# APPLICATION OF ARTIFICIAL INTELLIGENCE IN COMPUTER GAME SEARCH ALGORITHM

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***ABSTRACT****: An important branch of computer science is the development of artificial intelligence, which is an important direction for the development of artificial intelligence. Machine game is a complete knowledge game, that is, both parties involved are fully aware of the situation and status of both sides of the game at any time. The core idea of machine game is not complicated, in fact, the game tree node valuation process and the game tree search process combination. At any intermediate stage of the game, a game tree can be conceived on the stand of one of the parties to the game.*

***KEYWORDS****: Artificial intelligence, computer, game search algorithm, application, research*

## 1 INTRODUCTION

An important branch of computer science is the development of artificial intelligence, and the game of chess is also an important direction for the development of artificial intelligence. Many well-known domestic and foreign scholars and well-known scientific research institutions have been involved in this aspect of research, after more than half a century, so far has made many amazing achievements. In 1997, IBM's "Dark Blue" beat the world chess champion Kasparov, aroused the world. In addition, the Othello (Othello) program Logistello and the Chinook chess program Chinook of the University of Alberta in Canada are successively identified as world champions of two-person, zero-sum and complete information games (so-called duo, zero sum, That is, at any moment of the game process, only two players on both sides of the game, either party's understanding of the current situation information are sufficient, full and fair, that there is no probability of information, and the game must be able to win the final victory negative). Research is underway on many other kinds of game, such as go, Chinese chess, bridge, poker and so on. The core technology of machine game is game search algorithm, which is also a hot topic in machine game research.

Artificial intelligence is a rapidly evolving and comprehensive science. Its central task is to study how to make computers work that can only be done by human intelligence in the past. There are many fields of research in which machine games are one of them. Machine game is a complete knowledge game, that is, both parties involved are fully aware of the situation and status of both sides of the game at any time. Backgammon, chess, etc. all belong to a complete knowledge game. The typical method in a complete knowledge game is to search the game tree to decide which step to go. The standard machine game consists of four parts: (1) state representation; (2) candidate approach; (3) search method; (4) a situation assessment function to determine the relative advantage state. The artificial intelligence of machine game lies in that the computer finds a best governer from all legal candidate governers by the search algorithm based on the situation evaluation function, and the search algorithm makes a choice.

The search algorithm can be divided into two kinds: blind search algorithm and heuristic search algorithm. The difference between the two is that each step of the heuristic search algorithm tries to search toward the target state, while the blind search algorithm is based on the fixed rules Search, and then determine whether to reach the target state, compared to heuristic search algorithm to overcome the blind search algorithm blindness. Although the heuristic search algorithm can solve the problem of blind search algorithm of the blind search, however, in many practical problems to solve, the lack of some necessary information to build a heuristic search algorithm, this time using blind search algorithm is still the effective way to solve the problem. In order to improve the performance of CS algorithm, the idea of PSO algorithm is used in the location update process of CS algorithm, and a cuckoo search algorithm based on particle swarm optimization algorithm is proposed. In this way, the bird's nest renewal can always search the current optimality and the global optimum like the particle in the PSO algorithm, not only preserves the

randomness of searching, but also reduces the blindness of searching and accelerates the particle to the optimal solution convergence. At the same time, the stochastic elimination mechanism of CS algorithm makes the algorithm escape from the local optimum successfully, so as to improve the performance of CS algorithm. Starts from original state S, the use rule production search tree next any point, inspects whether appears problem status G, if has not appeared, by this condition use rule production next any point, again inspects again whether for problem status G, if not for, continues above operating process, carries on the leaf point (i.e. not to be able continuously to regenerate new condition point); When had not discovered when problem status G, on the date back to a result, possibly takes another one to expand the search the branch, produces the new condition point; If were still not the problem status, presses this branch to expand continuously to the leaf point, if had still not discovered the problem status that uses the same recollection means to return draws back to the upper formation point, expands the possible branch to produce the new condition; Works so continuously, until found problem status G.

