

The Application of Optimized Artificial Intelligence Algorithm in Chinese Chess

Yingying Qiu^{1, a}

¹ Guangxi Economic and Trade Vocational and Technical College, Nanning, Guangxi, China, 530021

^aemail,

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Abstract. In the field of artificial intelligence, the rule of Chinese chess is different from International chess and chess and it decided that the Chinese chess artificial intelligence algorithm has its particularity. Based on the characteristics of Chinese chess, this paper analyzes the computer artificial intelligence algorithm of Chinese chess, such as game tree algorithm, historical heuristic algorithm and Alpha-Beta algorithm, and puts forward the recent activity method, dynamic sub-force method and player style method. The computational analysis shows that the improved new algorithm has a significant improvement in efficiency and speed.

Introduction

After the birth of the computer, artificial intelligence has been constantly moving forward, its specific applications are also more and more areas. The development of artificial intelligence has several directions, including simulation of human intelligence and intelligent game with human beings.

Computer in the chess aspects of the intelligent algorithm research, foreign countries have made a breakthrough in the chess, 1997 IBM's "deep blue" (Deep Blue) in the game to beat the men's chess leader Kasparov, even if the accidental factors, But also can mark the computer's chess artificial intelligence algorithm has reached the world champion level and international master level. In contrast, computer scholars in Chinese chess research than the chess to be late, coupled with the complexity of Chinese chess is higher than the chess, so the Chinese chess computer program has not yet reached the top human level, China Chess computer artificial intelligence algorithm there is room to further improve, but also need a lot of man-machine competition data to support. Although it is inevitable to invest in the hardware, but the algorithm research also need to be a breakthrough.

Although the exhaustive method must be able to solve the problem, but it is clear that it is usually inefficient. Chinese chess all the way to go (full search tree) complexity is 10 of the 150 power and that is using the world's top computer to operate, all search also need $3 * 10^{127}$ square years, obviously this is inefficient and unnecessary. Some of the way out clearly do not have to consider, such as the first step will start (handsome) step forward, or gun hit the other horse, or out of cars, so when using intelligent algorithms, you can artificially set some conditions to reduce the search time, search efficiency. However, after the start, the law is not so obvious, so the need to use intelligent algorithms to improve the speed of operation.

The Current Intelligent Algorithm

At present, there are game tree, historical heuristic algorithm (and its special killer algorithm), Alpha-Beta algorithm and valuation algorithm, which are used in the analysis of Chinese chess.

Game tree algorithm refers to the search, not just search for their side, but also to search for each other to participate in the game, that is, all possible coping strategies are searched. Obviously, its essence is exhaustive. The essence of the exhaustive law, of course, determines that it can get the optimal solution, but does not meet the time cost and the effect of the request. According to the

study, the Chinese chess in the Bureau of the stage, each step about 35 kinds of sub-law, so at a time to search for the next two rounds of walking (one step, one step, one by one, the opponent step by step) Need to check $35^4 = 1500625$ kinds of possible. And then add a round, the search target will surge to $35^6 = 1.838$ billion as much as possible, we can see that the game tree algorithm does not apply to the intelligent operation of human-computer warfare.

Historical heuristic algorithm refers to the search process, if you have encountered in the history of the search has been almost the same situation, then the previous search that the best way to go, in general, there is a great probability to become the current situation under the good way. This is also one of the methods used by human players in practice. The human player has accumulated a lot of experience in the practice of playing chess for decades, so the effect of the historical heuristic algorithm on human players is self-evident. For the machine, because the storage space and the search speed and the accuracy of the search comparison are far better than the human, so the historical heuristic algorithm in the study of man-machine war has a certain position.

Alpha-Beta algorithm is based on the current node information to determine the sub-nodes of the upper and lower bounds Alpha and Beta, and then according to the return value of the child node for the corresponding operation. For example, at a node, the situation is MAX, and the maximum value of 55 is returned from all the child nodes. If the value of the first child is 55, the other child nodes do not have to search again. Obviously, the efficiency of this algorithm is affected by the order of the nodes, is unstable.

The Improved Intelligent Algorithm

In view of the above methods, some improvements can be made to improve the efficiency of the algorithm.

Recent Activity Method. In the historical heuristic algorithm, the common idea now is to find similar chess games in the history table, thereby reducing the amount of search and the amount of computation. But the human players in the process of game with the machine found the problem, which uses the sword to follow the common sense chess, the results of machine algorithms tend to be defeated. Human players on this situation will not be affected by this "strange trick", but the machine cannot effectively deal with the historical heuristic algorithm weakness lies in this, one is not deliberately out of ordinary opponents of the opponent's trick to prevent, Is that the situation is similar to the same under the law.

The current research gap lies in the fact that the overall situation of the current disk is estimated, so it is necessary to analyze all the pieces that can be moved, including the analysis of the other pieces. In practice, however, we learned that the two recently moved pieces, including the pieces that had been moved in the last few steps, and the pieces affected by the move before and after the pieces (such as a piece moved to the gun, may not be eaten with this piece, but only for the use of guns), often attack point (general or eat) where. Therefore, in the analysis of the time, we should first analyze the other side of the last step or a few steps to move the pieces. Moreover, in extreme cases, the need to reduce the amount of analysis, improve the speed, you can only analyze the other recently moved the pieces. In this way, the amount of calculation will be greatly reduced and the program cost will be greatly improved.

