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Optimal Allocation of Resources for Innovation and Entrepreneurship Education in Universities Based on PSO Algorithm

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Abstract. Innovation and entrepreneurship (IAE) education in universities is an important way to promote IAE among college students. In order to improve the quality of IAE education in universities, it is necessary to optimize the allocation of its resources. Through the analysis of IAE education resources in colleges and universities, this paper combined PSO (Particle Swarm Optimization) to optimize the allocation of resources, and achieved certain results in practical applications. This paper studied the resource allocation model, defined the optimization objective function, and used PSO for optimization calculation. Experimental data showed that when the number of iterations was 100, it took the longest time, but the optimization effect was the best. The optimization scheme of PSO can effectively improve the effect of IAE practice in colleges and universities, thus promoting the cultivation of students' innovation spirit and entrepreneurial ability, and providing an effective optimization idea for colleges and universities.

Keywords. Particle Swarm Optimization, College Education, Innovation and Entrepreneurship, Resource Optimization.

1. Introduction

The IAE education in universities is constantly developing and improving. The proportion of IAE education resources in higher education is increasing, but there are still some problems. There are many theories related to the optimization of IAE education resources. For example, some scientists proposed a solution based on ant colony optimization algorithm to explore more effective optimization algorithms for enterprise technological innovation resources [1-2]. Some experts also believed that digital educational resources are an indispensable component of information-based teaching and a key factor in further promoting and improving the efficiency of educational informatization [3-4]. In addition, some experts conducted configuration

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screening based on the classification of regional resource elements, and determined the factors that affect subject participation and resource allocation mechanisms through multiple iterations of improved ant colony algorithm [5-6]. The optimized allocation of IAE education resources can effectively promote the improvement of comprehensive abilities of university students and promote comprehensive social progress.

This article aimed to analyze the characteristics and current situation of IAE education resources in universities, and study the application of PSO for resource optimization and allocation, in order to improve the quality and efficiency of IAE education in universities. This article focused on the issue of optimizing the allocation of resources for IAE education in universities, and analyzed in detail its resource characteristics and current situation. Based on the establishment of a resource allocation model, PSO was applied to optimize the allocation of resources for IAE education in universities. This has achieved optimization of resource allocation and improved the quality and efficiency of IAE education^[7].

2. Resource Allocation of Innovation and Entrepreneurship Education in Universities

2.1 Model Design

Based on PSO, this paper designed an IAE resource model based on PSO, and introduced the model design in detail. It is assumed there is a IAE education projects, each project has b resource needs (such as funding, technology, talent, etc.). A matrix of a*b is defined, in which each element represents the resource demand of the project. In addition, an n-dimensional vector \mathbf{x} is defined, where each element \mathbf{x}_i represents the total amount of resources obtained by the i-th project. The fitness function is defined as the sum of the total resources obtained by each project:

$$f(x) = \sum x_i, i = 1,...,n$$
 (1)

In each iteration, the following particle update rules are used:

$$v(t+1)i = w * v(s)i + c1 * r1 * (pbest - x_i) + c2 * r2 * (gbest - x_i)$$
(2)

$$X_i(t+1) = X_i(t) + v(t+1)i$$
 (3)

Among them, w is the weight; c1 and c2 are constants; r1 and r2 are random numbers. In the model of this article, \mathbf{X}_i represents the total amount of resources obtained by the i-th project, and v represents the speed at which the project obtains resources; pbest represents the maximum number of resources received in the history of a project, while gbest represents the maximum number of resources received in the history of all projects.

2.2 Experimental Plan

For PSO, common parameters include population size, inertia weight, social learning factor, cognitive learning factor, etc. In the model of this article, the population size was set for resource allocation, and the maximum number of iterations was set to 100.

