Urban Public Art and Artificial Intelligence: Application of Intelligent Algorithms in Art Creation and Interaction

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Abstract: With the continuous advancement of science and technology, intelligent algorithms have been widely used in artistic creation. Compared with traditional computers, artificial intelligence technology has the advantages of higher efficiency, more flexibility, and easier operability. This paper will first provide an overview of intelligent algorithms and analyze the current research status; secondly, the application of neural network method in artistic creation based on fuzzy set theory is explained through examples, and at the same time, a high-tech company is taken as an example to discuss the problems existing in the system design and implementation process; finally, this paper tests the performance of intelligent algorithms in artistic creation and interaction. The test results show that the average data of the intelligent algorithm after 50 rounds of training is between 71 and 76. This paper believes that applying the advantages of artificial intelligence to the creation of artistic works will make the works more humanized, more efficient, easier to operate and more accurate.

Keywords: Urban Public Art, Artificial Intelligence, Intelligent Algorithm, Artistic Creation

1. Introduction

With the continuous development of society and the improvement of the level of science and technology, people's requirements for the quality of life are also getting higher and higher. They have higher and more demanding standards for their own quality and environmental conditions. Intelligent algorithms are a way of using computers to deal with these problems. Artificial intelligence technology is a new comprehensive system with a high degree of autonomous learning ability, which can automatically analyze data and make decisions and controls [1-2]. It can decompose and combine complex information to achieve simplification.

Although domestic scholars started late in artificial intelligence technology, they have achieved some research results. Some scholars have proposed a 3D virtual scene creation method based on an interactive model, which combines intelligent algorithms with traditional manual methods. This laid the foundation for future related work, and provided a certain degree of reference value and reference [3-4]. Other scholars believe that combining artificial intelligence technology with industrial design is an

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innovative way of thinking. It can combine artificial intelligence technology and traditional craftsmanship to create work, effectively improve production efficiency and reduce labor intensity. At the same time, it can also solve the dependence of human beings on machines when they cannot adapt to complex environments. Computer-aided designers can deal with certain problems and replace human brains to complete tasks to achieve better artistic effects [5-6]. Therefore, this paper will use artificial intelligence as a basis to study the role of intelligent algorithms in artistic creation and interaction.

With the development of artificial intelligence, its application in artistic creation is becoming more and more extensive. As a new technology, new material and new technology, intelligent algorithm provides more opportunities for artists. This article will study how to use existing experience to design and create better works of art from the perspective of combining artificial intelligence with traditional architecture. At the same time, it will summarize computer technology and basic theoretical knowledge of related disciplines, and put forward corresponding measures and suggestions based on the current situation of urban public art in China. It is hoped that it can help the general public realize the application of intelligent algorithms in daily life, improve work efficiency and creative level.

2. Discussion of Intelligent Algorithms in Artistic Creation and Interaction

2.1 Intelligent Algorithm

Artificial intelligence is a highly automated technology that can automatically generate information and convert it into computer language to solve various uncertain situations that may be encountered in real life. Artificial intelligence involves vast amounts of data and knowledge, including images, sounds, and other categories of problems. Once a large amount of data is acquired, it can be sorted, summarized, and computationally reasoned, and finally the results can be obtained for use by computer systems [7-8]. For a complex problem, it is usually necessary to clearly express all objects, which requires intelligent algorithms to accurately deal with the relationship between things of different types, structures and properties. Intelligent algorithms operate based on rules for a complex system. However, artificial intelligence is not immune to interference from external environmental factors. Therefore, the requirements for the running speed of the program are very high, and the algorithm itself is very fragile. This requires that the algorithm must be guaranteed to have good anti-attack capabilities, otherwise the expected effect cannot be achieved. Artificial intelligence is based on computer technology, simulating the development process of human society, and using mathematical models to predict the relationship and change law between various parameters when unknown things change, and how to optimize the distribution of these parameters. Finally, transforming it into the optimal solution or optimal combination to obtain the best solution [9-10].

Intelligent algorithm is also a nonlinear function approximation method based on artificial neural network, which abstracts and simplifies complex problems and combines the knowledge acquired in the cognitive process of the human brain for

processing. The basic idea is to establish a model, use fuzzy mathematics, probability statistics and other theories, and input data into the computer system according to actual needs, and give corresponding rules [11-12]. In this simulation environment, the data is processed through intelligent algorithms, and the expected results are output to the user.

