AI Application in Computer Games

Qianjun Geng
Wuxi Taihu University, China

Abstract. It is well-established that artificial intelligence has already been used in nearly all kinds of computer games. The purpose of most games is to entertain (though there exists some educational games which aim to teach), and AI takes the role to improve the player's experience. First, current use of artificial intelligence in computer games is introduced, then, some AI applications which aim to promote both entertainment and interactive environment is mentioned. Then, the future of artificial intelligence to find the possibility to create a kind of AI which can not only interact with players but also improve as number and experience of players grow. Lastly, the paper will analyse the future use of AI in different fields of computer games including, but not quite, the feedback of game bugs and solutions of players' problems.

Keywords: Artificial Intelligence; Computer Games.

1. Introduction

Nowadays, artificial intelligence has been applied in all kinds of fields in people's lives, especially in computer games. Computer games has become a way of entertainment for no matter young teenagers or adults, even some old people are sometimes log in to play games. As an important role in all kinds of games, Artificial Intelligence (AI) has great value of research and discussion. In current games, techniques of AI such as finite state machines, scripting, agents and flocking are widely used [1]. All these techniques can satisfy game designers' requirements of saving time and resource. However, predictable characters and tasks make players feel boring, so it is necessary to find other techniques to improve the experience of players.

In this essay, we will describe the current use of AI in games and discuss how can AI be improved through current techniques to provide a more exciting and challenging game world.

This study will list some techniques currently used in games to create artificial intelligence. It will also point out some problems exist in games and explore the possibility to solve these problems.

2. Discussion

For players, the behavior of AI may directly influence their experiences, if AI, or no-player character in another word, gives them too much trouble, they may soon give up the game easily. Oppositely, when AI make many stupid actions in defence with players and let them reach the goal without any difficulty, players may also get bored with it. So, it is necessary to find a way to balance the difficultly of games, or make AI to satisfy players' requirements. Current types of games that AI applied in includes FPS (First person shooter) games, RTS(Real- Time Strategy) games, RPG(Role Playing Games), MOBA(Multiplayer Online Battle Arena), MMOS(Massively Multiplayer Online Role-Playing Games), Sports Games and so on.[3]. Next, we will use some of them as an example to discuss.

2.1 FPS Games

FPS Games are one of the most famous games in the game market all around the world. They also define concepts like HP, helmet and armour, power-ups medicine and weapons. AI in this kind of games is designed to be enemies who against players and training their skills to reach higher levels.

2.1.1. Techniques of AI in FPS

AI in FPS Games always takes the responsibility to enhance the tension of the game, so that players can always immerse themselves in the battle scene because of the existence of enemies or teammates

which controlled by AI. In an ideal FPS game, there are always a database of movements exists and rules for AI to learn and work under the guide of all those data. This makes AI seems more similar as a real player. The animation system can make actions of AI move at chosen speed and let them finish complex actions like shooting while run or looking for shelters and reload weapons.

2.1.2. Shortcomings of Current AI

AI system in this kind of game consists of different levels of module. Once the system decided which behavior is the most suitable one for the given situation, a lower-level of module must choose the best method to finish the decision. For computer still cannot analyse situations roundly as human's brain does, the result of AI system may sometimes seems unrecognized. This problem was been discussed as "Target Selection for AI Companions" [4]. In order to solve it, our target is to find the possibility to make AI can analysis the situation as correct as possible and give the right choice. To reach the target, we think the database need to take in more real choice made by real players when different situations enable to let AI get to learn.

2.1.3. Future Possibility

In the future, we need to improve the performance of AI in both single player FPS Games and Online ones. For single player experiences, developers need to create a better AI to satisfy the requirement of players to own a teammate or truly feedback similar to real wars. For online fps games, AI characters needs to have the ability to follow player and ready to record backup for the next days' players [2]. For database, AI needs to collect more behaviors from players and try to create a system of behaviors of AI to give the right reactions according to players' choice and the changeable gaming situation.

2.2 RTS Games

The real-time strategy roots in the 1980s [3], players of this game need to take into different kinds of wars. Unlike FPS Games we talked before, players are commanders of the war, they have their armies and the division of arms are decided by them. Each step of their decision may influence the final result of the war happen in the sandbox. The Blizzard game, StarCraft, is one of the most famous RTS games in the history.

