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Application of Travel Management System Based on Route Inquiry

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Abstract

The traditional tourism system's information inquiry is incomplete, images are not intuitive and the results are not three-dimensional. In order to solve these problems, this paper proposes system management design and application based on tourist routes inquiry. Firstly, based on MAP technology, it achieves a cross-check of space and attribute data, then explores the knapsack problem through the genetic algorithm, making the travel route arrangements more reasonable and providing latest shareable maps for tourists, and finally conducts simulation experiment on system model. The results show that compared with the traditional one, this tourism management system's information inquiry is faster, and also its inquiry results are more three-dimensional and visual. It is much more convenient for tourists with practicality.

Keywords: *Tourism System, Routes, Queries, Application*

1. Introduction

Storage and processing of tourism System's information is related resource information about information and tourism business, it is a business decision support system [1-3]. With the continuous development of information technology, e-commerce has been developed rapidly. With emergence of some third-party payment software like Alipay payment, Yu Ebao, tourism industry becomes more and more information-based and it needs to provide online services and queries. Meanwhile tourism information is also included in the "Twelfth Five Year Plan" of China; there are opportunities and challenges, which is bound to accelerate the development of tourism system management's application [4-8]. Tourism management information system will be greatly applied in hotels, resorts, travel agencies and so on. Compared with other industries, tourism has its own characteristics. Tourism information resource is its intermediary; it delivers information such as routes and destinations to its employees and visitors. It is crucial for tourism information's collection, screening, processing and delivery; therefore it is very important to tourism industry's healthy development [9-13]. Tourism is a multi-industry with wide industry range, involving human geography, store merchandise, tourist attractions planning, tourism accommodation and other industries, it is comprehensive. From this we can see that the development of tourism information systems is not only a hot spot within the tourism industry, it also can promote the development of its related industries. Thus, to promote the construction of tourism information systems has become a popular issue and an imminent task today.

At home, in the early 1980s, some tourism enterprises already used the travel management information system. In 1981, Hotel of China introduced the PRIME560 tourism management system [14]. 1985, Jinjiang Hotel introduced Conie's tourism management information system [15]. From the late 1990s with the advent of Internet network, to 2000, tourism management system has been gradually used by travel agencies and hotels all around our country.

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In other countries, there were types of tourism management information system, in 1995; the United States developed tourism management information system [16]. In 1996, the Dutch established a regional tourism management information system [17]. In 2000, Australia used virtual city information to establish a virtual management information system for tourism [18].

At present, the construction of China's tourism information system is outdated for long-term development in the future. 2010 Shanghai World Expo stimulated the development of tourism, and people's material living standard also has been greatly improved, correspondingly domestic and abroad tourism has been developed rapidly. Statistics by the National Bureau of Statistics showed that: in 2012, 2013, 2014 the number of domestic tourists respectively reached 1.802 billion, 1.923 billion and 2.212 billion, as shown in Figure 1.

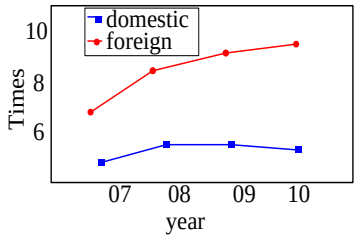


Figure 1. Statistical Trend of Domestic and Abroad Tourists

We can see from Figure 1 that the number of domestic tourists has been holding a rising trend, while the number of foreign tourists was more stable. Tourism has become an important role in economy. At the same time, as tourism grows rapidly, tourists ask more from tourism services, requiring much more comprehensive, three-dimensional and visual information. This makes tourism industry uses information as the main ways to improve the efficiency of tourism services, and actively carries out online travel services and network marketing, using online booking and payment to facilitate travel.

2. Tourism Information Management System

A. Travel Information Systems Entity Framework

The tourism management information system this paper mainly includes four entities: attractions, provinces, regions, and appraisal. Their association is shown in Figure 2.

