Research on Tourism Rural Itinerary based on MATLB Ant Colony Algorithm

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Abstract: On the basis of the basic principle and the improved theory, the paper makes a deep study on how to improve the ability of ACA, and then a new improved algorithm is put forward. The new algorithm make ant recognize the optimum path in short time adjusting the pheromone updating rule. Besides, the evaporation factor is instead by the pheromone volatile function, to insure the balance between “exploitation” and “exploration”, avoiding the algorithm into the stagnation. The simulation results of the typical travelling salesman problems (TSP) show that the improved algorithm has better performance.

1. Introduction

With the improvement of people's living standard, they begin to spend more and more time on touring. However, the development of tourism in our country is still in primary stage. To a large extent, travel agencies still play a role of the organization of rural and tourism. Their main task is to arrange rural, accommodations and attractions. The quality of tourism is greatly influenced by rural conditions and rural itinerary. Therefore, rural itinerary optimization in tourism will have a direct effect on the profits of travel agencies.

This paper focuses on the research of rural itinerary optimization in tourism on the point of travel agencies' view. And the problem of rural itinerary optimization in tourism is divided into “one day-visit” optimization problem and “multi day-visit” optimization problem. In this thesis, the model and algorithm of the rural itinerary optimization in tourism are both involved. After the qualitative and quantitative analysis, the objective function of rural itinerary optimization in tourism is improved.

Rapid development of the economic led to the development of all works, and the logistics industry performances outstanding. Logistics as the third profit source has been concerned widely by many large enterprises. As a traditional agricultural country, three rural issues has been the focus of our attention. Agricultural materials logistics as main impact of agricultural development has become the focus, too. Efficiency of agricultural materials logistics directly affects farmers' harvests, agricultural production and rural stability. Improving the circulation system of agricultural Materials is an important part of agricultural modernization, helping improve the economic efficiency of agriculture. However, China's agricultural circulation way and level is relatively backward, which cannot meet the modern agricultural production and modern market economy requirements. Thus, promoting agricultural transportation network and improving the circulation system is necessary. China's logistics technology professional level has made a great progress, but there is a big gap with advanced logistics technology and transportation services from other developed countries.

2. The application of ant colony algorithm

Vehicle routing problem as one part of Logistics transportation routing optimization problem is the research focus in the field of logistics. How to choose the path of logistics transportation and How to optimize existing transportation route have become research focus for many scholars .More and more scholars have committed to research a variety of intelligent algorithm for solving vehicle routing problem, and achieved some good results.

This paper aims to select an optimal path for the fertilizer' transportation of A company running agricultural materials, which must go through all cities and be shortest with the highest rate of loading. In this paper, the improved saving algorithm and the max-min ant colony algorithm are used

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to solve the problem .After comparing the results, we draw the conclusion that max-min ant colony algorithm results not only saves mileage and vehicle number, but also improves vehicle loading rate. Moreover, the paper also describes commonly used methods for solving the logistics transportation routing optimization ,mainly including precise algorithms, heuristic algorithms, intelligent algorithms ,and makes a detailed description of the basic principles of a specific algorithm, advantages and disadvantages, and adaptation, then, it focuses on introducing saving algorithms and improved saving algorithm, ant colony algorithm and improved algorithm.

Subsequently, taking fertilizer transportation of A company running agricultural materials for example, this paper calculate the results based on improved savings algorithm and max-min ant colony algorithm ,and compare the two results .in the end, max-min ant colony algorithm is better for solving vehicle routing optimization problem.

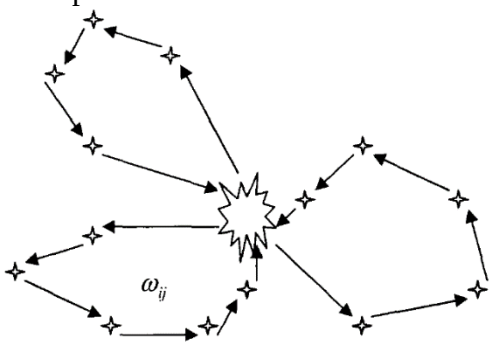

Figure 1. “Mufti day-visit” transportation itinerary in tourism.

Traveling Salesman Problem (TSP) is a classical combinatorial optimization question; the research on TSP has great theoretical and practical significance. However, with the development of science and technology as well as the enlargement of human living space, the scale of question is also gradually expanding, which leads to the result that general methods have poor efficiency in solving TSP. So people put forward a great many of heuristic intelligent optimization algorithms utilized to get the approximate results of many complex optimization problems, and ant colony algorithm belongs to them.