When solving problems, a variety of intelligent techniques can be used, such as particle swarm optimization. Figure 1 is a schematic diagram of particle motion. The size of the particle population is fixed to contain N particles, each dimension of the particle corresponds to the corresponding dimension of the solution space, and the value of the dimension is D. Each dimension of each particle has two indicators of speed and position, and the update method is shown in formulas (1) and (2).

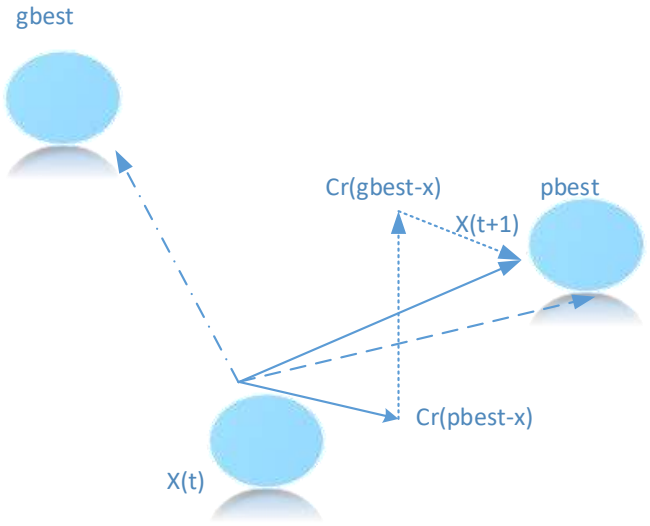

Fig.1 A Schematic representation of the particle motion

$$v_{i,j}(t+1)=wv_{i,j}(t)+c_l r_{l,j}(t)\left(pbest_{i,j}(t)-x_{i,j}(t)\right)+c_2 r_2(t)\left(gbest_i(t)-x_{i,j}\right)(t) \tag{1}$$

$$x_i(t+1)=x_i(t)+v_i(t+1) \tag{2}$$

The value ranges of i and j are [0, N] and [0, D] respectively. The initial velocity of the particle is obtained by formula (3):

$$v_0=v_{\min}+r\left(v_{\max}-v_{\min}\right) \tag{3}$$

The combination of these technologies and concepts can solve various complex problems encountered in real life that are difficult to describe accurately or directly conduct quantitative analysis, and appropriately simplify or process them. Intelligent

algorithms describe the connections and differences between things by simplifying and classifying natural language, and establish mathematical models. Then transforming it into a simple, clear, understandable and easy-to-understand algorithm, and apply it in real life to achieve the purpose of intelligently processing complex data. This is one of the methods widely used in the current application field. Intelligent algorithms have self-learning ability, and are not affected by external factors such as computer technology and language programming to change their own characteristics. It can process information and use automatic learning and decision-making to obtain required parameters, store, calculate and analyze, and provide decision support functions, thereby improving system operating efficiency and data information volume. Figure 2 is the number of iterations of particle swarm intelligence algorithm.

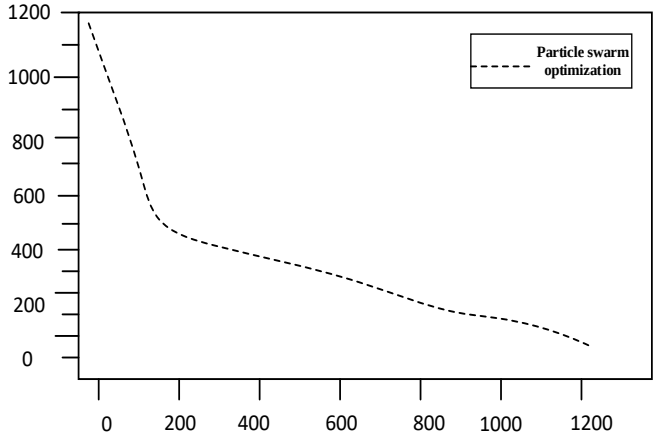

Fig.2 Number of iterations of the particle swarm intelligent algorithm

In a specific environment, intelligent algorithms can control behavior patterns or working states according to different tasks, and provide a large amount of new knowledge and experience to meet higher-level and broader needs. At the same time, it also poses problems in many complex situations, such as safety, performance, etc., and non-linear relationships such as predicting and evaluating the future. Due to the complexity and nonlinearity of information processing, storage and calculation, the human brain is highly adaptive, which determines that intelligent algorithms can effectively solve some or all of the problems with complex and uncertain factors.