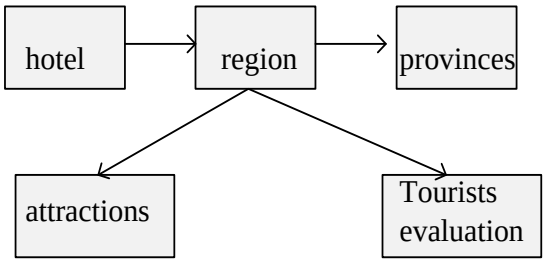


Figure 2. Tourism Information Management System Contact Framework

B. Travel Data Query of MAP Technology

MAP technology can be used to timely acknowledge the data flow and processing conditions of the information systems, and it is a typical model of tourism information systems. It is able to divide the function modules, compile data and process information data flow, as shown in Figure 3.

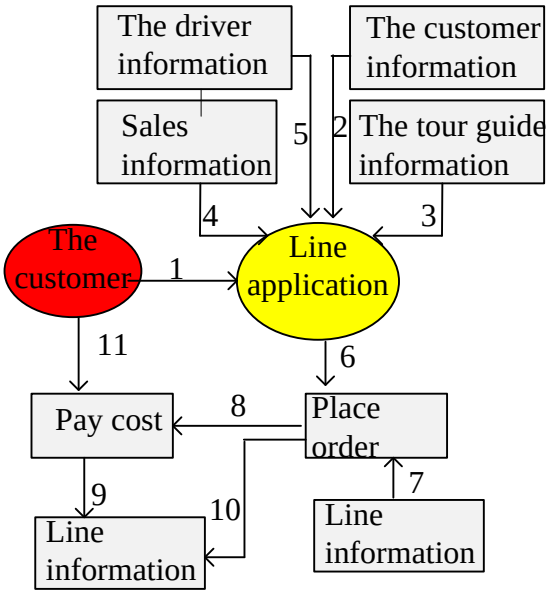


Figure 3. Travel Management System Data Flow

As can be seen from Figure 3 that the flow is: visitors enter a query, the system processes the query then returns the query information to tourists; tourists feed back on attractions and give corresponding rating and reviews; System administrator is able to add and modify every table in the database, which greatly improves the rate of queries, making it more convenient for visitors.

3. Tourism Knapsack Problem Genetic Algorithm

A. Genetic Algorithm

Genetic algorithm developed rapidly in recent years, it is a new optimized algorithm with random search. It was proposed by Professor J. Holland from University of Michigan. It is a random search algorithm, using the reference of natural selection and genetics theory in living nature. It originated in Darwin's theory of evolution, it is a computational model of biological evolution process imitating Darwinian genetic selection and natural elimination. Attention of domestic and foreign scholars was attracted by it. Since 1985, the international community has held a number of academic GA meetings and seminars, ICGA (International Conference on Genetic Algorithms) and FOGA (Workshop on Foundation of Genetic Algorithms) meetings organized by the International Society of Genetic Algorithms provided opportunities for international exchanges on research and application of genetic algorithm. Its main feature is that it does not contain the form of the problem to be solved. It achieves overall optimization by changing the gene configuration, and thus it belongs to the bottom-up optimization method. Similar to biological evolution, the genetic algorithm processes the coded set of variables rather than the variable itself. It operates directly on the structure of the object, it is not limited by derivation and function continuity; implicit global inherent parallelism and better optimization ability; uses optimization method of probability, it can automatically obtain and guide optimized search space, automatically adjusts the search direction without determined rules. These characteristics of the genetic algorithm have been widely used in fields such as combination and optimization, machine learning, signal processing, adaptive control and artificial life. It is one of the key technologies about modern smart calculation. In recent years, genetic algorithm has been successfully applied to fields such as tourism management, economic management, transportation, and

industrial design, it solves many problems. For example, it is used in tourism line inquiries, knapsack exploration.

