Automation and Machine Learning (2023)
Clausius Scientific Press, Canada

DOI: 10.23977/autml.2023.040206
ISSN 2516-5003 Vol. 4 Num. 2

Mini-Review of Unmanned Vehicle Route Planning Based on Ant Colony Algorithm

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Keywords: Driverless vehicle, optimal path, ant colony algorithm

Abstract: Unmanned autonomous vehicles play an important role in the future transportation field. It has changed the control mode of traditional cars from the source, and improved the safety and efficiency of the transportation system by means of science and technology. The optimal path of driverless vehicles is the focus of path planning, and selecting a correct algorithm is also the key. Ant colony algorithm is selected to improve the algorithm on the original basis, and change the pheromone update mode and search strategy. According to the combination of actual road conditions, the shortest path is not necessarily the best path. This improvement can better deal with emergencies in road conditions.

1. Introduction

With the development of urban technology, driverless cars appear in our field of vision. Driverless cars literally mean cars that do not require human operation and can be programmed to make themselves on the road. The introduction of driverless cars can effectively reduce the possibility of traffic accidents, and in recent years, it has also appeared in our lives in the form of ride-hailing, which has brought great convenience to our lives. But now the level of urbanization motorization is getting higher and higher, and traffic road congestion is a common problem in cities now. This problem has great disadvantages for unmanned vehicles. Driverless cars drive according to the route given by the program, and it is impossible to reasonably avoid unexpected situations that may occur on the road at any time. Therefore, in order to effectively solve such problems. This paper will plan the unmanned path based on the ant colony algorithm, no longer limited to the shortest path, and allow the unmanned vehicle to better cope with the unexpected situation on the road through the choice of multiple paths.

2. Principles advantages and disadvantages of ant colony algorithm

Ant colony algorithm is an intelligent algorithm, its inspiration comes from the natural ant foraging phenomenon, in nature ants in a certain range of random wandering, and leave pheromones in their own path, through the expression of pheromones, the information is conveyed to the subsequent ant colony, if other ants find a shorter road, the shorter road of pheromone concentration will be more than the previous road of pheromone concentration, will attract many ants to choose

the road, over time, the pheromone concentration on the road is getting higher and higher, so as to find the shortest path, the algorithm principle is:

1) First put the ants on the road where the food is unknown and start looking, and initialize all parameters;

2) If ants need to find food, they need to traverse all the roads;

3) If ants find food, the road they pass through will release a pheromone to attract other ants over, and more and more ants will find food

4) But if some ants do not take the previous path and open a new path, if the new path opened is shorter than the previous one, then more pheromones are released. Finally, after a long period of accumulation, more ants will choose this path, forming a shortest path.

The ant colony algorithm adopts a positive feedback mechanism, which continuously converges in the search process and finally finds the optimal solution. Because the algorithm is implemented through the behavior of animals, each individual can perceive changes in the surrounding environment through pheromones, make contact between individuals, change the choice of path, and because multiple ants are distributed for calculation, its calculation efficiency is very high; And the heuristic algorithm is not easy to fall into the local optimum, and can find the global optimum. Therefore, it has the characteristics of distribution, self-organization, positive feedback and robustness. It also has good optimization ability, so it is widely used in data mining and combinatorial optimization and other fields. Up to now, many people have proposed the application of ant colony algorithms in drones, robots and other fields, by changing the basic formula of ant colony algorithms or combining them with other algorithms to find a new movement trajectory.

The shortest path can be obtained by applying the ant colony algorithm to plan the path. However, the ant colony algorithm also has some disadvantages, such as: slow convergence speed, in the early stage of the algorithm, ants choose a node is random, although you can find the global optimal solution as much as possible, but the positive feedback takes a long time to play a role, so the initial convergence speed of the algorithm is slow. Optimization ability, ant colony algorithm has been widely used in many fields, but the change of parameters will also affect the self-generated optimization ability of ant colony algorithm and reduce the efficiency of the algorithm. Therefore, in order to solve these problems, researchers have also changed these shortcomings in many ways to achieve their own goals.[1-3].

3. Research on path planning of unmanned vehicle based on ant colony algorithm

Driverless cars are an indispensable existence in today's society, and we can also see them in daily life, such as driverless cars in schools to help deliver food, and driverless cars in restaurants to help serve food. Therefore, driverless cars have a wide range of applications whether indoors or outdoors, and driverless cars use sensors, computers, artificial intelligence, communications, navigation and positioning and other disciplines to control the complex. Driverless cars control the driving of unmanned vehicles through environmental perception, navigation and positioning, path planning and other technologies, and the driving of unmanned vehicles is mainly based on the program written in the computer to make unmanned vehicles perform a series of operations.

The development of unmanned vehicles has become a hot trend in the past two years, and many companies are currently investing in the research and use of unmanned vehicles. This year, Baidu Radish Express won the unmanned manned service license, allowing services to be carried out under the Yizhuang road in Beijing when the driver's seat is unoccupied. However, the situation on the road is complicated, there are many pedestrians and non-motor vehicles, and the weather is also a problem that we need to continue to study.