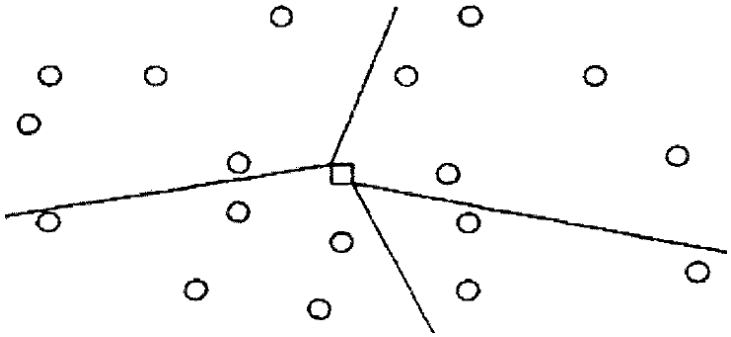

Figure 2. Regionai division.

Ant colony optimization algorithm (ACO) is a newly intelligent bionic evolution algorithm proposed by simulating the foraging behavior of ants group in nature. It adopts the distributed parallel computer system, has stronger robustness, and easily comminutes with other algorithms. However, with the defects of spending longer time in searching for optimal solution of the problem and easily falling into the local best, this thesis presents an improved algorithm and makes further research into its application to TSP.

Ant is a small insect and the individual intelligence is not high, however, the group can complete a series of complex tasks orderly, such as foraging, nest building and so on. The foraging ability of ant is so powerful, that the group can find the nearest path to the food source independently in a short time, and can adapt to the changing environment. Based on this behavior of the ants, the ant colony algorithm (ACA) was proposed by M.Dorigo in 1991.Compared with more sophisticated algorithm like genetic algorithm, ACA is an immature algorithm. ACA which has many advantages like strong

robustness, parallel computing, etc, has received extensive attention since being raisied, so there is a big development on the theory and application. Nowadays, ACA have been successfully used in the job shop scheduling, power system, robot and other fields.

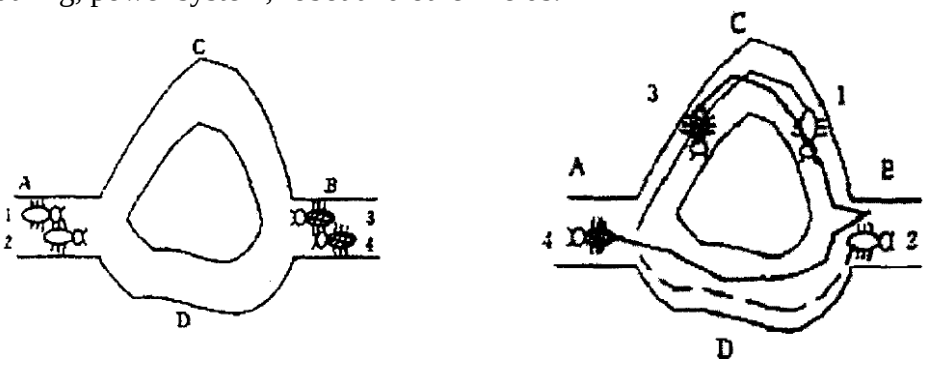

Figure 3. Choose the path and Finish the path choice.

3. The realization method and improvement of binary ant colony algorithm in continuous domain

Taking into account of three important parameters: the pheromone evaporation improved algorithms, and for one of whose ant colony system (ACS), the improved ant colony optimization algorithm is applied to solve TSP problems. With MATLAB simulation, the dissertation selected 10 TSP problems from TSPLIB for experiment and first compared with the results of ACS, which proved the effectiveness of the improved algorithm, then with the ones of self-organizing neural network algorithm, further proving that it has better global searching performance. For example, this paper made a comparison between the improved algorithm and three algorithms(F-W, NCSOM, ASOM)introduced in literature,the average relative error of four algorithms are: F-W(10.81464%), NCSOM(3.2416%), ASOM(1.74936%) and the improved ant colony algorithm (0.73188%). Finally, the improved ant colony algorithm was used in solving the practical optimal path problems in China, for the Chinese 100-city-TSP example, the comparison results of four algorithms are: F-W(25958 km),NCSOM(25983 km),ASOM(25702 km)and the improved ant colony algorithm(20622.461635 km.