Evolutionary Computing is an emerging discipline since the 1960s. Taking evolution as the simulation bases and with the natural selection optimization rules and methods, it is used to solve difficult optimization problems in the field of science and technology that the traditional methods could not solved. It initially has three branches: Genetics algorithm (Gentic Algorithm, GA), evolutionary programming and evolutionary strategies. They have a common nature, deriving from Darwin's theory of evolution. They respectively focus on different aspects of nature evolution: genetic algorithm emphasizes chromosome operations, evolutionary strategy emphasizes behavioral change of body, and evolutionary programming emphasizes behavior changes of population. The relationship between them is shown in Figure 4.

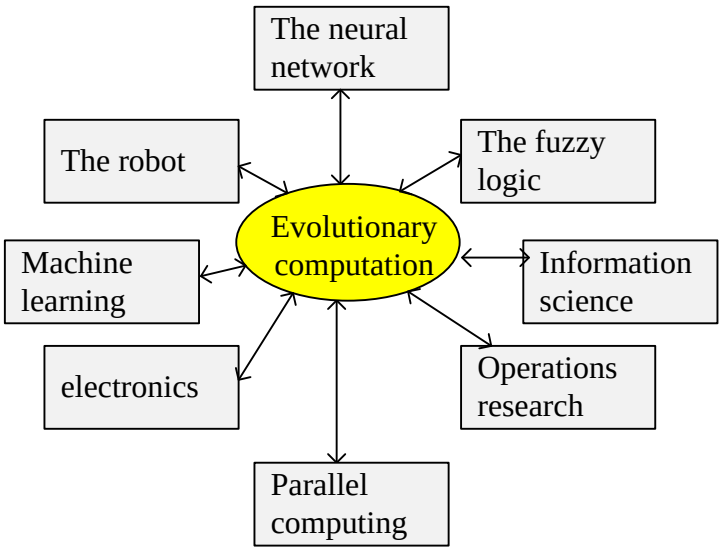


Figure 4. Relationship between the Three Algorithms

B. Tourism Knapsack Optimization of Genetic Algorithm

In this proposed tourism management system, there is a problem needed to be solved: in the planed playtime, visitors can select sights with praise as high as possible. This can be attributed to the following knapsack problem: backpack capacity T defined as planed play time, P as the rating, sights are represented with 1,2,,,N , t_i as the play time of sight Ii denoted Ii , p_i indicates the rating of sight i , $i = 1, 2....n$. In addition, use x_i to indicate whether select sights or not, $i, e.., r, f$ and c, μ_0, v_0, γ, s respectively denotes choosing and not choosing sight i. Then the above knapsack problem is transformed into the following optimization problem:

$$\begin{pmatrix} r \\ s \\ t \end{pmatrix} = \begin{bmatrix} y_{10} & y_{11} & y_{12} \\ y_{20} & y_{21} & y_{22} \\ y_{30} & y_{31} & y_{32} \end{bmatrix} \quad (1)$$

In the genetic algorithm, the chromosome is composed as binary string with 0 and 1:

$$R = ht[y|-c] \quad (2)$$

Meanwhile, this chromosome is written as $c = (x_c, y_c, z_c)$ and the value range of X is noted as $t = \begin{bmatrix} y_\gamma & m & \mu_0 \\ o & y & v_0 \\ o & o & 1 \end{bmatrix}$, then get the fitness $c_i = \cos\theta_i, s_i = \sin\theta_i$, which is the objective function value of the above optimization problem.

In the genetic algorithm, the randomly generated initial population, as well as cross-new chromosomal aberrations may not meet the constraints of problem (3):

$$T = \begin{bmatrix} 1 & o & o \\ o & c_x & s_y \\ o & -y_v & c_x \end{bmatrix} \times \begin{bmatrix} c_y & o & s_v \\ o & 1 & o \\ -s_v & o & c_x \end{bmatrix} \times \begin{bmatrix} c_v & s_v & o \\ -s_v & c_v & o \\ o & o & 2 \end{bmatrix} \quad (3)$$

Therefore, we use the following greedy method for chromosome amending.

GA greedy method for correcting encoding steps are as follows:

Step1. For chromosome $i = x, y, z$, its corresponding sights are c_x, c_y, c_z, then put them in descending order of the highest praise to form a new attraction serial number.