This method raises the question of the fact that the pawns that are currently moving cannot be moved, including one's own pieces and the other's pieces, may become viable pieces after a step or a few steps. For example, the horse was originally stuffed, but after the relevant pieces moved, the horse's direction of the law from the ban into a valid, or guns across the two pieces cannot eat, when one of the pieces from the line after the opening, the gun becomes a can eat. This kind of method is also in the search process should be considered.

From Table 1, we can see the superiority of the recent activity method.

Search depth	The number of opponents in Exhaustive method			The number of opponents in Recent Activity Method		
	10	11	12	1	2	3
1	1.10E+12	1.76E+13	2.81E+14	16	256	4096
2	1.21E+24	3.09E+26	7.92E+28	256	65536	1.68E+07

Table 1 The comparison table of exhaustive method search and recent activity method search

When the search depth is 1, in the case of the opponent remaining 10 to 12 pieces, the exhaustive method to search for the child may be a total of 10 to 12 times the order of magnitude, and the recent activity method only need to search 1 to 3 Pawn, the number of children to be searched for may be only on the order of 4000.

When the search depth is 2, in the case of the opponent remaining 10 to 12 pieces, the exhaustive method to search for the child may reach a total of 10 more than 24 times the order of magnitude, and the recent activity method only need to search 1 to 3 The number of pieces to be searched for can only be on the order of 10 in the order of 10.

When the search depth increases, the exhaustive method and the latest activity law are of the order of magnitude.

Dynamic Sub-Force Method. The valuation algorithm is to attack the pieces of the attack, the loss of the attack as a valuation, each of the attack formed by the intensity and defense effect to do a comparison, so as to get more favorable side of the way. This method of the pieces of the attack power is mechanical fixed and the disk situation cannot make the proper calculation. According to the rules of Chinese chess we know that when a pawn is the other side of the coach to kill the chess attack, the other must deal with, or will lose chess. So a general of the pieces, the attack should be seen as a greater upgrade; and it cannot move the pieces, the attack should be appropriate to reduce.

In addition, a pawn, in different board area caused by the attack is different. For example, in the same no way to eat, the soldiers generally more than the threat of nine soldiers in the search process should also be properly considered.

There is also an unusual dynamic sub-force, that is, the combination of force. Such as double guns, double horses, horses and other guns. The combined force should be based on the original sub-force of the piece and its formation in the disk attack and defense system to make another calculation and analysis.

Player Style Method. Another blank spot on the current market is that there is no analysis of the chess style of the player. For example, the player starts with a hand-held hand and a cactus guide, and its starting style is different. And a player who always wants to oppose the same pawn and try to avoid the clash of players, their style, the level of pressure and threat is different, should take a different countermeasure. Therefore, in the game to join the player style of the deal will be able to improve the speed and calculation results. In practice, the pieces can be divided into large attack power of the horn guns and small attack of the two soldiers, the analysis of the opponent against the type of child. Further, because the players are generally not the horse transfer, the gun as a commuter. For example, the attack power of the car is significantly greater than the artillery, if one side to use the car to the other side of the horse or gun, generally there will be hidden behind the law or have more law. Therefore, it is also possible to divide the pieces of the large attack force into two types of cars and artillery, which are divided into opposites. After such a breakdown, the chess game analysis can create a new path.

Similarly, it should be on the start, intraday, messy and other stages were analyzed separately, so that the various stages of the player's style to make a comprehensive judgment. This method is a new method, not too much to learn from, and because it is not easy to quantify cannot be precisely defined and measured, it can only from the fuzzy mathematics, gray theory and other non-traditional methods to proceed to analyze.

Some Precautions

In the process of programming, there are some problems that need attention, can improve the efficiency of computing. For example, in the long-term practice, the predecessors summed up the classic Chinese chess game, such as guns, flying, five or seven guns on the screen horse, etc., can be used to maintain the common start into a library, until the Bureau to search, which can improve the efficiency of the program. In the middle of the search period, you can cache the calculation process, if the opponent has been used to search and save the law, you can directly in the cache search records for the child, so as to avoid re-search time and space overhead. This approach is also very useful for the mess. In the postseason phase, there are often some unexpected abandonment of the law can play the effect of killing chess, so to a large extent to increase the exhaustive search and calculation. In order to improve efficiency, on the one hand can do the debris library, on the other hand should also use and study more efficient algorithm in order to achieve a shorter time to achieve near-exhaustive effect.

Conclusion

In view of the artificial intelligence problem of Chinese chess, this paper will focus on the pieces with recent activities and do the targeted search analysis on the Chinese chess disk changes, which can greatly improve the efficiency of the operation. This article also creatively puts forward the method of judging the style of the player from the macroscopic point of view. The study of the player's style will have a positive effect on improving the efficiency of Chinese chess game.

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