Research on Computer Weiqi Game based on Mathematical Model

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Abstract. In recent years, computer hardware and software, even the Internet have developed rapidly, at the same time, the related disciplines are also making progress. Artificial intelligence (AI) has been a hot topic for a long time, and computer game is one of the research directions. As one of the most complex game projects, the challenging Go game can fully test the development level of artificial intelligence. Therefore, the study of computer Go game plays an important role in computer games, artificial intelligence and even computer science. Because it is inconvenient to generalize the knowledge rules of Weiqi and the search space is too large, the traditional computer game theories and methods are not applicable at present. In recent years, on the basis of the great improvement of computer performance, the computer Go game adopts the Monte Carlo method for dynamic evaluation, and introduces the upper bound confidence circle application tree algorithm, the search efficiency and evaluation performance have been greatly improved, and the level of computer Go game program has been constantly improved. At the same time, this clustering intelligent computing method is not only applicable to Go, but also applicable to planning and decision problems. Many problems, so the computer Weiqi Boben research results have important practical significance, can have a broader field of use.

Keywords: Computer Software, Internet, Artificial Intelligence, Computer Game, Monte Carlo Method

1. Research background
Since the naissance of atanasoff-Berry Computer (ABC) and ENIAC, many people from all over the world have devoted great enthusiasm to the research of electronic computers. With the continuous development of computer hardware and software, and the entry of human society into the Internet era, people's use and research of computers are getting deeper and deeper, and their level is getting higher and higher. In research, artificial intelligence, as a research and development of theories, methods, technologies and application systems used to simulate, extend and expand human intelligence, has always been the focus of computer research.

Legends of artificial intelligence can be traced back to ancient Egypt, but the term was officially coined after the invention of the electronic computer. The term artificial intelligence (AI) was first coined
at Dartmouth in 1956 and has nearly a history of its own. As a simulation of the information process of human consciousness and thinking, artificial intelligence itself is not equal to human intelligence, but it can imitate the way of thinking and even surpass the level of human intelligence. Artificial intelligence attempts to understand the nature of intelligence and to produce a new type of intelligent machine that can respond in a manner similar to human intelligence. The fields of research include robotics, expert systems, language recognition, image recognition and natural language processing, among others. With the gradual maturity of many theories, methods and technologies and the increasing scope of application, artificial intelligence has made remarkable achievements in the fields of machine learning, knowledge engineering and pattern recognition, which has significantly promoted the progress of science and technology and the development of society. Intelligent community, intelligent control technology, data mining technology and artificial intelligence robots brought by artificial intelligence have become very common. They have changed human life and brought convenience and comfort to people[1].

Computer game, also known as machine game, mainly studies how to develop game programs with computing and decision-making abilities for electronic computers, so that computers can play games and games just like human beings. In short, to be able to play chess and CARDS, to think, judge and reason like a human being, and to make reasonable decisions. Computer game, with board and card games as the main research object, is a very influential research field in the direction of artificial intelligence and has made outstanding achievements for many years[2]. In 1997, IBM's chess computer "Deep Blue" beat Gary Kasparov, then the world champion, 5-5. In 2007, academics from the University of Alberta in Canada were published in Science. A paper published in the Journal science claims to prove the mathematical validity of Checker3The paper was named one of the top ten scientific advances of the year by the journal Science. Through the continuous efforts of a large number of researchers and fans, most of the chess and card games have already had a relatively ideal solution strategy[3].

2. Research significance

Weiqi is the quintessence of Our country, which originated in China. According to legend, it was invented by the Ming Emperor Yao or Shun in ancient times and has a long history. From the evolution into the original Boben, to the development of the modern game, four chess has experienced at least 2500 years of long history. As one of the most complex human Boben projects, Weiqi has its remarkable characteristics in computer processing. The simple and fast Weiqi has a high complexity in computer processing, which is a good touchstone to test the development level of artificial intelligence. With the development of the computer state, the study of the computer Go game has attracted the enthusiasm of many scientists and enthusiasts, and has become a hot topic in recent years. How to improve the chess ability of the computer go game program has become a great concern for artificial intelligence.Study on computer Game of Yingyu Monteca live tree control rope[4].

