

A Study on the Impact of Computer Games Using Artificial Intelligence Technology

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Abstract

Recently, artificial intelligence technology that combines artificial intelligence technology of global companies is attracting attention. In the past, a lot of effort was put into research centering on realistic graphic processing and natural movement processing technology to improve realism, but recently, artificial intelligence technology that thinks like a human is attracting attention. Artificial intelligence in games is the part that takes on the role of a player, the role of an unregulated player, the role of a team member, etc. instead, like a human, with the ability to learn to think like a human and intelligent behavior to act like a human. Artificial intelligence information technology is an important part that enables human-like thinking, and continuous research is required in the field of intelligent artificial intelligence among game elements, and interest in artificial intelligence is gathering in computer games. Therefore, this study seeks to research artificial intelligence technology in computer games.

Keywords

artificial intelligence, AI, deep learning, computer games and artificial intelligence technology

1. Introduction

The need for a technology related to artificial intelligence was sought, and that technology was to create computers that think, or have "artificial intelligence" known as AI. Artificial intelligence computers that store a lot of data will be able to analyze concrete data and produce more solid and substantive social theories. In addition, human beings will be able to pursue a much better life by utilizing robot brains that are applied to industrial sites in place of humans. Recently, AI technology has been attracting attention as the confrontation between Alphago and Go professional players in a global company has attracted the attention of the world. Past games have made a lot of effort in research centered on realistic graphics processing and smooth motion processing technology to improve the experience, and the technology transplant of artificial intelligence that thinks like humans is gaining new interest. There is Artificial intelligence in the game is to perform the role of the player, the role of the uncoordinated player, the role of the team member, etc., like a person. This includes intelligent behavior that thinks and acts like humans. In past games, a lot of effort and money was spent to create characters that behaved like humans, but now artificial intelligence information technology plays an important role in creating accidents like humans do. It can be said that there is For this purpose, continuous research in the field of intelligent artificial intelligence among game elements is necessary, and interest in utilizing artificial intelligence in computer games is emerging. Therefore, in this study, we would like to look at ways to influence artificial intelligence technology in computer games.

2. Body

2.1 About the game

Since the 1950s, computer games have rapidly developed into a popular cultural form, and are now one of the most powerful multimedia cultural forms, competing with existing media such as movies, OTT, television, and records. A

computer game is defined as one created by a computer program in which interesting content on a computer hardware is advanced through a selection-decision process based on certain rules. This definition is not based on theoretical arguments, but includes external factors such as computers and computer programming, rules, choices, and decision processes.

Wolf who prefers the term videogame to computer game, sees that defining a videogame must consider its video and game phases. A visual display element, the latter including elements such as conflicts, rules, utilization of player abilities, and evaluation of game results. And the computer that makes the game possible is considered to have the phase of a player and a referee. On the other hand, Juul defines computer games as activities based on formally prescribed rules that involve evaluation of player actions. In this way, many scholars have defined game theory, but the definition of a game has not yet been established (Moon 2003).

The point of view of computer games will undergo a great change in the social atmosphere of the United States, which is entering a new era (Lee 2003). This change in computer games is a new form of capitalism with the value of consumer goods that expands and develops capital through revenue generation, rather than computer games as a vehicle for everyone, as people genuinely think. Appears as a product of On the other hand, in the first stage of computer games, students made a super-large computer at the media lab of the Massachusetts Institute of Technology (MIT). It's a game called. This game is modeled on a war that takes place in space, where two spaceships with fat Shiga patterns fight in a space created by a computer. to destroy the opponent's trap.

The game that caused the biggest formal change in computer games was Atari's "Brick-Out", a common sight in Korea's electronics rooms and highway bus terminals in the late 80's, where you could "break blocks". It was the first form of the game. This game has been made with various formal changes until now. It is a product of the developer's intentional development to survive the competition by enclosing equipment that constantly induces the sustained use of currency and time by giving the user immersion and addiction through the game can be seen as an extension.