2.2.1. Techniques of AI in RTS Games

In RTS Games, AI replace the role of online players to work as commanders of the enemy when players have the idea to play themselves without other online players take part in. After the whole game, AI may give the feedback in the form of an analysis table to let players know how well they done.

2.2.2. Shortcomings of Current AI

Lack of real-time planning. In each game, AI nearly do the same things at the same time. As Figure1 shows, in the game Warcraft-2, wood and gold are the resource and everyone born with their own gold ore and forest. For online player A, he may realize that he can go through his own area to take up and exploit the ore 3 as soon as the ore 1. Later, he can use his gold to train soldiers and attack AI player B to despoil the ore 2. However, AI player B only have the idea to run out his own resource first and then went to the middle area to take up the ore 3. As a result, it can only wait for player A to attack and lose the game.

Opponent modeling and learning. For AI, one of the biggest shortcomings is that it cannot learn quickly. For human players, a map can be master after several games, but AI find it difficult to do that [5].

Cooperation. For human players, teamwork can be easily carried out through communication and experience. Players catch the shortages of the enemy and break their defence. When a game mixed with human and AI, cooperation is not important either between AI and AI or AI and human. AI can only follow the program to finish the given behavior.

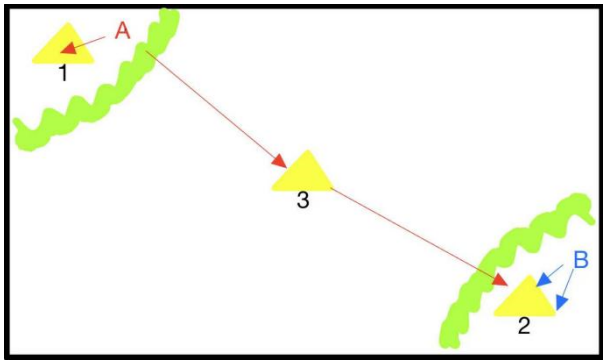


Figure 1. Simple map of RTS Game. The start locations of player and AI are represented in A and B. Green lines represent forest and triangles represent gold ores.

2.2.3. Future Possibility

As the plan [6] said, by the end of 2015, twenty percent of the USA army will transform into robot army. RTS Games can work as analog system under the background of given situations. Real soldiers can also be recorded and added into the gaming system, the data index of models can follow their real data accurately. In order to realize, an ORTS system needs to be built [5]. The system should base on a programming environment for conducting real-time AI experiments. Anyone can have access to use the ORTS, players can use the scripted system. They can also run their RTS designs with the server provide by the system.

2.3 RPG Game

Role Playing Games aim to create an open world for players to explore. In this kind of games, AI has made a great contribution. There are always be a monster, witches, dragons and other kinds of otherworldly creature, all of them are controlled by AI in current games, which we called NPC (non-player-character).

2.3.1. Techniques of AI in RPG Games

Behavior tree [7]. An embedded system of AI in games. When AI have no idea what to do next, it will ask the "behavior tree" for help and put an uncertain task in its plan. Later, AI may think twice to find out whether the task still can be done after changeable situation. So, we can think of AI as having its own schedule, and the system "behavior tree" is only one step to fill plans into the schedule but not ensure to do the plan next.

Group AI System. Different from the "behavior tree", Group System gives AI the opportunity to get information from other AI or other systems. We can describe it as a blackboard, AI system can record data on it, so do other systems. With the huge 'blackboard', AI can learn pluralistic knowledge and give reaction accordingly. For example, some creatures have two sides: docile and fiery. They never attack players actively when players are not hostile. So-called "hostility" may give by players' operating system to make AI realize that they need to fight back.

2.3.2. Shortcomings of Current AI

Long-time. For AI's ability to learn can be influenced by different kinds of factors like character information of identity, number of samples, site factors, it may cost up to three or four months for an AI to reach the average level. If we want to apply it in team work, it may cost even more time.