The first extreme value search algorithm studied the object is the single variable extreme search problem and the so-called univariate extreme search problem refers to the variable search only need to optimize the extreme value of a variable. It is similar to the MRAS gradient method, the design method of first introducing the loss function, through the filter, get the loss function of the gradient, the variable to search along the loss function of the negative gradient direction changes can easily make the loss function to get the maximum or minimum value. And, of course, the scope of the adaptive gain depends on the size of the input signal and the process gain, go beyond the limit of adaptive gain will cause the system unstable and it brings to the single variable extremum search algorithm design big obstacles. The multivariate extreme value search algorithm is obtained by using different gradient of each variable filter, then each variable integral value after, after a comprehensive demodulation as the control variable of the system, because the gradient loss function for each search variable is different, so the separation of search variables to then prevent interference between. Mainly for the current particle interference information items, can be achieved so that the population jump out of the local maximum converges to the global optimum performance and its updating formula tends to Cauchy distribution when the degree of freedom is small in the initial stage of iteration, and has strong global search ability. When the degree of freedom in later iteration is large, t distribution tends to Gaussian distribution with better local search ability. The algorithm in the mid-term of implementation, the mutation operator is between the Cauchy and Gaussian distributions, which combine the Cauchy and Gaussian distributions to perform better global and local development searches.

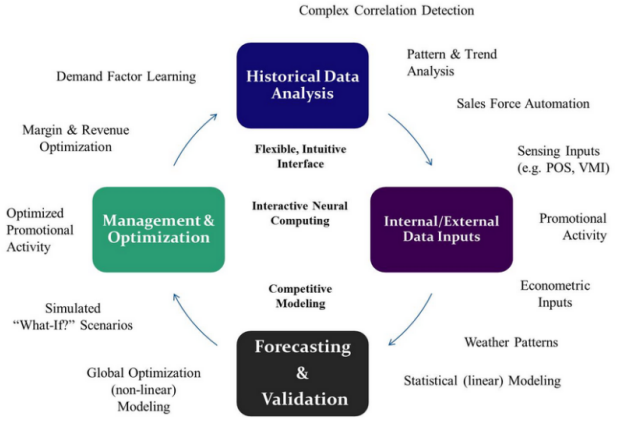


**Figure 1. The Data Overview Structure and Pattern**

The core idea of machine game is not complicated, in fact, the game tree node valuation process and the game tree search process combination. At any intermediate stage of the game, a game tree can be conceived on the stand of one of the parties to the game. The root node of the game tree is the game of the current moment. Its son node is a game of chess after assuming a further step. The grandson node is a chess game that is further played from the son node's game, and so on. The whole game tree, until the outcome of the game can be divided. The whole game tree is very large, and the different chess are different. The game tree with big branch factor is obviously bigger than the game tree with chess factor such as chess. The task of the game program is to search the game tree to find the current optimal walking chess. A very small search of the game tree can achieve this goal. Very small search, because the purpose of the two sides of the game to achieve the contrary, one side is just looking for the interests of the interests of one side is lost, so one side of the game always want to go the next child node is the largest value, while the other Quite the opposite. This formed a very small process. In this process, the most important is the search algorithm, efficient search algorithm can guarantee to use as little time and space loss to find high-value walking. But really want to improve the game chess, you must also have a good evaluation mechanism for the situation, that is, the valuation algorithm for backing. That is to say, the value of the situation appraised by this valuation algorithm must be objective, correct and conclusive to

evaluate the merits of the situation and the extent of its advantages and disadvantages.