In the 1990s, it developed into a multimedia game with powerful CPUs, CD-ROMs, sound cards, graphics accelerators, and other systems necessary for games. It has made possible the so-called CD games, which are as sophisticated as video game consoles. And most importantly, since the late 1990s, the popularization and sophistication of the Internet has made the PC the foundation for online gaming, which now allows interaction between a large number of gamers, i.e., multiplayer gaming. From the game genre side, the appearance of PC games has reduced the proportion of arcade games such as shooting, fighting, platform, and racing, and genres such as fantasy, adventure, and puzzles have increased, and the relative balance seems to be restored. However, from the early 1990s onwards, the spread of home video consoles increased the share of action games again. Computer games have grown into a cultural industry in less than 10 years since their appearance around 1960, and have become a major axis of modern multimedia culture for more than 30 years. And now, games have gone beyond the stage of industrialization of hardware and software production, and entered the stage where professional gamers themselves are industrialized like popular sports. Compared to other cultural industries, this is a tremendously rapid growth. Artificial intelligence games will also appear according to the trend of the times (Choi 2002).

2.2 Games and artificial intelligence

Artificial intelligence began in 1956 when 10 scientists gathered at the University of Dartmouth in the United States and had a meeting on artificial intelligence, just as machines replace human intellectual activities. This conference was the first time the term Artificial Intelligence was used to get sponsors. Research on artificial intelligence began in the mid-to-late 1950s, mainly in American universities, and in the early days, it was an experimental character in which tasks such as games, translation between different languages, and proof of mathematical arrangement were mainly performed by machines, was strong. Since the publication of Minsky's Perceptrons in 1960, research on neural networks, a form of artificial intelligence, has rapidly dried up, and then research on artificial intelligence has boomed. FSM was often used in existing games to artificially implement in-game enemy movements. This FSM is a computer engineering, mathematical concept that has been widely used in various ways since ancient times, and refers to one simple machine composed of a finite number of states, which is the meaning of the term. One State here means only one condition. The FSM can be divided into four components: 1) current state, 2) input, 3) output state, and transition function. The current state literally means the current state of the FSM, the input is the input information that entered the FSM, the output state is the state of the next stage, and the transition function is the function that determines the output state based on the input information and the current state. In other words, an FSM is a machine with a finite number of states, one of which is the current state. An FSM receives an input and causes a state transition from the

current state to the output state based on which state transition function. And the output state becomes the new current state, and the computer is also an example of FSM when viewed broadly.

Such an FSM can be used in various ways to implement artificial intelligence in a game, and can be said to be an implementation of artificial intelligence that determines typical monster behavior. Each state of the FSM is called the monster's emotion, which changes depending on the current state and inputs to the FSM, and how it changes is determined by the state transition rules. Creating code to perform different actions based on the monster's emotions would make the monster behave like a real monster with emotions. Complex characters have many more states and inputs and state transition rules. Determining which states and inputs to distinguish and how they transition is the fundamental process of creating artificial intelligence based on FSM. FSM (Finite State Machine) is currently the most widely used artificial intelligence processing method. Figure 1 below shows the basic concept of FSM, divided into various states, the current state of the character determines how to deal with the outside world. In other words, when the external circumstances change, so does the state.