Repetition. The technique called "static decision tree" dictated AI's dialog. Every time players start a dialog with them, they will give the same answers and let players choose from several fixed options. For example, we define an NPC who owns a shop called Catherine, players can buy meat from her and the price is 100 gold per unit. Players can choose their answer to the welcome of Catherine from "I don't actually need some meat", " I truly need some, but I only have 80 gold", or " Nice price, I will buy some". Even Catherine may give some feedback, but when players leave and come back, the dialog appear again.

2.3.3. Future Possibility ‘

To shorten the time to train an AI, we just shorten the time for AI to calculate before applying in games. Several NPCs can share a neural network to own a similar behavior. In a group, we can add code to make inactive AI to follow surroundings to get the behaviors, in another word, train a ‘teacher’ to a group and let all other AI learn from the ‘teacher’. To the problem of repeating, a far more believable, but much more expensive (in terms of modeling, computation and storage space) solution is to give Catherine an initial disposition and memory. Thus, even if the player leaves, she will “remember” previous conversations and experiences with the player and react accordingly.

3. Requirements for the AI in Computer Games in the Future

Intellectuality. In the future, AI can replace human’s work in some jobs. They can learn to solve players’ problems according to previous similar record. It is also possible to make AI imitate customer service staff to calm the player down.

Adaptation. AI needs to have the ability to adapt the emergency made by players suddenly. For example, a player gets the task to break into a cave and defeat the boss. In a general way, he may keep fighting from the entrance of the cave and defeat the boss finally, but the player finds a direct way (maybe because of some hidden bug) into the cave suddenly and find the boss without fighting with any other creatures, the condition will not be fired and the boss cannot realize what to do next. The game could crash, more seriously, the illusion of game could disappear.

Controllability. The fundamental objective of AI is to increase the entertainment of games but not make more trouble to players. The training of AI cannot out of control, such as “Doomsday Computer” of league of legends or Open AI of Dota2. Exploring the potential of deep technology is truly necessary and interesting for programmers, but we still must consider of players’ experiences.

Authenticity. Today, even though AI has made the player's experience in the game world almost realistic, there are still some loopholes in the game that allow players to easily distinguish between reality and the game. Designers need to give the game more real-world conditions, even under an elevated worldview. For example, in a future-set RPG fight, the player can use the mechanical arm to block the opponent's attack, but after a few times the player's left or right arm will be damaged, then the attack relying on the arm will not be used, and even the designer can make the arm directly scrapped in this case, the player needs to leave the battle or solve the battle and then go to a specific location for repair.

4. Conclusion

In this paper, we discussed AI in all kinds of computer games in terms of current techniques, shortcomings that still exist and the future possibility. We also do some guess about the future of AI and show the basic requirement for AI in computer games. Although there are many challenges along the way of AI applied in computer games, we still believe the future of AI-used computer games is bright and desirable.

Acknowledgments

We would like to acknowledge Professor Jamie Vicary for inspiring my interest in the development of artificial intelligence. At the same time, thanks for Ekrem Ekici for his guidance through each stage of the essay.

References

[1] Sweetser, Penelope, and Janet Wiles. "Current AI in games: A review." Australian Journal of Intelligent Information Processing Systems 8.1 (2002): 24-42.

[2] Jeremy A. Glasser and Leen-Kiat Soh. "AI in Computer Games: From the Player's Goal to AI's Role." Computer Science and Engineering University of Nebraska-Lincoln Lincoln, NE 66588-0115 {jglasser, lksoh}@cse.unl.edu.

[3] "The Complete Guide to Video Game Genres: From Scrollers, Shooters, to Sports." https://www. gamedesigning. org/gaming/video-game-genres/#First-Person-Shooter.

[4] Tremblay, Jonathan, Christopher Dragert, and Clark Verbrugge. "Target selection for AI companions in FPS games." FDG. 2014.

[5] Buro, Michael, and Timothy Furtak. "RTS games as test-bed for real-time AI research." Proceedings of the 7th Joint Conference on Information Science (JCIS 2003). Vol. 2003. 2003.

[6] S. von der Lippe, R.W. Franceschini, and M. Kalphat. A robotic army: The future is CGF. In Proceedings of the 8th Conference on Computer Generated Forces and Behavioral Representation, Florida, USA, 1999.

[7] "How does NPC AI work? From program to planning on game AI" https://www.gameres.com.