial intelligence researchers primarily view games as a technique to test the intelligence level of software. Both conventional depth-first search and breadth-first search are nonheuristic methods. Game software also serves as a tool for training advanced artificial intelligence. Artificial intelligence researchers mainly regard games as a method to measure the intelligence level of software, because the virtual world with strict rules and reward system is a particularly useful environment for training certain software. Traditional breadth-first search and depth-first search are both nonheuristic. We simply demonstrate that non-heuristic route search is an exhaustive approach that explores the waypoints surrounding the pathfinder in a predetermined order until the destination waypoint is reached by recreating the search process with computer pictures. Weights will increase the randomness to some extent, but other child nodes won't be starved [13]. The chosen node becomes fully random if all of the child nodes' weights are set to the same value. Machine learning is a crucial data mining tool for in-game research, allowing game companies to examine user behaviour and uncover fresh ideas to continuously improve games. In actuality, the finite state machine keeps track of a state graph, in which the states are represented by the graph's vertices, the transition between vertices represents a change in state, and the logic of the change in state is specified by rules. Behavior trees can be used to describe the state jump process. The key to using powerful artificial intelligence in this industry will be a real-world video game character controlled by AI, or an AI system integrated into the game's overall design that can develop adapt, and behave like a human being while being played.

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B. Artificial intelligence routing

Although it is challenging to identify an existing linear formula to represent the solution model of non-qualitative AI issues in video games, these issues can be turned into particular patterns or nonlinear mappings. A game needs a flawless technique to support it in running smoothly. After discovering the established mode, a straightforward game can jump into a fixed mode, however conditional statements are only partially effective when dealing with non-discrete conditional decisions. Here, we may abstract human reading competition experience into a number of characteristics for neural network training. Allow the network to learn these representative choices; the input of further non-training sample data will rely on the neural network's capacity for generalisation. The game maze problem, which is also one of the challenges in game design, is the most well-known path search difficulty in the game. Finding the ideal labyrinth path can be compared to solving a variety of intelligence challenges, including chess, strategic decision-making, robot path planning, etc. The structure of agent nodes is depicted in Figure 3.

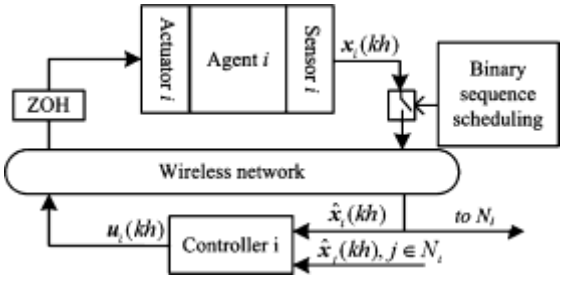

Figure 3 The structure other agent node

With the increase of path density, the shortest path between nodes increases, as shown in Figure 4.

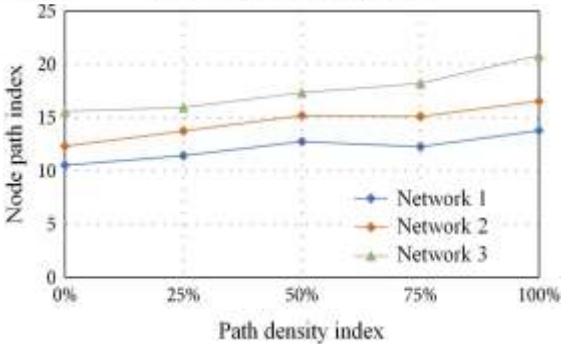

Figure 4 . Path density and node path relationship

For different terrains, such as marshes, hills, stairs, etc., different losses can be specified, and these can set higher travelling costs than flat ground. When the map is very huge or when you need to cross the map to discover the path, hierarchical path search is required. The most exciting aspect of the potential future may not only be the creative role that software will play in the process of creating the art of games, but also the constantly evolving and custom experience that this technology will produce. It will never get boring to focus on a single objective at a time. Hence, only one activity is carried out at a time. Moreover, only the target rules that are presently being processed are tested, creating context. The first rule that satisfies the conditions is applied first, and control is then transferred to a different new target. Players can have multiple experiences thanks to automated game design because the game can be updated and modified frequently.

IV. CONCLUSIONS

Great advancements in science and technology, particularly in the area of artificial intelligence, have been accomplished thanks to China's economy's rapid growth and development. intelligence, which has enormous mining potential. Artificial intelligence engines will be just as essential to the development

of large-scale video games as game graphics engines are today. Nowadays, the creators' missions can still be completed by the typical in-game artificial intelligence, and by integrating it with additional audio-visual interactive tools, it is possible to create the illusion of a genuine intelligence. Machine learning is a crucial data mining tool for in-game research, allowing game developers to examine player behaviour and uncover fresh ideas to continuously improve games. Although it is challenging to identify an existing linear formula to represent the solution model of non-qualitative AI issues in video games, these issues can be turned into particular patterns or nonlinear mappings. As for the model's ability to learn on its own, offline learning can be utilised in game creation to extract various characteristics that greatly affect decision-making and train neural networks so that the networks can, to a certain extent, learn how game specialists comprehend the game. The future of game production, gameplay, and gaming experiences will eventually be reinvented and changed whenever the most recent artificial intelligence based on machine learning is utilised.

ACKNOWLEDGEMENTS

The Industrial Science and Technology Research Project of Henan Province under Grants 202102210387, 202102210332, 182102310969, and KJGG0022018-ZDJH-219 provided some funding for this work.

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