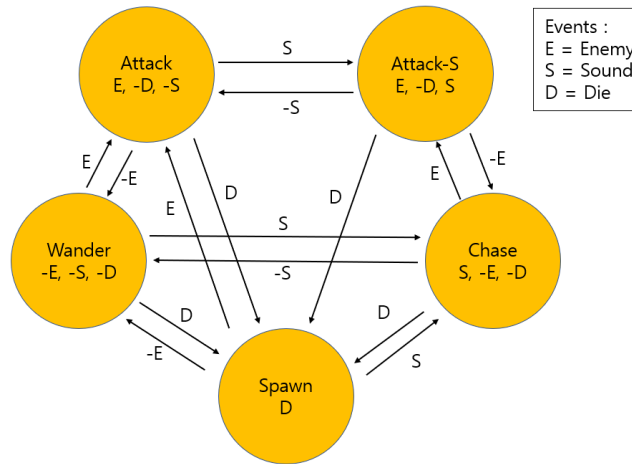


Figure 1. Basic concept of FSM

As you can see in the picture above, the character always behaves the same way when in a certain state. For example, if an enemy is discovered (E) in the Wander state, it moves to the Attack state, and continues to do the same while in this state. If the player dies (D) in this state, it changes to the Spawn state, and if the enemy is not visible (-F), it changes back to the wander state. The advantage of this FSM model is that it is easy to understand and easy to implement in a program. FSM doesn't require particularly good artificial intelligence, and is used in most games. However, the downside of FSM is that when the number of states increases, it is difficult to organize the state diagram, and the external sensor input routine that enables state change becomes rapidly complicated, and it is easy to predict the behavior of the character using it. To partially solve this problem, one state can be divided into several substates. GVGP (General Video Game Playing) means playing multiple games with one agent. In order to play GVGP, the agent's goal is to find out how the game will respond to his actions, what kind of reward he will get, and ultimately how he can win the game. If an agent is created using domain knowledge of one game, the agent will show poor performance in other games except for the game, so overall development is necessary. Tom Schaul proposed VGDL (Video Game Description Language) to provide an environment for GGP (General Game Playing). (Kim 2014) VGDL is a development language that can easily create 2D video games, and its advantage is that it can easily create games with various concepts as long as there are images. In fact, all games in the GVG-AI competition are made using VGDL. When VGDL is used, various victory conditions range from simple game victory conditions (for example, a simple path finding problem) to victory conditions that require complex logic (for example, a problem in which a certain number of diamonds must be obtained and then exit) can be defined in a few lines of language. (Schaul and Thompson 2013)



Figure 2. Example of GVG – AI games made with VGD

Games made with VGDL differ in the actions that agents can perform for each game (Figure 2). While there are games where you can only move left and right, there are also games where you can move up, down, left, right and even attack. In this paper, when the agent is capable of attack, it is hypothesized that the probability of the attack side is given a little more, and as a result, the attack-oriented choice becomes the center. This is because, in normal cases, in a game where attacks are possible, you must defeat the NonPlayer Character or destroy the target within a limited time. However, teaching the agent to attack when there is an enemy right in front of it can get you out of GVG. For this reason, if you increase the probability of choosing an attack and attack, you will show good performance. AI is playing an increasingly important role. Early game AI was mostly processed with hard coding. Now, it is approaching a more systematic and academic aspect. Previously, AI felt difficult as an exclusive property of academic research, but AI elements are gradually being applied to our lives and games. The AI part in the game is basically applied to control the NPC (Non-Player Character) that the user does not manipulate. In simple 2D games that came out in the past, simple random algorithms were often used, but in current games, appropriate AI techniques that can digest various genres are applied. If you look at overseas games, you can see that the proportion of artificial intelligence is increasing.

Black & White is a game that Peter Molyneux recently released after going through games such as Populous. As the creator of the God game, the artificial intelligence of creatures especially stands out in this game. In this game, A-Life (Artificial Life) technology is introduced, and the response to the user's actions is displayed dynamically according to the creature's own desire and condition. What's even more amazing is that users can teach creatures. When a certain action is repeatedly shown to a creature, it is possible to educate in both directions of good and evil by copying the same action and praise and punishment in parallel.(Andre, 2023)