Driverless cars are an important development direction in the future, which can drive the development of other industries and promote green development. Driverless cars can bring good economic benefits, reduce the incidence of accidents, improve the environment and air quality, improve road traffic jams, solve parking problems, and facilitate special populations. But driverless

cars mainly rely on modern technology to solve problems, so there are still some drawbacks. Excessive reliance on navigation satellite systems, if you enter the underground parking lot, will lead to no signal, so that it cannot be located to choose the road, and now the charging pile in the road is also insufficient. And at present, the cost of autonomous driving technology is too high, the technology of automatic driving requires years of development and research The funds required are too high, not a normal family can afford, with the popularity of automatic driving technology its price will be greatly reduced, and the harmonious coexistence of unmanned vehicles and traditional cars and other problems, are what we need to solve in the future, solve these problems, the development of driverless cars will be newly improved.

4. Research on path planning of unmanned vehicle based on ant colony algorithm

The path planning of unmanned vehicles based on ant colony algorithm is also a research hotspot in recent two years, and many scholars have also published a large number of valuable academic papers on this issue. By improving the ant colony algorithm, the unmanned vehicle can choose the path more flexibly and efficiently.

4.1. Research on expansion of search scope

There are always various emergencies when driving on the road. For these unknown situations, driverless cars also need to be reasonably avoided. By changing the step size of the ant colony algorithm to expand the search range, you can sense whether the road ahead is blocked, and avoid obstacles as soon as possible, or choose to combine with the grid method to avoid obstacles. In the complex environment space, the space model is established based on the grid method, and the obstacles are placed in the grid to simulate the avoidance of obstacles encountered by ants in the process of foraging. At the same time, for the need of path planning unmanned vehicles, we choose to change the heuristic factor of ant colony algorithm or change the initial concentration of pheromone to detect obstacles, so as to avoid obstacles more effectively and reasonable.

When dealing with an emergency on the road, we need to perceive it before we can choose an alternative road. We can let the unmanned vehicle use it as an obstacle to avoid. At the same time, we can perceive whether the obstacle will affect the normal driving of the road according to the expansion of the search scope, to determine whether to continue normal driving on the current road or choose an alternative road.

4.2. Research on alternate paths

For the choice of path, under normal circumstances, we will choose a suitable path to reduce the travel time and distance. When using ant colony algorithm to select the optimal path, the algorithm is easy to fall into the optimal solution, and it is difficult to jump out of the existing cycle to find a more appropriate path. The two - way search method is selected to improve the algorithm. One end is specified as the starting point, and the other end is specified as the ending point. Both ends start searching at the same time. After the search stops, if the ants traveling in the forward direction reach the end point, the ants traveling in the reverse direction can get the driving path when they reach the start point; if two pheromones appear in the road, that means ants at both ends meet, a new driving path can be constructed by combining the two paths. In order to avoid excessive accumulation of pheromones in the search process, the ant colony algorithm will stagnate. We prevent this phenomenon by updating the pheromone of the ant colony algorithm locally or globally.

When selecting the optimal road, we can import the improved ant colony algorithm into the vehicle map, and exclude the road with too many traffic lights and too many courtesy pedestrians by combining the traffic condition information. In this way, we can exclude the road that is prone to congestion and the road that is too long according to the traffic condition during the initial selection

At the same time, we can select one or two roads next to the optimal path according to this, and ensure that there are intersections between them and the optimal path, so that we can deal with emergencies in the optimal path[4-6].

4.3. Research on road selection

The popularity of unmanned vehicles is to facilitate people's lives and free our hands when using unmanned vehicles to take passengers. For the needs of family life, many passengers will choose to take some things home on the way home. Therefore, in order to facilitate the use of passengers, the control system of the unmanned vehicle can be changed. In addition to selecting the shortest path, the place where passengers want to pass can be added between the origin and the destination, and the above methods can be used to plan the path to meet the requirements of passengers. For parking of unmanned vehicles, we can use navigation to judge whether this place can be temporarily parked, or search the nearest parking lot for parking[7-9].

When it comes to choosing roads, we definitely want to choose roads that are fast and not congested. There may be a problem of courtesy to pedestrians in some paths, especially near schools, and students crossing the road on the way from school may cause road congestion to a large extent, so when choosing roads, we should give priority to roads with less courtesy to pedestrians to avoid stop-and-go vehicles bringing a bad riding experience.

4.4. Research on obstacle avoidance

In the process of ant colony foraging, when encountering obstacles on the path, ants will avoid obstacles due to changes in the environment and find the optimal path at a faster speed. There are generally two ways to avoid road obstacle path planning: the first is to abandon all the roads previously specified and find a new path in the current location. The other is re-planning within the set range, and re-overlapping with the previously planned road. Because the ant colony algorithm has good global planning and is easy to combine with other methods, when avoiding obstacles, the advantages of the above two methods are combined and the ant colony algorithm is combined with other algorithms, which can be used flexibly.

5. Conclusion

The above research on path planning of unmanned vehicles based on ant colony algorithm is summarized, and it can be seen that improving the ant colony algorithm to solve the road problem is an effective method As the main development in the future road, driverless vehicles are the key to reduce traffic accidents. However, we need to study the diversity of driverless vehicles' road choices and how to update the road in real time according to the real - time nature of the road. Existing research can choose the most suitable path from many roads. However, we still need to study the road congestion caused by too many pedestrians in rush hours and holidays. As for the diversity of road development, we still need to study the problem of road selection for unmanned vehicles, so as to make the driving of unmanned vehicles more humanized, more convenient and more practical in the future[10-11].

Acknowledgements

This paper is funded by the Innovation and Entrepreneurship Training Program for College Students of Anhui University of Finance & Economics, with the project number of 202110378307. The ownership of the project research results belongs to Anhui University of Finance & Economics.

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