2.2 Artistic Creation

Artistic creation is the highest state of people's creative thinking in daily life, and applying it to life is also the final stage of artistic development. In contrast, artificial intelligence technology demonstrates its potential by applying existing knowledge, experience and ideas to real life. Intelligent algorithms are very different from traditional calculation methods: first, they have obvious advantages in adaptability; second, the calculation process is simple and easy to master; finally, it can also adjust the results according to the actual situation to meet the needs of different users [13-14].

Therefore, it is easy to implement and achieve the desired effect in design. In the process of artistic creation, artists express the inner world of human beings through unique and creative imagination. The expression of art is based on the understanding of the works of art and the inner emotional experience of the viewer. "Human" can be regarded as a special kind of existence, which has the characteristics of being rich and varied, in different poses and with different expressions. But at the same time, it also has its own unique rules and value standards, that is, the principle of aesthetic feeling: the form of beauty should have a strong attraction, and pure colors cannot be used to express things or emotions; otherwise, it will become a simple and boring artistic creation. Art creation is a comprehensive discipline. In a broad sense, it refers to the artist-centered, through a series of activities such as analysis and creation of artistic images and forms of expression, to realize the communication and interaction between works expressing emotions and thoughts and feelings. In a narrow sense, it refers to the concepts or viewpoints that are rich in content and clear in meaning contained in works of art. In the field of urban public art, artistic creation is no longer limited to traditional paper materials, but incorporates the use of computer technology. With the continuous advancement of science and technology and the continuous development of computer applications, people can use artificial intelligence methods to solve related problems and apply them to artistic creation. At the same time, artificial intelligence technology can also be used to deal with existing or possible problems in urban public art, and apply these technologies in space planning and design. The intelligent algorithm can make a reasonable spatial layout according to the surrounding environment information to meet the needs of different groups of people [15-16]. In addition, combined with computer software and hardware, it can also realize the processing of dynamic change control function and auxiliary working status. Using the characteristics and characteristics of intelligent algorithms, various data parameters involved in urban public art activities can be processed. In urban planning, urban space can be divided into multiple independent parts, and through the rational organization of these parts, it can be decided whether to build public art facilities or carry out architectural design. At the same time, it is also necessary to consider the connection between the various areas and the buildings in each area, as well as their characteristics. Therefore, urban space planning and architectural planning need to be combined with each other, making full use of artificial intelligence technology and computer applications to improve the quality and effectiveness of urban public art.

In daily life, many things that have a significant impact on the perception and cognition of the human brain can be called works of art, such as artistic creation and the artist's analysis of living environment, working status, etc. Art not only enables artists to process the emotions and thoughts expressed in their works, but also transform them into meaningful or creative thinking beyond themselves. When innovating and transforming works of art, it needs to have colorful, unique and personalized characteristics. This includes two aspects: first, the artist himself observes and recognizes objective objects such as social reality, history and cultural background; the second is to use the unique senses of human beings in the works to experience their spiritual world and lifestyle. From another perspective, artistic creation is a process of presenting the subjective world based on the creative thinking mode and method of the human brain, and expressing the author's thoughts and feelings through the expression of one's own inner emotions. By combining and

arranging various elements in the image space, the information content that the designer wants to convey can be expressed; and color is one of the factors that can best reflect the designer's personal emotion. Therefore, color has unique vividness and strong visual impact, and plays an important role in artistic creation, making it more vivid and well known and loved by the public.

2.3 Urban Public Art

In the modern fast-paced life, people are more inclined to enjoy a good and relaxing time indoors. However, there are also many people who need to spend time with their families for a long time or actively participate in society, and can produce psychological responses and satisfy aesthetic needs by perceiving and experiencing the surrounding environment. Therefore, urban public space art design and interactive functions came into being. Urban public art is an art form that is based on the daily life of urban residents and meets the aesthetic needs of citizens. It covers multiple areas of life, work and entertainment, and is mainly planned and designed by the architectural design department [17-18]. In daily life and social processes, people have an impact on the surrounding environment and realize psychological or physical goals by perceiving the natural environment. Intelligent technology can effectively solve these problems and make them a reality, such as intelligent robots and so on. This helps to realize the harmonious coexistence between human beings and nature, and promotes the development of the whole way of life in a more humanized and automated direction. From a macro point of view, urban public art refers to various morphological elements contained in a region and their combinations. From a micro perspective, it covers cultural information in all aspects of human life, including the social material environment, the spiritual world, and the relationship between man and nature, and between things. Therefore, urban public art is a form of cultural activity centered on people. It not only meets people's material needs, but also gives full play to the harmonious symbiotic relationship between man and nature and the positive impact of human interaction. Architectural shapes, landscape sketches, etc. should have aesthetic value and use function, so that users can obtain great pleasure on the visual and psychological levels. Urban public space has two main functions. On the one hand, it provides a place for people to entertain, rest and communicate; on the other hand, it also exists to meet the needs of the public, including various event venues and facilities. These public domains constitute a complete system, widely used and accepted, and open and shared [19-20].