## 2 COMPUTER GAME SEARCH ALGORITHM

### 2.1 The basic idea of machine game

The game program to answer is how to find the best move in the current game tree. In fact, the program cannot and does not need to search all the nodes in the entire constructed game tree. For those apparently bad walking methods, we can cut off the subtree rooted in it. Moreover, there is no need for search to be able to determine the outcome of the game, as long as the search to our pre-requested depth on the line. If you really want to make the search go, we must reduce the search space is small enough. When we search to a certain depth, we must use the situation evaluation mechanism to evaluate the current situation, give a reference value, and select the best walking node according to the principle of maximum and minimum. Then returns the node to the superior, and then gives a more objective evaluation of the value of the father node in the current situation, and then returns the obtained node to the superior until the root node, so that we can get the best method It's

In the search process, the search algorithm is the most important, efficient search algorithm can save us a great deal of time and space, which can get a better way to go. But really want to improve the game chess power, but also need a good situation evaluation mechanism, is the valuation algorithm. The use of valuation algorithms can be more objective and correct evaluation of the quality of the situation and its extent.

### 2.2 The composition of the machine game system

Starting from the basic idea of machine game, we can relatively easily determine the general structure of a machine game system.

The first is how to express the problem, that is, to find a more appropriate way to record chess. The method of representing the board is an important issue. The general method uses a two-dimensional array to represent the board. A position is usually represented by a byte. However, the position of each board is far less than 256. For many chess classes, a bit board is a space-saving and efficient way to improve performance.

Second, for different chess, according to its rules to have a corresponding method to generate the law. We can use it to construct the whole game tree, that is, we can generate all the grandchildren nodes of any node through this function, that is all the following rules that follow the rules.

Then, is the valuation function. Valuation functions are techniques that evaluate the value of a game based on certain established rules. This involves evaluating the value of the piece, the flexibility of the piece, the ability to control the board, the evaluation of the relationship between the pieces, and so on, but also with the chosen search algorithm. This part of the designer's knowledge of chess great relationship, and different chess vary greatly.


**Figure 2. Computer Game Search Algorithm**

### 2.3 Genetic Algorithm and Machine Game

Genetic algorithm used in the machine game search algorithm: Search for the game tree, the response position binary coding, chess positions randomly arranged to get a response string. Each pair of chess strings contains the game process of the two sides. In this way, N response strings are generated. During the genetic process, the opponent strings that are already favorable to each other are selected as the optimization target to obtain the initial population. The initial population crossover, mutation operation, get a new game on the string. Finally, we choose the starting point of the string with the largest fitness function as the solution to the problem. This algorithm can focus the search on the high performance part and can find the best method quickly.

The computational time spent in large-scale calculation is quite long, so it is not suitable to calculate the numerical problem with a large number of particles. Linked list search method, also known as the background mesh method, in the search for an increase of a cover all the particles of a single size grid, the grid size is not less than the maximum support for all particles in the domain, then for a given particle, its phase neighboring particles can only be in the same grid or immediately adjacent to the grid. According to the structure of the grid, it is easy to get the immediate grid of the grid. Therefore, when each of the grids is linked with the grid to which it belongs, the search

range can be limited to the grid to which it belongs and its immediate vicinity.

In the PVM parallel programming, the need for the main program and from the program. In this model, only layer 0 is a strict main program. The Nth (N> 1) is a strict subroutine. The other layers should obtain the current state from the main program as well as allocate tasks to the next layer or their own calculations, both the main program, but also from the program, in order to construct the convenience of parallel computing network, you can write them into a program, in different computers as long as the configuration can make the appropriate part of the work, the construction process is very simple convenience.

