

Application technology of intelligent algorithm in civil engineering field

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Abstract: In the development of modern urban construction, social residents of civil engineering quality requirements are more and more high, the traditional sense of the application of technology has been unable to meet the needs of the industry, how to reform and innovate the application of technology in the field of civil engineering, has become the main issue for enterprises to discuss. After entering the era of big data, intelligent algorithm has made excellent achievements in the research and application of various fields, especially in the field of civil engineering. The technical theoretical framework with intelligent algorithm as the core can not only collect and process more data information, but also improve the efficiency and quality of practical construction. Therefore, on the basis of understanding the research status of civil engineering application technology, this paper mainly discusses the application content of BIM technology, UAV mapping technology and GPS technology according to a variety of intelligent algorithms proposed in recent years, and determines the future development direction from the perspective of long-term development in the field of civil engineering.

Keywords: Intelligent algorithm; Civil engineering; Genetic algorithm; Artificial neural network; BIM Technology

1. Introduce

In essence, civil engineering refers to the creation of all kinds of engineering facilities of science and technology, will use concrete, stone, brick, wood, metal materials and other materials to build houses, railways, tunnels, Bridges, ports, municipal health engineering, etc. The steady development of society and economy in the new era has not only created basic space for people to meet their needs, but also fully demonstrated the comprehensive strength of social development. In scientific research, civil engineering is a comprehensive subject with a very wide range of contents, so in practice, it is necessary to start from the investigation, design, construction, maintenance and other links. [1.2.3]According to the accumulated experience in the field of civil engineering in recent years, this kind of engineering has the following characteristics: First, safety issues. Using technology to realize project construction, we must consider the safety problems brought by human factors, environmental factors, construction conditions and other factors, so as to ensure the safety and stability of project construction on the basis of; Second, basic materials. The use of a large number of materials to achieve the construction objectives of civil engineering, truly meet the needs of social development and residents, and construction technology can help the construction unit to present the initial design scheme, really achieve the fundamental goal of project construction management; Third, comprehensive system. With the continuous development of social economy and science and technology, civil engineering in the new era has created a good condition, civil engineering has developed into a rich content, complex structure of the comprehensive system; Finally, it is practical. The development of application technology in the field of civil engineering is based on practical experience. With the continuous innovation of science and technology theory, the application technology of civil engineering is becoming more and more mature. On the basis of mastering more work experience, construction personnel are required to scientifically deal with the problems that project construction management may face. Therefore, after entering the era of big data, scholars in the field of civil engineering put forward to combine intelligent algorithm to optimize construction application technology, which can not only solve the problems existing in

traditional construction management, but also fully show the application value of intelligent algorithm.[4.5]

Intelligent algorithm refers to the novel algorithm or theoretical knowledge often encountered during engineering construction. The most common ones are neural network, genetic algorithm, simulated return of goods, sparrow search algorithm, etc. These contents all have similarities in practical application, such as simulating natural process, and can focus on solving complex engineering problems. According to the application of intelligent algorithm by scholars at home and abroad in recent years, intelligent optimization algorithm is mainly used to solve optimization problems. The most common combinatorial optimization problems include packing problems, processing scheduling problems, travel salesman problems and so on. At the present stage, there are many optimization algorithms applied in the field of civil engineering, such as linear programming and dynamic programming, and some scholars have improved and analyzed the algorithms in practice, such as the fastest descent method, mountain climbing method, etc., while neural network and chaotic search refer to the system dynamic evolution method. Usually, the local search is based on the greedy thought and domain function search analysis, if found a better than the current numerical solution, then it is necessary to choose the optimal solution, but finally can only get the local minimum solution, and genetic algorithm, neural network, simulated annealing algorithm, from different angles and methods can be effectively improved, finally obtain the global minimum solution.

