Research on Path Planning of Robot Based on Artificial Intelligence Algorithm

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Abstract. the Task of Robot Path Planning Based on Artificial Intelligence Algorithm is to Determine an Optimal Strategy, with the Goal of Maximizing the Return. When the Robot is in a New State, It Needs to Select an Action from the Action Set and Execute It. In Order to Improve the Quality of the Algorithm, It is Necessary to Apply the Search Strategy to the Action Selection. in the Path Planning System of the Robot, One of the Most Critical Links is the Realization of Directional Reference Vehicle Scheduling. Generally, Artificial Intelligence Algorithm is the Most Widely Used in Robot Path Planning. in This Paper, an Artificial Intelligence Algorithm is Used to Optimize the Vehicle Scheduling Problem. the Path Variable of the Problem Can Be Defined Correspondingly, Which Originates from the Planning Node. the Sequence of Sending Points Reached by Completing Other Sending Requirements is Called the Legitimate Sub Path, While the Corresponding Traversal Path Does Not Include the Sequence of Several Legitimate Sub Paths of Repeated Planning Points. the Algorithm Can Significantly Improve the Efficiency of Multi-Robot System, Reduce the Number of Explorations and Speed Up the Process of Convergence.

1. Introduction

This Section Focuses on the Concept Setting of Ai Algorithm, Including the Basic Idea of Ai Algorithm and the Basic Operation of Ai Algorithm[1].

1.1 Basic Idea of Artificial Intelligence Algorithm

Artificial Intelligence, Short for Ai. It is a New Technical Science to Study and Develop the Theory, Method, and Technology Application System for Simulating, Extending and Extending Human Intelligence.

Artificial Intelligence is a Branch of Computer Science That Seeks to Understand the Essence of Intelligence and Produce a New Kind of Intelligent Machine That Can Respond in a Similar Way to Human Intelligence, with Research in the Field Including Robotics, Language Recognition, Image Recognition, Natural Language Processing and Expert Systems[2-4]. Since the Birth of Artificial Intelligence, the Theory and Technology Have Become Increasingly Mature and the Application Field Has Been Expanding. It Can Be Imagined That the Scientific and Technological Products Brought by Artificial Intelligence in the Future Will Be the “Container” of Human Intelligence. Artificial Intelligence Can Simulate the Information Process of Human Consciousness and Thinking. Artificial Intelligence is Not Human Intelligence, But It Can Think Like a Human and Possibly Surpass It[5].

Artificial Intelligence is a Challenging Science, and Those Who Do Must Understand Computer Knowledge, Psychology and Philosophy[6]. Artificial Intelligence Covers a Wide Range of Science. It is Made Up of Different Fields, Such as Machine Learning, Computer Vision, Etc. Generally Speaking, One of the Main Goals of Artificial Intelligence Research is to Make Machines Capable of Some Complex Tasks Which Usually Require Human Intelligence to Complete. But Different Times and
Different People Have Different Understandings of This Kind of “Complex Work”. [7] in December 2017, Artificial Intelligence Was Selected into the “Top 10 Buzzwords of Chinese Media in 2017”.

1.2 Basic Operations of Ai Algorithms

Ai algorithm mainly consists of three ai operating parts, including selection, crossover and mutation. Here is an introduction to the three ai operations:

First, selection
What kind of algorithm is easier to be chosen by the next generation of artificial intelligence, it is necessarily algorithm with higher fitness, in this sense, the artificial intelligence algorithm with low fitness are difficult to be the next generation of artificial intelligence algorithms to choose reference, this evolution of artificial intelligence methods for the artificial intelligence algorithm of individual screening provides a good guarantee [8-11]. The operation of artificial intelligence algorithm is a kind of simulation of this phenomenon. In other words, the artificial intelligence algorithm individual that can adapt to the artificial intelligence algorithm is found in the previous generation of artificial intelligence algorithm, and this individual artificial intelligence algorithm is transferred to the next generation of artificial intelligence algorithm.

Second, cross or genetic recombination
Crossover operation: the crossover procedure refers to the artificial intelligence algorithms require crossover operation, and the probability of crossover operation is established, and the probability is the need to set in accordance with the existing in the system, after the last generation of artificial intelligence algorithms selected two individuals, part of the gene sequences in the two individuals algorithm for processing operations, and form a new individual after the replacement of restructuring. The essence of crossover operation is to select the individual closest to the optimal solution in artificial intelligence algorithm by means of constant recombination and replacement, which is also the most direct and simple method, and the error will be small. Different codes for different individuals.