3. The Experimental Process of Intelligent Algorithms in Artistic Creation and Interaction

3.1 Intelligent Algorithm Framework

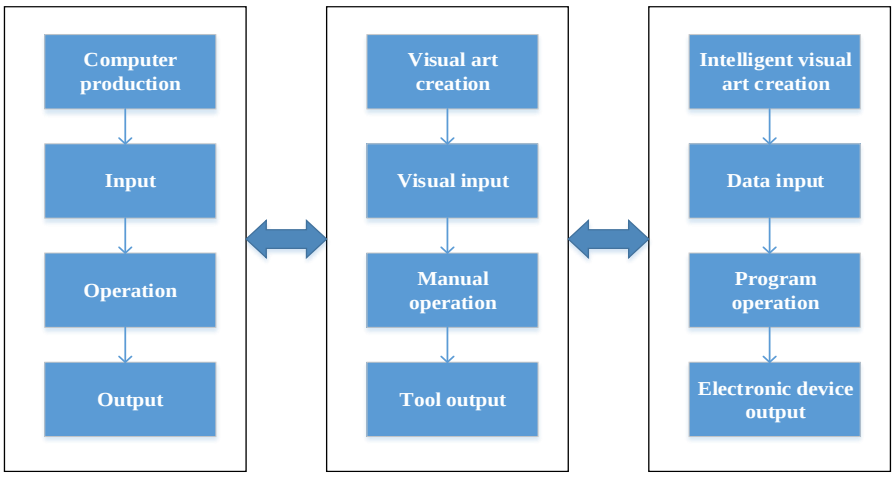

Fig.3 Framework diagram of the intelligent algorithm

Figure 3 shows the framework diagram of the application of intelligent algorithms in artistic creation, which is a logical model developed based on artificial intelligence technology. This framework diagram mainly includes two aspects. The first is the level of human-computer interaction interface, which is suitable for the two characteristics of fuzzy description and uncertain description, especially for the situation where it is difficult to obtain accurate data in complex systems. The second is the level of algorithm execution platform, application service function module and database interface module. Both levels need to consider handling various data types and orders of magnitude as well as non-numerical levels of information volume, and also need to consider the interdependencies that exist between users, while providing solutions for the system to operate. In this framework, intelligent algorithms are jointly determined by artificial intelligence technology and machine learning theory, rather than general rules. It uses the screening and analysis of the database to obtain user information, and uses computer hardware equipment to complete the logical reasoning process and automatic identification, judgment and tracking functions. In addition, it is necessary to design an artificial intelligence system based on fuzzy set model algorithm and artificial neural network technology. This way of thinking may have problems such as instability and randomness, but intelligent algorithms can effectively solve these difficulties and obstacles and are widely used. At the same time, intelligent algorithms help designers understand and master logical relationships and regular features more intuitively and effectively, so as to achieve the goal of personalized creation.

3.2 Intelligent Algorithm Performance Evaluation

When designing intelligent algorithms, it is necessary to fully consider the use of artificial intelligence technology by users. Therefore, these algorithms need to have scientific rationality, strong feasibility and high operability, and also need to adapt to the requirements of the actual application environment and have good adaptability. Because artificial intelligence is different from other disciplines, it has the advantages of high level, strong theory and excellent operational performance. At the same time, it has stricter and more complex requirements for computer processing power, so there are certain difficulties in calculation. The computational complexity of intelligent algorithms is relatively high, but the requirements for the hardware environment are not high, and the calculation results are very stable and not easily affected by external interference. In order to compare the relationship and feature quantity between the parameter values of the problem model and the data in the required calculation area, the relevant information can be obtained through the expert system. Second, neural network theory can be used to establish simple, easy-to-understand mathematical expressions that can quickly solve complex problems to accurately describe unknown process or object characteristics. Finally, choosing the appropriate algorithm according to the actual situation and apply it to the specific scene. For different users, it can set different parameters of the system to understand their usage and their advantages and characteristics. If these parameters do not exist, it needs to consider how to convey this information and handle it accordingly. If this information is missing, the next-level interface will not be able to display the current status or relevant data. This is done to facilitate the user to work better and improve efficiency.