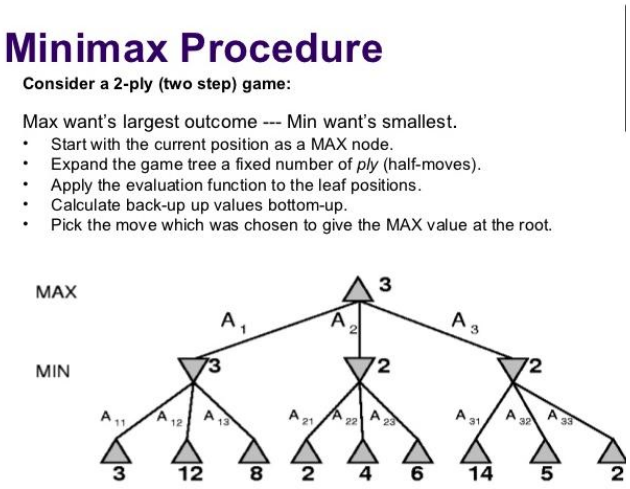


**Figure 3. The Overview of the Searching Pattern**

We will training data set from a low dimensional feature space nonlinear mapped to a high-dimensional feature space, mapping, training data set in low dimensional space linear inseparable, mapping, the training data set in high dimensional space into a linear separable, and then in the high-dimensional space with the method of linear separable class work is completed, after the completion of the travel through the inverse mapping back to low dimensional space. Many parameters, such as operation operators in the algorithm can be adjusted spontaneously according to the historical information and the latest information in the operation process.

In SLA, mutual learning phase based on sharing mechanism is a very important process, which undertakes the task of searching the global optimal solution. Sharing mechanism includes information exchange and information sharing. In information exchange, individual individuals in the population exchange their historical information and current information, including their respective searched solution spaces and corresponding fitness function values. Through information exchange, the current generation global optimal solution, and the individual taboos of individual individuals in the population are fused to form global taboo information.

Genetic algorithm optimization situation assessment function: In the machine game, the situation evaluation function to a large extent determines the game chess strength. When using genetic algorithm to optimize valuation, you can use some famous game or game with other games to see how likely it is to win when using a certain set of parameters. After several tests in general you can get a better valuation. Traditional algorithms generally only maintain a good set of parameters. Genetic algorithms are parallel optimization algorithms that can maintain several sets of better parameters simultaneously. The worst one is removed by adding a new set of parameters to it and comparing it to the old set of parameters.

## 2.4 Search algorithm in machine game

The basic idea of game search has been more than half a century from the present. At present, it has been extensively studied that it is a game search with two people, zero sum and complete information. Two people, zero and complete information game theory has been very systematic search, the most basic is the very small algorithm. Based on this, it is a mainstream, depth-first alpha-beta search and its series of enhancement algorithms.

Minima algorithm. Always valuing the current game on one of the two game players' standings, giving a higher score to our favorable game, which is unfavorable to our giving a lower score, and for those who cannot be more specific. To determine the strengths and weaknesses of both sides is given a medium score. When we walk the chess, choose the son of a great score to go, the other chess choose the node of the smallest value go.

Negative value search. In the extremely small search, every time in the selection of very small nodes, we must determine the node is to take the maximum or minimum, in order to eliminate the difference between the two makes the program easier to understand More than half a century later, Knuth and Moore proposed a negative maxima algorithm in 1979, which only needs to maximize the value of the game. The core idea is that the value of the parent node is the maximum of the negative values of each child node.

One of the obvious problems with extremely small searches is data redundancy. Redundant data is bound to be deleted to reduce search space. The

alpha-beta pruning proposed by Monroe Newborn in 1975 is what we want to use Methods. Adding alpha-beta pruning to Minimal or Negative Search results in an important alpha-beta search.