At present, intelligent algorithms are widely used in the application technology in the field of civil engineering. Scholars from various countries have proposed more valuable hardware and software equipment through practical exploration. For example, BIM technology is also known as building information model, which should digitally represent the physical and functional characteristics of construction projects in the whole life cycle of construction projects and implementation. Thus complete the whole process of project design, project construction and project operation; Uav surveying and mapping technology uses integrated ATK positioning module to replace the traditional manual data collection mode, which is very suitable for application in the complex construction environment. It is equipped with a built-in shock absorption system and a five-lens camera optimized by experiments. After shooting high-definition image data, it can be processed by professional software cluster to form a three-dimensional construction site model. This technology is more simple than the traditional architectural surveying method, allowing the staff to complete the data analysis and effective processing under the guidance of intelligent algorithms; GPS technology as a positioning technology, practical application functions include GPS terminal, transmission network, monitoring platform, compared with other navigation systems, the data accuracy is higher, real-time positioning speed is faster, strong anti-interference performance. In this paper, on the basis of understanding the application technology research status in the field of civil engineering in the new era, according to the classification of classical intelligent algorithm, the main research BIM technology, UAV surveying and mapping technology, GPS technology application effect.[6.7]

2. Method

2.1 Genetic Algorithm

This kind of algorithm regards evolution theory as the basic idea and can solve optimization problem effectively in practice. All individuals in a population are regarded as research objects, and randomization technology is used to guide efficient search of the parameter space of the north code. In the basic operations of selection, crossover, mutation and so on, simple general and parallel processing is used to achieve global optimization search. Nowadays, the genetic algorithm is more and more widely used in the field of civil engineering, and has achieved excellent results in practice. The specific process is shown in Figure 1 below:[8.9]