2. Vehicle Scheduling in Robot Path Planning

2.1 Problem Description
In the path planning of modern robots, the orientation reference planning of robots is an important part of the process. In robot path planning, vehicle path problem is also developed with the development of robot path planning. At the beginning of the development of robot path planning, the problem of vehicle scheduling at that time focused on fixed information vehicle scheduling in the workshop. The whole process of scheduling control is very simple, just considering scheduling from the perspective of operational research. With the development of robot path planning, the center of robot path planning is gradually faced with greater transportation capacity demand. Therefore, with the reform of robot path planning method, a large regional center is established in many urban transportation hubs to meet the demand of vehicle scheduling in different locations. The main management goal is to realize the maximum robot bearing reference requirements by using shorter mileage and less vehicle resources. In the realistic robot path planning, the corresponding extension of different problems is gradually formed.

In order to complete the model discussion of the above actual situation, the following conditions are established:

(1) the robot's orientation reference center planning information is the same
(2) each sending point in the city is known
(3) the number of information of each recipient is known
(4) the actual distance between each receiving site and the node is known
(5) the quantity of M is full, and there will be no shortage of vehicle resources

Similarly, the relevant constraints for the robot's orientation reference programming are as follows:

(1) all demand points in the city must be covered
(2) the verification and loading of the robot bearing reference vehicle must be strictly controlled
(3) there is a predetermined upper limit on the total time of sending the car
(4) must plan on time

To sum up, the problem model is how to allocate limited planning vehicle resources under the above constraints, how to plan a reasonable route for the planning vehicle, and complete the corresponding delivery demand with the minimum time and transportation cost.

2.2 Problem Analysis
In the description described in the previous section, the path variable of the problem can be defined accordingly, starting from the planning node. The sequence of sending points reached by completing other sending requirements is called the legitimate sub path, while the corresponding traversal path does not include the sequence of several legitimate sub paths of repeated planning points.

In this optimization model, we add some virtual planning nodes and correspond with planning vehicles. On this basis, all routes are integrated into several major routes, and only one planning network is set for the whole route. A sending vehicle cannot pass two or more routes. For example, a planning node (number 0) needs to carry information to the remaining number 1, 2... N sending points, M cars are available, and m-1 virtual planning node is set (actually the same planning node, number is N+1, N+2,... , N+m-1), and set the distance matrix according to the actual meaning. Thus, we turn the CMTSP problem into the (N+M) point TSP problem.

3. Artificial Intelligence Algorithm Optimization for the Optimal Path Problem of the Robot's Orientation Reference Planning Vehicle

3.1 Design of Artificial Intelligence Algorithm of Robot Bearing Reference System
In the daily work of the planning system, the main research work is the key research content of the road planning. In this process, it is necessary to find the shortest route, which is also the shortest path. In general, the path planning and the shortest path design can be jointly analyzed. The problem of planning path shortest in reality is that there are many realistic conditions to be analyzed, including measurement surface, time, space, cost and other elements. The shortest path problem is applied to the bearing reference link of the robot. There is no denying that this is a reflection of the performance of specific analysis, but the operation of the algorithm in the specific analysis process is a common feature, and its differential content is mainly reflected in different curves with different weights. If the shortest distance is to be found, the weight can be designed as the actual distance in the path. If it is to be designed as the transport time, it is necessary to design it as the fastest distance in the path. Its time and distance are proportional to each other, so relevant operation effect can be achieved through the calculation of the algorithm, which is also to ensure that it can achieve maximum economic cost performance and build the optimal path at one time.