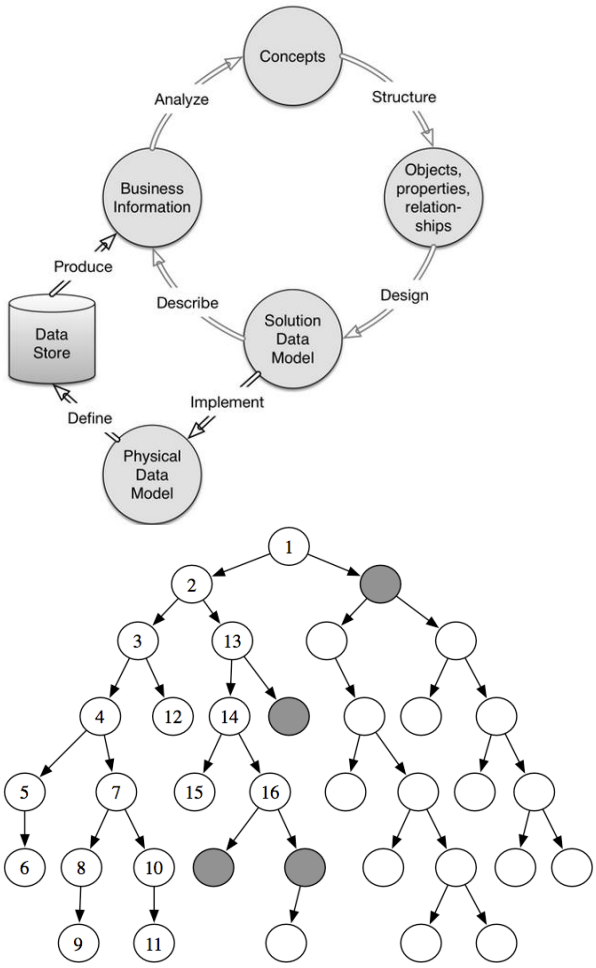


**Figure 4. The Finalized Model Pattern**

Because of its simplicity, ease of understanding, and small footprint, alpha-beta search is widely used as the basis for current mainstream search algorithms. However, one disadvantage is that it is very sensitive to the order of nodes. For nodes on the same level, if the arrangement is reasonable, the pruning efficiency can be very high, so that the actual searching game tree approaches or even reaches the minimum tree. The definition of the smallest tree is to search down, the first node is to find the way to go. However, once the nodes are arranged in the worst-to-best order, they may not be able to produce pruning, which is actually equivalent to searching the whole game tree.

## 2.5 Innovative Application of Genetic Algorithm in Machine Game

The standard genetic algorithm adopts binary coding. The advantage of this coding method is that the gene expression is exquisite and the coding of the problem is long, which is good for solving the combinatorial optimization problem. However, the method is not flexible enough and needs to be mapped from the coding domain to the problem domain. The intermediate process More complicated. Genetic algorithm can also use tree coding, to solve the problem of large changes in coding length, the tree structure is more flexible representation. And machine game itself is the process of searching the tree structure. If the game tree can be directly manipulated, the encoding process can be simplified and the game efficiency can be improved.

The game tree is considered as the population of genetic manipulation. All the subtree composed of root node and leaf node in the game tree are individuals in the population. The fitness function of each individual in the population is calculated according to the optimization objective, and the initial population is determined according to the fitness function value, so that the individuals with high adaptability (large fitness function value) get more crossover and heredity Opportunity to generate a new generation of individuals, through repeated iterations, can be satisfactory solution. The following example to Gobang, to explore all aspects of genetic algorithm to achieve.

Initial population generation: During the simplification, a 15 × 15 Gobang board was used, with a total of 255 checkers. To determine the game tree under a certain situation, first list the current state can play chess position, in the backgammon, in addition to the position of playing chess, the remaining positions are chess positions, playing chess for different locations Different ways to deal with, which can be the current state of the game tree, and as a genetic operation of the population. Before and after the game is started, the game tree obtained is extremely large and complex, so it is difficult to analyze and operate it. Many of the positions are meaningless to the five children. Therefore, the game tree redundancy can be reduced through the constraint.

Select population: In order to reduce the size of the game tree, according to the rules of Gobang, we can choose some vacancies in the current state as chess points. For example, a chess piece at a location with a minimum distance of more than 4 is excluded from it; for a place where the chess piece is first placed, spaces in hand positions such as "33", "44" and "Changlian" are also excluded. Through the above operation to streamline the game tree, but also choose a practical significance, a higher feasibility of the response.

## 3 CONCLUSION

In this paper, we concisely explain the principle of machine game theory and the structure of machine game system, and give a comprehensive description of the existing two-person, zero-sum and complete information search methods. The study of the two-person, zero-sum and complete information game has been more than half a century old. The system of knowledge structure and its hierarchy are clear, and many amazing achievements have been made. In addition to many of the same situation in the game tree, there are many similar situations.

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