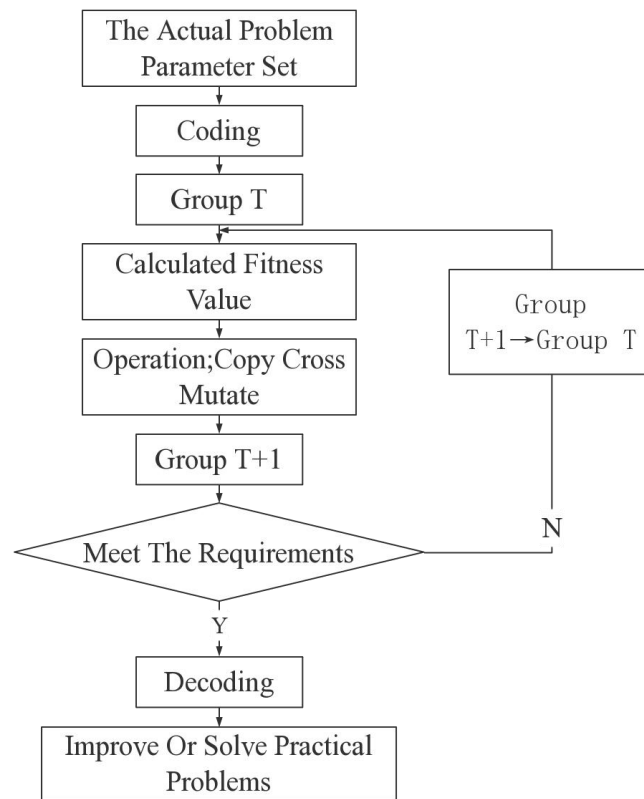


Figure 1. Flow chart of genetic algorithm

2.2 Artificial neural network

This kind of algorithm will simulate the pattern of human brain processing information, and build some simple model on the basis of abstract transformation of human brain neuron network, and finally divide into different network structures according to different connection ways. In the field of engineering and academic research, it is also called neural network or neural network. In recent decades of scientific research, artificial neural network has been widely used in the field of civil engineering, and has the following characteristics: first, nonlinear. The phenomenon of wisdom in human brain itself has nonlinear characteristics, and the artificial neurons are in two different states of activation or inhibition, which is also regarded as a nonlinear relationship from a mathematical perspective. The network model composed of neurons with threshold values can further improve the storage capacity and fault tolerance. Second, non-limitation. [10-12]A neural network usually contains multiple neurons, and the overall behavior of the system is not only affected by the characteristics of a single neuron, but also determined by the interaction between the units. Third, very qualitative. The artificial neural network itself has the ability of self-learning, self-organization and self-adaptation. It can not only process various changes of information, but also present the changing process of dynamic system by using iterative process on the basis of information processing. From the perspective of practical research, artificial neural network is a parallel distributed system, which effectively solves the problems existing in the aspects of unstructured information and processing intuition, and meets the needs of application technology reform in the field of civil engineering in the new era. The structure of the artificial neural network is shown in Figure 2 below:

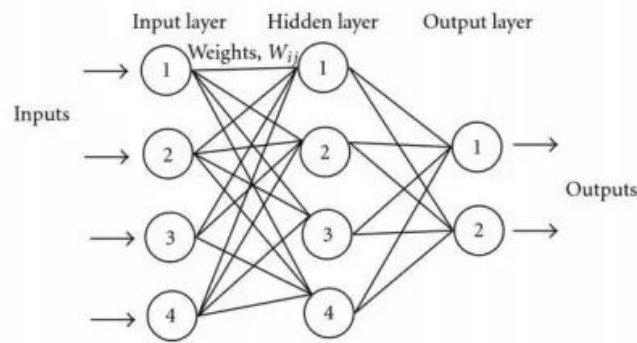


Figure 2. Structure diagram of artificial neural network

2.3 Particle swarm optimization

Derived from the study of flock hunting behavior, these algorithms use swarm intelligence to build simplified models. In the field of civil engineering application, mainly used to solve the optimization problem. According to the flow diagram shown in Figure 3 below, the solution of each optimization problem is a bird in the search space, which is called a particle. All particles have an adaptation value determined by the optimized function, and each particle has a speed that determines the direction and distance in which they fly. These particles then follow the optimal particles to efficiently search the solution space.[13]

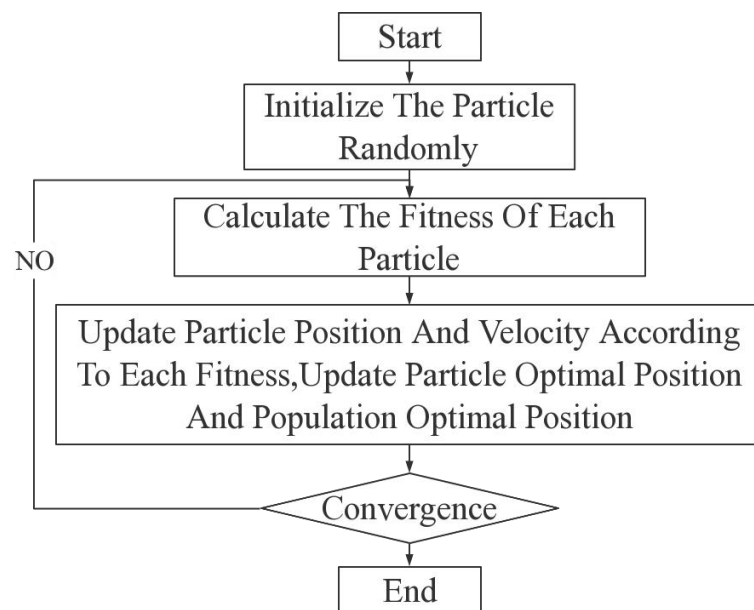


FIG. 3 Flow chart of particle swarm optimization

3. Result analysis

3.1 BIM technology

BIM technology with intelligent algorithm as the core is applied in the field of civil engineering. The specific process is shown in Figure 4 below:

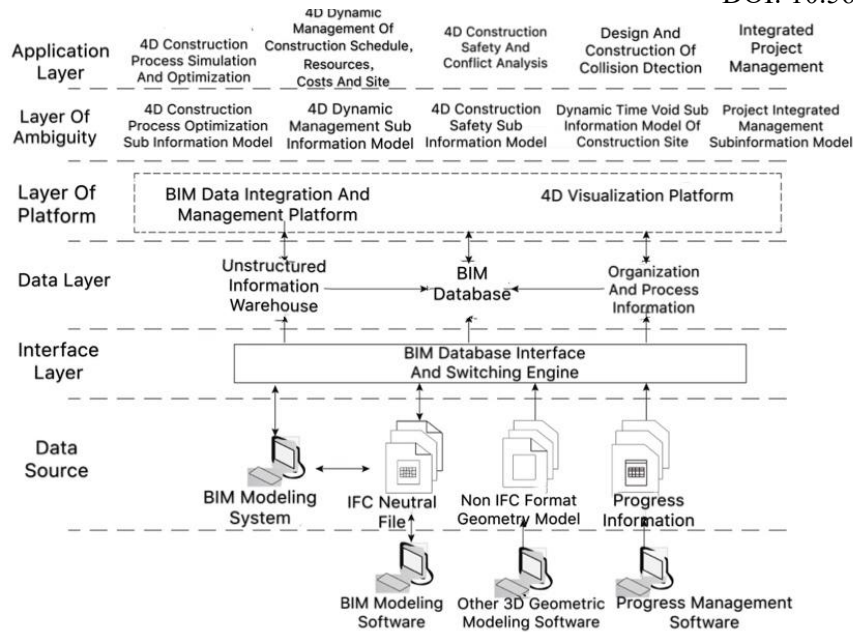


Figure 4 Construction flow chart of BIM technology

Based on the above analysis, it can be seen that the application of this technology in the field of three-dimensional geometric modeling can ensure that the final model construction is as close to the real framework as possible, and the modeling results can be regarded as an effective basis for the subsequent work of BIM technology. For construction projects with unique modeling, if the traditional construction mode is continued, it is easy to have more problems during the design and construction. The application of B M technology to realize 3D modeling can not only truly represent the building shape, but also provide an effective basis for site construction risk control. At the same time, the construction unit can also make comprehensive use of Project software and MVC system to build a 4D system structure system with BIM technology as the core, and establish the corresponding implementation process to clarify the logical relationship and possible obstacles of each work. In addition, the use of the virtual construction process as shown in FIG. 5 for project construction management can not only guarantee the life cycle of the project construction, but also continuously optimize the construction level of the construction unit.[14]