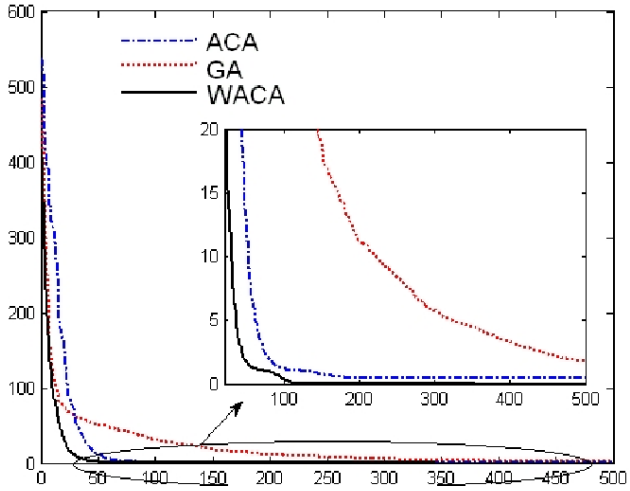

Figure 7. Optimization results.

With the improving of the probability select model and summarize the main research work, pointing out the shortcomings and deficiencies of this study, and prospect the content and area that ant colony algorithm will be further studied and the application of improved ant colony algorithm in other fields.

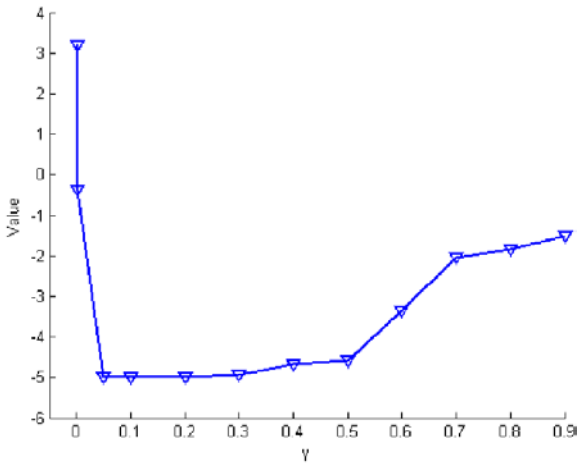

Figure 8. Relation chart between y and value.

The traveling salesman problem (the Traveling salesman problem, TSP) is an old and typical NP-hard combinatorial optimization problem. If TSP's scale is smaller, many ways are able to quickly and efficiently find the solution of the problem, but as the expanding of the problem's scale,the number of solution also increase rapidly in the form of index, so getting a ideal solution set is bound to spend huge time or in a short period of time there could hardly be a desirable outcome. TSP problem especially for large TSP, its effective problem, not only has an extremely important theoretical value and academic value,but also of more help to shoe many practical problems in social life, its usefulness is very high. Therefore, this problem has been a hot issue for the numerous Chinese and foreign scholars to research. In order to realize new breakthroughs in the TSP, people began to think from some new angles and propose new ideas to solve the problem.

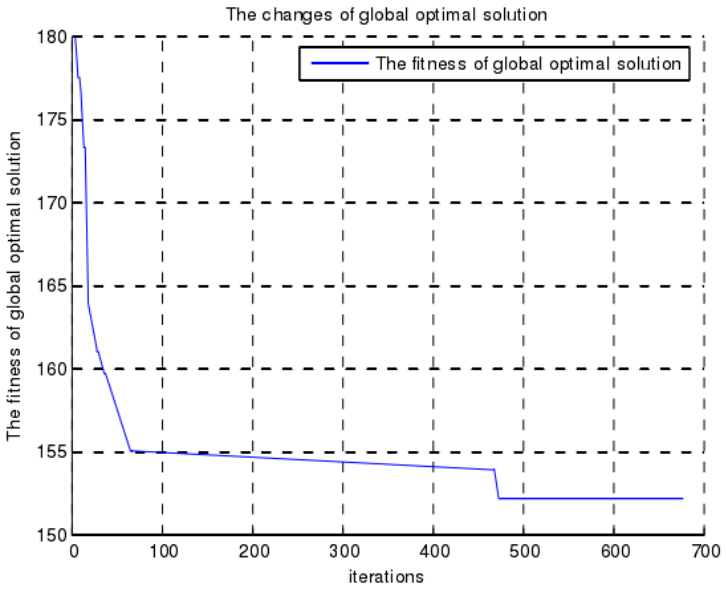

Figure 9. Variation process of optimal solution with iteration number.