4. Experimental Analysis of Intelligent Algorithms in Artistic Creation and Interaction

Table 1. Intelligent Algorithm Performance Parameters

Train	Standard deviation	Median	Maximum	Minimum
Round 1 training	21	63	87	35
Round 10 training	20	65	86	30
Round 20 training	23	69	89	31
Round 30 training	24	64	81	35
Round 40 training	26	63	82	36
Round 50 training	25	65	84	32

The application of intelligent algorithms in artistic creation is mainly to select the most suitable method, comprehensively considering aspects such as technology, economy and user needs. Table 1 is the intelligent algorithm performance parameters. Artificial intelligence can perform performance evaluation and analysis from both visual and auditory perspectives. On the one hand, people can intuitively understand what kind of things they need. On the other hand, the application effect of intelligent algorithms in artistic creation can be calculated according to the human brain neural network model, and the system can be evaluated and improved.

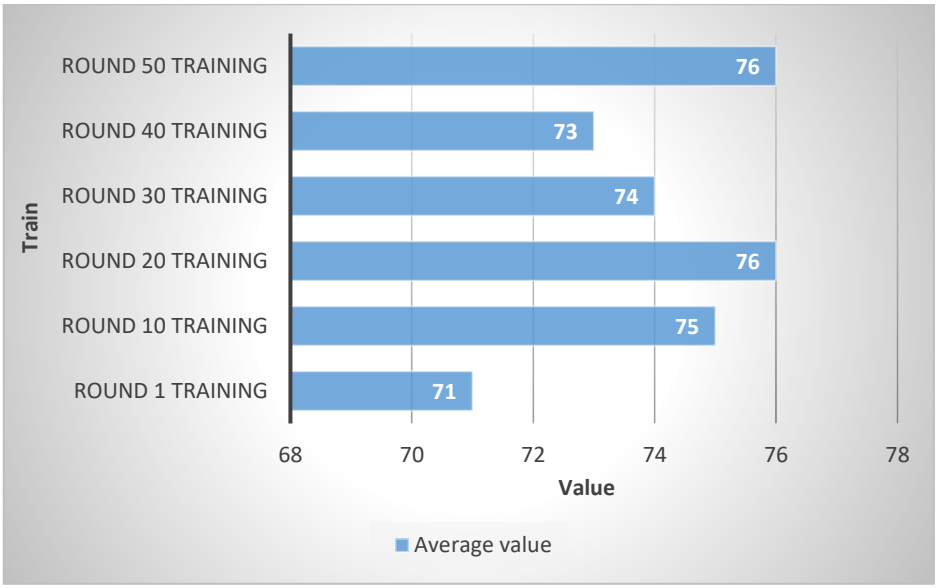

Fig.4 The average of the smart algorithm

After the artificial intelligence work is completed, operations such as data processing analysis and calculation judgment must be carried out. The implementation of these processing tasks is based on time requirements. Therefore, for a design, it must have the ability to respond quickly, accurately, and efficiently, and it needs to use a variety of efficient algorithms to simplify complex problems and optimize the technical means required to improve the implementation of the automation process. Therefore, it is crucial to design efficient intelligent algorithms. These algorithms need to be able to process large amounts of data quickly, produce accurate results quickly, and be adaptable to different task requirements. At the same time, in order to ensure the accuracy of the average value, it is also necessary to take into account various characteristics of the data and possible trends in the design of the algorithm. Figure 4 is the average data of the intelligent algorithm after 50 rounds of training, which is between 71 and 76. Only in this way can artificial intelligence works be effectively implemented, thereby bringing more convenience and benefits to users.

5. Conclusion

The frequency of use of intelligent technology is increasing in social life. Among them, artificial intelligence, as an advanced, convenient and effective auxiliary tool, plays an important role in the new era. This article takes urban public art and robots as examples to analyze smart technology in detail. First of all, starting from the two aspects of urban public art and artificial intelligence, respectively discusses the existing problems of each, and puts forward the corresponding solutions. Secondly, through specific cases, it introduces how to use algorithms to improve creative efficiency, and at the same time

provide the audience with a better sense of experience, demonstrating the application of intelligent technology in design. Ultimately, this article aims to achieve the purpose of the research and is of great significance, expecting to provide a certain reference value.