This paper used MATLAB software to realize the IAE resource model based on PSO, and carried out experimental verification. This article randomly generated input data, and the demand for each resource was randomly distributed between 1 and 10. This article was run 100 times and obtained 100 sets of results. After that, the average results were calculated and compared with the benchmark results. Benchmark results refer to the results obtained by allocating resources to all projects in the same way as resource requirements^[8].

3. Experimental Results of Resource Allocation

This article considered using PSO to optimize the allocation of IAE education resources. In PSO, the number of iterations, social factors, and learning factors are all key factors in optimizing the results. The social factor (i.e. global optimal solution) represents the best result learned by the particle swarm in the entire search space, while the learning factor (i.e. individual optimal solution) represents the individual optimal result of a single particle in the search space. In this experiment, this article investigated the relationship between the number of iterations, social factors, and learning factors by adjusting their values. The social factor and learning factor were set to different values, respectively, and PSO was run separately.

This article set the learning factor to 0.8 and the social factor to 0.2, 0.5, 0.7, and 0.9, respectively.

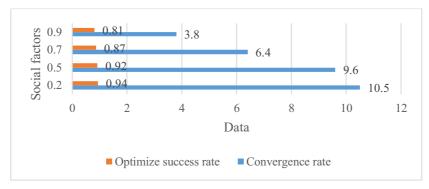


Figure 1. Ability of the PSO Algorithm under Different Social Factors

In Figure 1, it was found through experimental results that under smaller social factor values, the optimal solution of PSO may converge more slowly, but in the final iteration result, good optimization results can also be achieved. Under larger social factor values, PSO may cross the search space faster, but it may also lead to poor optimization performance. Therefore, the value of social factors needs to be adjusted based on specific problem needs.

The social factor was set to 0.5, and the learning factors were set to 0.2, 0.5, 0.7, and 0.9, respectively. Experiments have found that under small learning factor values, PSO

may be sensitive to the initial solution and gradually lose its ability to optimize. Under larger learning factor values, PSO is prone to falling into local optima and failing to achieve global optimization goals, resulting in a continuous increase in time as the learning factor changes. Therefore, the value of learning factors also needs to be adjusted based on specific problem needs, as shown in Table 1.

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	Optimize success effect	Time
0.2	0.78	4.5
0.5	0.73	5.6
0.7	0.67	6.3
0.9	0.6	8.2

Table 1. Ability of the PSO Algorithm under Different Learning Factors

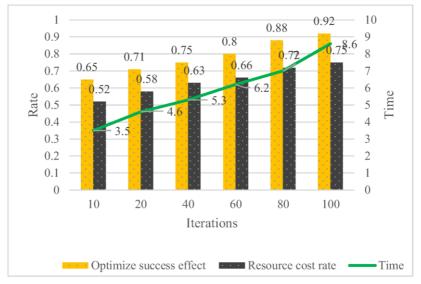


Figure 2. Results of the PSO Algorithm at a Different Number of Iterations

In Figure 2, the PSO results under different iterations were compared. This article can be found that as the number of iterations increased, the optimization effect of PSO significantly improved. However, as the number of iterations increased, the time and resource costs of the algorithm also increased. Therefore, while ensuring sufficient algorithm time and resources, it is necessary to choose an appropriate number of iterations to balance the efficiency and effectiveness of the algorithm. In summary, the number of iterations, social factors, and learning factors are important factors that affect the effectiveness of PSO optimization. The relationship between them needs to be adjusted according to specific problem requirements to obtain the best optimization results.

This article designed a PSO based IAE resource model, which can better allocate and utilize various resources and provide better support for IAE. Through experimental verification, this article proved the effectiveness and robustness of the model, which has certain reference value in practical applications. Specifically, the contributions of this article include: studying the scientific evaluation criteria system for innovative education resources in universities, constructing a reasonable optimization model, aiming to

achieve optimal resource allocation. This paper tried to use advanced algorithm particle swarm optimization to optimize the model, so as to carry out effective management and allocation of innovative education resources in colleges and universities. A performance evaluation model of innovative education resources in colleges and universities based on particle swarm optimization algorithm was established. It can be used to evaluate the effectiveness of resource allocation and take corresponding adjustment measures based on the evaluation results, continuously improving the efficiency and optimization results of educational resource allocation. The model can more effectively allocate and utilize various resources, and the total resource allocation varies compared to the benchmark results^[9].