Step2. k=1;

Step3. If $p(\xi|\phi) = \sum_{k=1}^{u} w_i t_i(\zeta)$, them turn to Step3，otherwise turn to Step4.

Step4. Suppose that (x, y, z, i)

Step5. Set all genes of chromosome $i = x, y, z$ to 0 which are corresponding with c(i), $\sum_{k=1}^{u} w_i = 1, t_i(\zeta)$,to form a new chromosome $G_{aus} - s_{ian}$,so in this case, $\sum_i$ is a chromosome that meets condition (3-2).

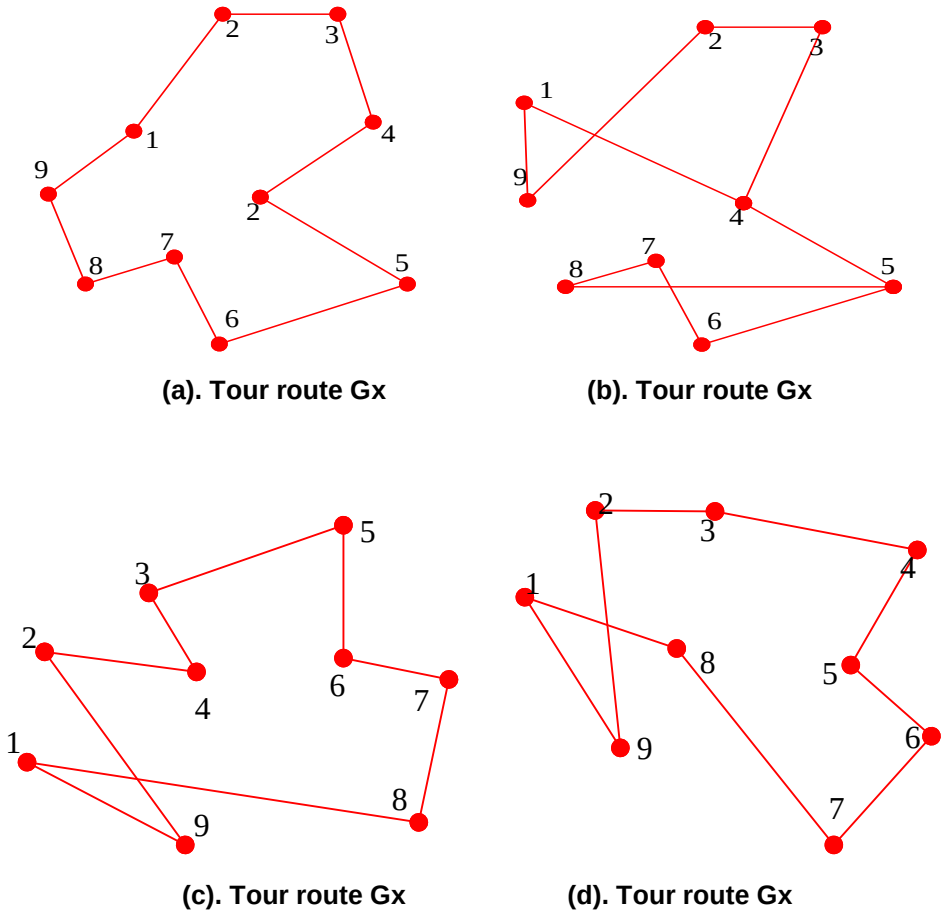
C. Traveling Salesman Problem

The so-called traveling salesman problem is the distance problem: let the traveling salesman travel through a city or even N cities for one time, and the line can not be repeated, then finally go back to the departure point, and a shortest route should be designed for the traveling salesman. It is one of the most representative optimized combination problems and an NP-hard problem, for its possible path number and the number of cities grow exponentially. Therefore it is generally difficult to precisely obtain its optimal solution, so seeking its effective approximation algorithm is of great theoretical significance. On the other hand, after simplification, a lot of practical problems, such as drilling alignment options of a printed circuit board and goods distribution routes of chain stores can be modeled as a traveling salesman problem. Thus research of the traveling salesman problem's solving method also has important application value, since travel planning is a typical traveling salesman problem.