References

[1] Huang W , Ren J , Yang T ,et al.Research on urban modern architectural art based on artificial intelligence and GIS image recognition system[J].Arabian Journal of Geosciences, 2021, 14(10):1-13.

[2] Li X .Suitability evaluation method of urban and rural spatial planning based on artificial intelligence[J].Journal of Intelligent Systems, 2022, 31(1):245-259.

[3] Jiang T .Urban public art and interaction design strategy based on digital technology[J].Cluster Computing, 2019, 22(4):1-8.

[4] Zicheng Zhang, Xinyue Lin, Shaonan Shan:Big data-assisted urban governance: An intelligent real-time monitoring and early warning system for public opinion in government hotline. Future Gener. Comput. Syst, 2023, 144: 90-104.

[5] Koliada M , Bugayova T , Reviakina E ,et al.EFFECTIVE MANAGEMENT OF THE INTERACTION OF SPORTS TEAM MEMBERS BY USING ARTIFICIAL INTELLIGENCE IDEAS[J].Human Sport Medicine, 2019, 19(1):72-79.

[6] Ruffle J K , Foulon C , Nachev P .The human cost of ethical artificial intelligence[J].Brain Structure and Function, 2023, 228(6):1365-1369.

[7] Zhang Q , Zhou X .Predicting the Fracture Characteristics of Concrete Using Ensemble and Meta-heuristic Algorithms[J].KSCE Journal of Civil Engineering, 2023, 27(7):2940-2951.

[8] Patowary R , Devi A , Mukherjee A K .Advanced bioremediation by an amalgamation of nanotechnology and modern artificial intelligence for efficient restoration of crude petroleum oil-contaminated sites: a prospective study[J].Environmental Science and Pollution Research, 2023, 30(30):74459-74484.

[9] Bing Yang, Chen Wang, Sai Ji, Yang Zhou, Nawab Muhammad Faseeh Qureshi:An effective revocable and traceable public auditing scheme for sensor-based urban cities. J. King Saud Univ. Comput. Inf. Sci, 2023, 35(4): 152-160.

[10] Ursina Christina Boos, Tumasch Reichenbacher, Peter Kiefer, Christian Sailer:An augmented reality study for public participation in urban planning. J. Locat. Based Serv, 2023, 17(1): 48-77.

[11] Arihara C , Yabutani Y , Akui K ,et al.METHOD OF ANALYZING THE "CHARACTER" OF URBAN SPACE BY FOCUSING ON THE COMPONENTS AND IMPRESSIONS OF THE CITY[J].AIJ Journal of Technology and Design, 2023, 29(71):400-405.

[12] Ando M , Ito Y .Examination of Human-centered Design in Artificial Intelligence System[J].The Transactions of Human Interface Society, 2023, 25(2):127-138.

[13] Rui Li, Jingqi Wang, Shunli Wang, Huayi Wu:Prediction of network public opinion features in urban planning based on geographical case-based reasoning. Int. J. Digit. Earth, 2022, 15(1): 890-910.

[14] Ahmed A H A , Jin W , Ali M A H .Artificial Intelligence Models for Predicting Mechanical Properties of Recycled Aggregate Concrete (RAC): Critical Review[J].Journal of Advanced Concrete Technology, 2022, 20(6):404-429.

[15] Haitao Li:Optimal matching of urban emergency resources under major public health events by multi-expert decision model of grey situations. Int. J. Appl. Decis. Sci, 2022, 15(5): 559-577.

[16] Feng Li, Xin Guo, Li Zhou, Jianjun Wu, Tongfei Li:A capacity matching model in a collaborative urban public transport system: integrating passenger and freight

transportation. Int. J. Prod. Res, 2022, 60(20): 6303-6328.
[17] Kurodai M .The Method of Know-how Transmission of Skilled Engineers to Younger Engineers using Artificial Intelligence[J].Concrete Journal, 2021, 59(1):51-52.
[18] Fukuyama Y .A Review of Applications of Artificial Intelligence Technologies to Energy Fields[J].IEEJ Transactions on Electronics, Information and Systems, 2023, 143(2):104-107.
[19] Mishima H .Latest Trends in the Fusion of Mechatronics and Artificial Intelligence and Expectations for the Future[J].SYSTEMS, CONTROL AND INFORMATION, 2022, 66(10):375-380.
[20] Kimura Y .Application of artificial intelligence in the field of nuclear security and its challenges (1)[J].Journal of the Atomic Energy Society of Japan, 2022, 64(11):610-613.