3. Basic theories and methods of computer games

3.1. Main characteristics of computer games

Games that computers can play have many characteristics. According to the number of players, the game can be divided into single-player game, two-player game, three-player game, etc., among which the game with 3 or more players is collectively called multi-player game.

A two-player game is one in which there are two players. A two-player game with competitive relationship is a game in which players choose their own optimal game behavior according to the game rules in order to achieve a certain game goal, and bear the reward results attached to the game behavior[3]. Weiqi, Chinese chess and Chinese chess all belong to two-player games, and are tools.A two-player game in a competitive relationship.The zero-sum game has a large proportion in the two-player game with competitive relationship. The two-man zero-sum game isgame with the following characteristics: the gain of - players is exactly equal to the loss of - players, and the loss of
one participant is exactly equal to the gain of - players. If the gains are positive and the losses are negative, then the gains and losses of two players in a two-player zero-sum game must add up to exactly zero. A two-player game with easy decision is a kind of two-player zero-sum game. If -- a participant.Win, the other participant must lose: If - one participant loses, the other participant must win: if it's a tie, neither participant loses and neither player wins. In general, in a two-player zero-sum game, it is the goal of each player to make himself or herself at least undefeated and better to win. Common two-player games, such as Weiqi, Chinese chess and Chinese chess, belong to two-player zero-sum game[6].

![Figure 1. Monte Carlo game flow chart.](image)

3.2. Complexity and solvability of the game

Complexity is a scientific indicator of the difficulty of using computers to solve game problems. Complexity is a basic concept in computer games, and it is an important index of resources needed by computers to deal with problems. It is used to measure the amount of resources needed by computer programs to solve game problems. When the required resource is time, the time complexity is used to measure the time resource. When the resource to be used is space, the space complexity is used to measure the space resource. Theoretically speaking, there are many ways to describe the complexity of computer games, among which the two most commonly used are the complexity of state space and the complexity of game tree.

The state space complexity refers to all the different legal games from the initial state of the game. The number of states, which essentially describes the range of complexity of the game that can be solved by the exhaustive method. Tree complexity refers to the number of leaf nodes in the minimum game tree generated from the initial state of the game that can completely solve the game problem. It essentially describes the range of complexity of the game that can be solved by searching in the game tree[7].

It is often difficult for us to accurately calculate the complexity of the state space or the complexity of the game tree, but it often needs the result, so we usually take the approximate method to estimate, and get a result that is close and has a definite value of use[6].
3.3. Commonly used search algorithms for game trees

Minimax is a decision rule derived from the two-man zero-sum game theory. Its purpose is to minimize possible losses while maximizing potential gains - typically applied to important fields such as machine gaming, decision theory, and statistics\[9\]. Minimax decision rules have a wide range of applications, both in the case of alternating sets and simultaneous sets, and have been extended to, for example, general decision theory, or to more complex game projects with uncertainties\[10\].

The minimax theorem put forward by Oohnvon: Neumann is as follows: for a two-man zero-sum game with any finite state, there is a evaluated value V and a set of strategies applicable to both sides of the game, When, the following two conditions are met: (1) Given player B's strategy, player A's best return is V; (2) Given player A's strategy, player B's best return is _V07. For a two-player zero-sum game, both players choose the best placement for each other's plates according to the rules of the game. According to the zero-sum principle, this strategy is also equivalent to choosing the worst placement for each other. The process in which the two sides take turns to set is the process of forming a minimax.

The minimax search algorithm is a recursive game tree search algorithm based on the minimax process, which is often used in two-player games. In the minimax search algorithm, each node of the game tree has one value, which is used to represent the advantages and disadvantages of the corresponding disk of a certain game party. For a two-person zero-sum game, in the calculation of the value of internal nodes in the game tree, the value of each -step drop of a -party is the minimum value that the other party can handle\[11\].

4. Summary

As a separate discipline, computer game has its complete and relatively independent theory and research methods. This chapter mainly introduces the basic theories and methods of computer games, including the characteristics of games, the concept of game tree, the complexity and solvability of games, the evaluation of game disk and the commonly used algorithms of game tree search, and has a deep understanding of some basic knowledge of computer games\[12-13\].
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