4. Conclusions

As one of the important intellectual resource banks of the country, universities are playing an increasingly important role in the new era. By analyzing the characteristics and current situation of IAE education resources in universities, PSO was applied to optimize resource allocation, and certain results were achieved in practical applications. This indicated that PSO is an effective optimization method in optimizing the allocation of IAE education resources in universities. At the same time, the research results of this article can also provide a certain reference for optimizing the allocation of resources for IAE education in other universities. This article explored topics such as PSO and its improvements, the IAE environment in universities, educational methods, and educational resource sharing, and analyzed its application in resource optimization. In the future, while improving the integration of IAE platform resources, universities should pay more attention to the implementation of IAE education and practice, and cultivate a group of professional "makers" with a sense of social responsibility and innovation ability^[10].

References

- [1] M. B. Sushma, Sandeepan Roy, Avijit Maji: Exploring and exploiting ant colony optimization algorithm for vertical highway alignment development. Comput. Aided Civ. Infrastructure Eng. 37(12): 1582-1601 (2022)
- [2] M. Bharathi: Optimum Test Suite Using Fault-Type Coverage-Based Ant Colony Optimization Algorithm. Int. J. Appl. Metaheuristic Comput. 13(1): 1-23 (2022)
- [3] Odiel Estrada-Molina, Dieter Reynaldo Fuentes-Cancell, Anaibis Alvarez Morales: The assessment of the usability of digital educational resources: An interdisciplinary analysis from two systematic reviews. Educ. Inf. Technol. 27(3): 4037-4063 (2022)
- [4] William Simão de Deus, Ellen Francine Barbosa: A Systematic Mapping of the Classification of Open Educational Resources for Computer Science Education in Digital Sources. IEEE Trans. Educ. 65(3): 450-460 (2022)
- [5] Mehrdad Ahmadi Kamarposhti, Ilhami Colak, Celestine Iwendi, Shahab S. Band, Ebuka Ibeke: Optimal Coordination of PSS and SSSC Controllers in Power System Using Ant Colony Optimization Algorithm. J. Circuits Syst. Comput. 31(4): 2250060:1-2250060:20 (2022)
- [6] Vipul Sharma, Roohie Naaz Mir: An enhanced time efficient technique for image watermarking using ant colony optimization and light gradient boosting algorithm. J. King Saud Univ. Comput. Inf. Sci. 34(3): 615-626 (2022)
- [7] Hadi Zavieh, Amir Javadpour, Yuan Li, Forough Ja'fari, Seyed Hadi Nasseri, Ali Shokouhi Rostami: Task processing optimization using cuckoo particle swarm (CPS) algorithm in cloud computing infrastructure. Clust. Comput. 26(1): 745-769 (2023)

- [8] Dalila B. M. M. Fontes, Seyed Mahdi Homayouni, José Fernando Gonçalves: A hybrid particle swarm optimization and simulated annealing algorithm for the job shop scheduling problem with transport resources. Eur. J. Oper. Res. 306(3): 1140-1157 (2023)
- [9] Ilyes Khennak, Habiba Drias, Yassine Drias, Faysal Bendakir, Samy Hamdi: I/F-Race tuned firefly algorithm and particle swarm optimization for K-medoids-based clustering. Evol. Intell. 16(1): 351-373 (2023)
- [10] Ashok J, Sowmia K. R, Jayashree K, Priya Vijay: A Novel Grasshopper Optimization-based Particle Swarm Algorithm for Effective Spectrum Sensing in Cognitive Radio Networks. KSII Trans. Internet Inf. Syst. 17(2): 520-541 (2023)