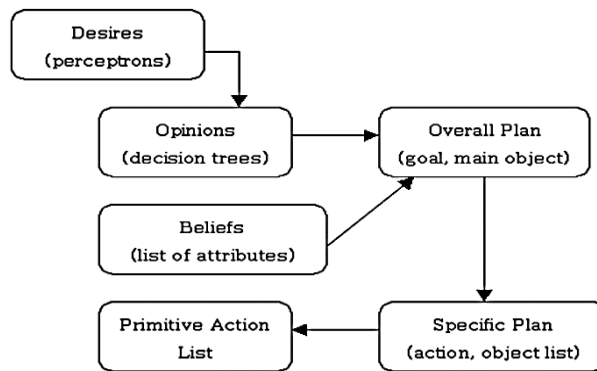


Figure 3. Black & White

Figure 3 at the architecture above, a creature's desires, opinions, and beliefs influence its behavior. In particular, the effect of education was implemented using a decision tree corresponding to Opinions. Black & White used a method called Dynamically Building Decision Trees, but it was changed to a more dynamic form by applying the general Decision Tree method. First, the Decision Tree method is a structure for implementing a certain logical plan in a game more efficiently. It can be processed with hard coding, but as shown in Figure 4, it is made into a structure that can be changed from the outside without directly changing the code by making it a more efficient structure.

```
typedef struct DECNODE_TYP
{
int operand1, operand2; // the first operands
    int comp1;           // the
comparison operator

    int operator;       // the
conjunctive operator

    int operand3, operand4; // the second pair of
operands
    int comp2;           // the
comparison to perform

ACTION *act_true;      // action lists for true and false

ACTION *act_false;

    DECNODE_PTR *dec_true; // branches to take if
true or false

    DECNODE_PTR *dec_false;
} DECNODE, *DECNODE_PTR;
```

Figure 4. Efficient Coding Structure

This Decision Tree is a simple method, but it can be used conveniently depending on the application.

The Sims is a simulation game from EA. It is a game made by Will Write, who is famous for the Sim City series. Real life has been put into the game in an interesting way, but each character has needs, so you have to satisfy them to make the game play smooth. What is characteristic of Sims is the use of AI techniques based on the character's desire and the way each object has information about certain actions. Desire-based AI techniques were also introduced in Gamasutra, but as a way to obtain appropriate effects by adjusting the thresholds for internal states, the limitations were appropriately adjusted to resemble the behavior of living things and applied. Will Write expressed the way objects generate events with the term "smart terrain," and the metaphor seems appropriate. Objects, which are objects, not subjects, generate event information about actions that the subject should perform. It can be said in the same way that if a hungry character walks by, he orders you to take it out of the fridge and eat it. It's funny in a way, but I'm seeing the effect in a very appropriate way. This game showcases AI using A-Life and Fuzzy-State Machine. In particular, in this game, the way each object generates states and actions, as Will Write says, "smart terrain." In other words, it is an event-driven method in which each object generates events for various actions to the character in an object-oriented method. The word A-Life is mentioned in Black & White or The Sims. To explain a little, the AI so far is from top to bottom, so unplanned actions from below as planned from above cannot occur, but A-Life It is expressed in the word from bottom to top, and each detailed simple rule is gathered to represent one big characteristic, and it has the characteristic of emergent behavior that is not specified. It can be said that it is a way to imitate more natural creatures.

3. Conclusions

Rather than using only one or two methods to implement artificial intelligence in games, it is common to implement several methods in combination depending on the level and genre of the game. In Black & White, the technology of

artificial life was applied, but the reaction to the user's actions was made to appear dynamically according to the desires and states of the characters themselves. Also, if the user makes the character repeat some action, the action is followed in the same way, and by presenting rewards and punishments, good and bad can be distinguished and educated. Sims, which is famous for EA's SimCity series, was developed by Will Write, and by translating everyday real life into games, each character has their own desires, and it is necessary to satisfy them to play smoothly. Despite the short history of computer-based games, they have developed into various genres, such as first-person shooter games, sports games, and various simulation games, in anticipation of many people. The appeal of computer games is that you can enjoy the game alone or with a computer-generated virtual opponent. In fact, how to create enemy planes that can better avoid missiles launched by gamers' spaceships and how to create an army that can use more diverse tactics are major issues in developing the field of artificial intelligence contributed. In the future, more games that embody various artificial intelligence theories are expected to appear.

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