In research, the author takes The S-shape River-bends of Yellow River National Geopark, Shaanxi as an example, dividing s-shape river-bends landscape, velley-curving landscape and loess landscape into nine parts as the principle of Geological heritage's distribution feature, enrichment degree and the relationship between each other. Calculating the weight system by Yaahp software, combined with expert questionnaire, with the help of Matlab software, we get the score of the nine Scenic Area's valuable resources, environmental condition, and comprehensive value and then use Dijkstra Algorithm to value the factors. At last, we educe the optimal tourist routes through solver macro and demonstrate it on the plan graph. By the case study, the author tries to build up the model based on landscape value and pain index to fit all the groper-like scenes.

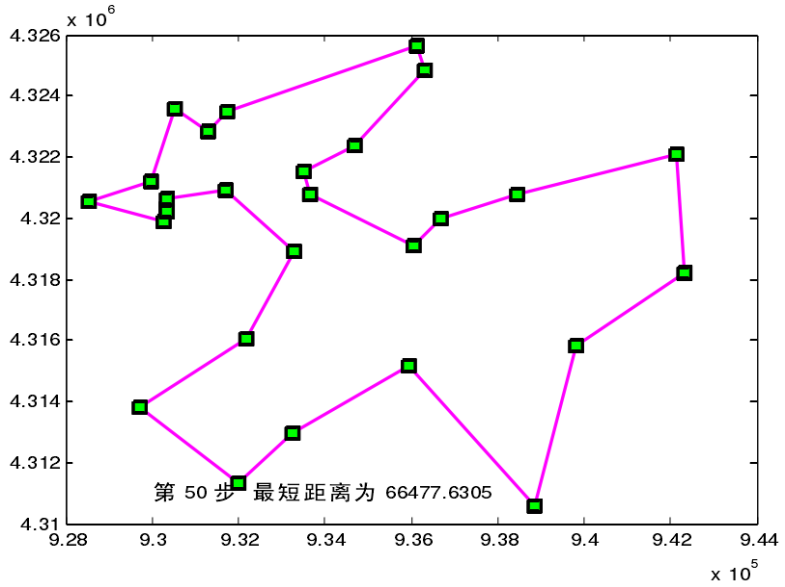

Figure 10. Route optimization between 27 attractions and Anxin.

This paper innovative integration of other disciplines research methods and means, according tourists different travel purpose, different time periods and different identity to design tourist routes. This paper is a tentative study, aims to provide the use of addition to the theory and practice lacking the groundwork for future research. The theoretical methods which used by this paper has certain guiding significance.

4. Conclusion

The model of rural itinerary optimization problem in tourism is built with operations research methods. After a comparative analysis of various heuristic algorithms, ant colony algorithm is selected to solve the problem of rural itinerary optimization in tourism. In this thesis, a new rule of path choice is raised. It not only increases the diversity of paths to choose, but also improves the ant colony algorithm. Finally, the thesis takes Beijing for example and obtains the results with the help of computer.

References

[1] Yang, Lei, et al. A Tourist Itinerary Planning Approach Based on Ant Colony Algorithm. Web-Age Information Management, pp. 399-404, 2012.
[2] Yang, Lei, et al. “A Tourist Itinerary Planning Approach Based on Ant Colony Algorithm.” Matlab, vol. 17, No.5, pp. 541-549, 2012.
[3] Ma, Jun, et al. “Solution to Traveling Agent Problem Based on Improved Ant Colony Algorithm.” Pattern Recognition & Artificial Intelligence, vol. 1, No. 1, pp. 57-60, 2003.
[4] Cao, Tuan Dung, et al. “Integrating open data and generating travel itinerary in semantic-aware tourist information system. “ Iiwas' 2011 - the, International Conference on Information Integration and Web-Based Applications and Services, 5-7 December 2011, Ho CHI Minh City, Vietnam DBLP, pp. 214-221, 2011.
[5] Zhang, Yanjun. “Personalized tourist trip design with multi-objective of group members based on fuzzy adaptive and polymorphic ant colony algorithm.” Computer Engineering & Applications, No. 101, pp. 41-48, 2012.
[6] Sawadogo, Marie, and D. Anciaux. “Sustainable supply chain by intermodal itinerary planning: a multiobjective ant colony approach.” International Journal of Agile Systems & Management, No. 3, pp. 235-266, 2012.
[7] Tseng, Sheng Yuan, J. W. Ding, and R. C. Chen. “WEB-Based Tour Planning Support System Using Genetic and Ant Colony Algorithms.” Journal of Internet Technology, vol. 11, No. 7, pp. 901-908, 2010.