4. Simulation for Tourist Route Query

A. Path Query Design of Tourist Information

For convenience, taking nodes N = 10 for example, encode the path and conduct operation on genetic operators. As shown in Figure 5, with A-J respectively representing 10 cities. Among them, A D B H F I J G E C represents a path which starts from A, goes through each node for one time, eventually go back to point A, and it ultimately shows that genetic algorithm can be used to seek a minimum tourist path.



(a). Tour route Gx **(b). Tour route Gx**

(c). Tour route Gx **(d). Tour route Gx**

Figure 5. F Trend of Tour Route

As can be seen from Figure 5, in the simulation, because the first letter A of path Gx path is the first letter of the standard path w shown in the formula (3-3), sot A is mapped to 1, and at the same time, delete A from the standard path W, then the standard path W turns into (BCDEFGHIJ); the second letter D of encoded path is the third letter in a new path, D is mapped to 3, and then delete D from the standard path D, finally the standard path becomes (BcEFGHIJ). By that analogy, path Tx can be encoded as: Gx = (l315244321) Similarly, the path Gx can be encoded as G (2211153311)..

Through crossover operators, after crossover operation on any two tour routes, another two new tour routes with practical significance can be obtained.

In the above traveling salesman problems of several cities, take tour routes Gx and Gy for example, if the intersection point of the crossover operation is between loci six and loci seven, then two new individuals Gx. and Gy can be gained after carrying out crossover operation on Gx and G:

$$\begin{Bmatrix} Gx = (1425780416) \\ Gy = (1236190213) \end{Bmatrix} \xrightarrow{\text{Single point crossover}} \begin{Bmatrix} Gx' = (1532893628 \\ Gy' = (2318943705 \end{Bmatrix}$$

Taking formula (3-3) as the standard path, to decode Gx. and Gy. For Gx. = (L315243311), the first number 1 corresponds to the letter A of standard path W = (ABCDEFGHIJ) in formula (3-3), remove A from W, then W becomes the second number 3 of (BCDEFGHIJ) Gx , corresponding to D of the new path (BCDEFGHIJ).

Table 1. City Coordinates

	City name								
Coordinate	Shanghai	Lushan	Beijing	Jiaxing	Changsha	Wuhan	Suzhou	Zhengzhou	Lianyungan
North latitude	32.09	29.03	30.84	33.02	32.14	31.14	31.28	29.04	31.74
East longitude	124.87	119.02	121.82	119.01	118.34	119.47	120.35	119.83	120.7

Routes of the cities in Table 1 is re-planned to become a new tour route:

Shanghai ⇒ Lushan ⇒ Beijing ⇒ Jiaxing ⇒ Changsha ⇒ Wuhan ⇒ Suzhou ⇒ Zhengzhou ⇒ Lianyungan

Similarly, the corresponding tour route of Gx is Gx = (B e A n EJIH o F). Thus, compared to traditional travel management systems, this path query system does not only improve the query speed, but also its query results are more accurate and more visual.

5. Conclusion

Based on entity framework of tourism information, this system uses genetic algorithm to optimize the travel path inquiry, solving problems of traditional tourism information system such as the query results are not instant and visual so as to failing at meeting the need of visitors, and promoting the development of tourism. Finally, takes the city tourist routes as example to simulate route design, and the results show that the model system is more practical than the traditional one.