3.2 Vehicle Path Model Construction and Optimization
First, search the corresponding next sending place according to the first known sending point, determine whether the given distance data is the shortest idea, and then add the relevant constraint of time limit. Then if is not the most effective way is determined, the probability calculation, in the following ways according to the send the coordinates of points given position, find the sending point closest to the road, and according to the distance and velocity calculation within a prescribed time all can be reached the next point, get these sent some of the shortest path, here for the shortest path in road length for weight, Dijkstra algorithm has been proved to be one of the most optimal algorithm can get the shortest path. By the algorithm described above, the process of the algorithm is composed of a large cycle, the outer loop run n - 1, inner loop for 2, are running n - 1, so the time complexity of the algorithm above to add up to is O (n) + O (1) + O (n) + O (n ^ 2) = O (n ^ 2). Artificial intelligence algorithm is applied to the local area of the map. Based on the algorithm, the probability of the shortest path that can be reached at a receiving point is calculated as follows:
Pr_r = \prod_{i=1}^{N_r-1} P_{n_i} (S_{n_i}, S_{n_i+1})^m (S_{n_i+1} / S_r) \quad (1)

Where m represents the MTH vehicle of the regional online store's car source, n denotes the corresponding intersection point as point n, and path r denotes \{S1, S2... For the combination of SNr\} series of sections, Nr refers to the number of crossing points for the path r, Si and Si+1 respectively represent the sections continuously passing on the path r.

The average probability of all paths is:

\[ P = \frac{1}{N_p} \sum_{r=1}^{N_p} Pr_r \quad (2) \]

Where Np represents all sending locations within 3 minutes, PR represents the probability of corresponding paths within a certain period of time.

Finally, the model integration is carried out for the data of all vehicles of the vehicle source in the network, in which the weight is initialized, which is set as the highest on the first few days of the week, followed by working days or weekends, and the rest is the minimum. Because this article plan implementation process, solving the offline probability and without using Hadoop cluster to realize, so the process to achieve the required time is too long, given the time constraints, for the following formula P at the time of the test point to solve the probability, set to 0, which contains only the trajectory planning vehicle ratio, if the real calculated values of P, is bound to further enhance the forecasting model to solve the accuracy of the probability.

\[ Pro = \frac{1}{M} \sum_{m=1}^{M} \left( w_m \cdot (P + P_{real}) \cdot (1 + \alpha) \right) \quad (3) \]

M as the analysis on the number of vehicles, Wm is corresponding to each car planning information amount of weight (relative to the remote areas, urban area within the scope of use of the vehicle's weight is set higher), alpha is a weighted parameters, if the amount of information in the full range, is set to 0 to 1, otherwise set to 0, P (2) that the above formula in calculating the probability; Preal refers to the ratio of the delivery load rate of a certain vehicle in historical data and the overall delivery quantity, and the calculation formula is as follows:

\[ P_{real} = \frac{C_{pass}}{C_{all}} \quad (4) \]

Where the Call is the total amount of all the information that can be delivered within the specified time, and the Class is the number of cars that have actually completed the delivery within the specified time. According to the probability value of the most recent segment selection, each shortest path can be obtained. The path planning diagram and the final experimental results are shown below:

The algorithm is described as follows:

| Input: location of receiving point (GPS coordinates x, GPS coordinates y), current time (year - month - day - hour - minute - second) | Output: the path is the optimal probability value |
| --- | --- |
| 1. Input: point_id, road_id, G(x,y) is the location of a car, T is the limit time. |  |
| 2. Output: Pro |  |
| 3. i ← G(x,y), P ← point_id, S ← road_id; |  |
| 4. while is_stations||is_inouts /* Test the location is or not belongs to hotspots*/ |  |
| 5. Pro ← 1; |  |
| 6. |  |
| 7. If ! is_stations||is_inouts |  |
| 8. Foreach point pi ∈ P(x,y) do |  |
| 9. Fetch; /* Fetching all points to find the segment_id of the location*/ |  |
| 10. If i ∈ Sj , do |  |

4
11. Pro ← Pro_count(i);
12. Break;
13. Else
14. Goto 2;
15. Return Pro;

**Figure 1** Schematic Diagram Of Path Planning

**Figure 2** Final Experimental Results
4. Conclusion
The task of robotic path planning based on artificial intelligence algorithms is to determine an optimal strategy with the goal of maximizing returns. When the robot is in a new state, it needs to select an action from the action set and execute it. In order to improve the quality of the algorithm, it is necessary to apply the search strategy to the action selection. In the path planning system of the robot, one of the most critical links is the realization of directional reference vehicle scheduling. Generally, artificial intelligence algorithm is the most widely used in robot path planning. In this paper, an artificial intelligence algorithm is used to optimize the vehicle scheduling problem. The algorithm can significantly improve the efficiency of multi-robot system, reduce the number of explorations and speed up the process of convergence.

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