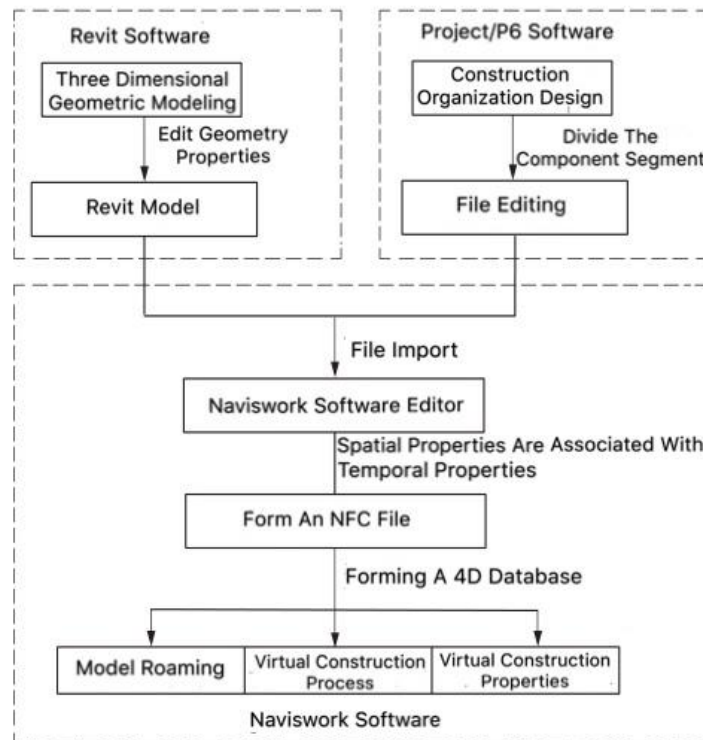


FIG. 5 Flow chart of virtual construction

3.2 UAV mapping technology

For the development of civil engineering field, UAV surveying and mapping technology is mainly used in engineering surveying, which can not only effectively relieve the pressure of special terrain measurement, reduce the work risk of construction personnel, but also ensure the perfection and scientific data acquisition, and limit the numerical difference of field measurement within the prescribed range. The UAV surveying and mapping technology with intelligent algorithm as the core can ensure that the acquired data can be automatically classified and sorted, ensure that construction personnel can quickly obtain valuable content, optimize the overall construction project measurement system, and improve the original data processing operation process.[15]

3.3 GPS Technology

In the field of civil engineering, the application range of GPS technology is very wide, in a certain sense can optimize the site construction environment, improve practice efficiency, promotes our country civil engineering industry steady development. After the integration and application of various intelligent algorithms, GPS technology can actively show its own measurement and positioning advantages in construction, Bridges, DAMS, tunnels, highways and other civil engineering fields. For example, during the construction of road and bridge, GPS technology can provide accurate three-dimensional positioning information, realize construction lofting in the horizontal control network and high-rise control, and ensure that the plane and elevation accuracy of lofting points meet the requirements of road and bridge construction. Among them, the three-dimensional positioning process of this batch of S is shown in Figure 6 below:

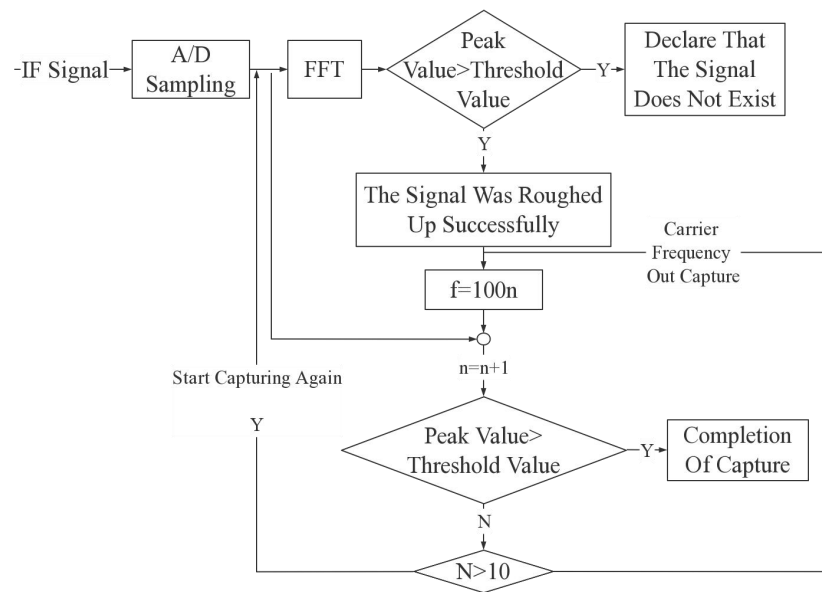


Figure 6. 3D positioning flow chart of GPS

4. Conclusion

To sum up, along with the continuous development of our country social economy and science and technology, the basic theory and application technology in the field of civil engineering master more and more, after the integration of a variety of intelligent algorithms, the original technical theory has been optimized innovation, not only improve the comprehensive technical level of civil engineering, but also in the practice of exploration to discover more valuable research results. Therefore, Chinese researchers should continue to strengthen the application of civil engineering technology and intelligent algorithm research, pay attention to the combination of practical cases for verification and analysis, in order to create a harmonious development of the social environment.

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