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References

[1] D. Xu, Z. Y. Feng, Y. Z. Li, *et al.*, "Fair Channel allocation and power control for uplink and downlink cognitive radio networks", IEEE, Workshop on mobile computing and emerging communication networks, **(2011)**, pp. 591-596.
[2] H. Liu, G. Jiang and L. Wang, "Multiple Objects Tracking Based on Snake Model and Selective Attention Mechanism", International Journal of Information Technology, vol. 12, no. 2, **(2006)**, pp. 76-86.
[3] S. Kudekar, T. Richardson and R. Urbanke, "Threshold saturation via spatial coupling: why concolutional LDPC ensembles perform so well over BER", IEEE.
[4] T. Gao, Z. H. Liu and J. Zhang, "Redundant Discrete Wavelet Transforms based Moving Object Recognition and Tracking", Journal of Systems Engineering and Electronics, vol. 20, no. 5, **(2009)**, pp. 1115-1123.
[5] S. Arulampalam, S. Maskell, N. Gordon and T. Clapp, "A Tutorial on Particle Filters for On-Line Nonlinear/ Nongaussian Bayesian Tracking", IEEE Trans. Signal Process., vol. 50, no. 2, **(2002)**, pp. 174-188.
[6] Y. Xue and H. Liu, "Intelligent Storage and Retrieval Systems Based on RFID and Vision in Automated Warehouse", Journal of Networks, vol. 7, no. 2, **(2012)**, pp. 365-369.
[7] L. L. Yuan and L. C. Lin, "A multicast routing protocol with multiple QoS constraints", Journal of Software, vol. 15, no. 2, **(2004)**, pp. 286-291.
[8] D. Cai, X. He, J. Han and H.-J. Zhang, "Orthogonal Laplacianfaces for face recognition," IEEE Transactions on Image Processing, vol. 15, **(2006)** November, pp. 3608-3614.
[9] L. Y. Ren, "Study on Scheduling Optimization in Construction Project of Lagerstroemia Hope City," Xi'an University of architecture & technology, vol. 6, no. 2, **(2011)**, pp. 12-17.
[10] M. Belkin and P. Niyogi, "Laplacian eigenmaps for dimensionality reduction and data representation," Neural Computation, vol. 15, **(2003)** June, pp. 1373-1396.
[11] R. Berangi, S. Saleem, M. Faulkner, *et al.*, "TDD cognitive radio femtocell network (CRFN) operation in FDD downlink spectrum", IEEE, 22nd International Symposium on Personal, Indoor and Mobile Radio Communications, **(2011)**, pp. 482-486.
[12] S. Pearson, "Taking account of privacy when designing cloud computing services", In CLOUD '09: Proceedings of the 2009 ICSE workshop on software engineering challenges of cloud computing, IEEE Computer Society, Washington, DC, USA, **(2009)**. pp. 44–52.

[13] Y. Yona and M. Feder, "Efficient parametric decoder of low-density lattice codes," IEEE International Symposium on Information Theory: Seoul, Korea. New York, NY, USA: IEEE, vol. 8, **(2009)** June 28-July 3, pp. 744-748.
[14] Z. Lian, M. J. Er and J. Li, "A Novel Face Recognition Approach under Illumination Variations Based on Local Binary Pattern", the 14th international conference on Computer analysis of images and patterns, vol. 6855, **(2011)**, pp. 89-96.
[15] A. Li, S. Shan and W. Gao, "Coupled bias-variance tradeoff for cross-pose face recognition," IEEE Transactions on Image Processing, vol. 21, **(2012)** January, pp. 305-315.
[16] H. Tang, M. C. Chen, Y. S. Sun, *et al.*, "A spectral efficient and fair user-centric spectrum allocation approach for downlink transmissions", IEEE, Globecom, **(2011)**, pp. 1-6.
[17] C. Wang, "Face Segmentation Based on Skin Color in Complicated Background and Its Sex Recognition", Journal of Software, vol. 6, **(2011)**, pp. 1209-1216.
[18] W. C. Kao, M. C. Hsu and Y. Y. Yang, "Local contrast enhancement and adaptive feature extraction for illumination-invariant face recognition", Pattern Recognition, vol. 43, **(2010)**, pp. 1736-1747.
[19] M. J. Mirza and N. Anjum, "Association of Moving Objects across Visual Sensor Networks", Journal of Multimedia, vol. 7, no. 1, **(2012)**, pp. 2-8.
[20] K. I. Kin, K. Jung and H. J. Kim, "Face recognition using kernel principal component analysis," IEEE Signal Processing Letters, vol. 9, **(2002)** February, pp. 40-42.

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