Preliminary Study on the Application of Artificial Intelligence Technology in Engineering Cost Estimation

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Abstract

Artificial Intelligence (AI), also known as machine intelligence, focuses on research areas including machine automation, recognition technology, and program automatic design. As a-edge technology in the current information technology field, it mainly relies on computer systems to carry out a series of complex activities. AI technology is a powerful complex that fully integrates human abilities as perception, thinking, memory, learning, feedback, and processing, transforming human intelligence into machine intelligence, and further simulating and expanding human intelligence.Its application is conducive to data model, improving the speed and accuracy of cost estimation.

Keywords

Cost estimation, artificial intelligence, BIM technology.

1. Introduction

Applying artificial intelligence technology in engineering cost estimation work has great practical significance. Therefore, relevant personnel should study artificial intelligence technology in depth, use BIM technology and artificial computing technology in engineering cost estimation work, and establish a cost database, so as to improve the quality and efficiency of cost calculation and promote the sustainable development of relevant enterprises.

2. Construction Cost Estimation Model Construction

2.1. Basic Principles of BP Neural Network

BP neural network is an artificial intelligence technology with a range of current applications, belonging to a special type of feedforward neural network. This network structure adopts the backpropagation method, and simulates the information transmission mode and connection relationship neurons in the brain, among which a large number of neurons and connection relationships form a nonlinear mechanical system [1]. This neural structure has strong learning and adaptation capabilities, and the micro-activity each neuron can produce powerful effects. According to the difference in the positions of neurons in the BP neural network, this network can be divided into three layers: input, output, and. There are multiple nodes in each of its layers, representing different neurons; there are no connections between nodes in the same layer, while nodes in different layers interact and connect, and information propagation between nodes proceeds sequentially[2-4]. After information is input from the input layer, it is sequentially passed into the hidden layer, and finally output through the output layer, with an irreversible direction. According to the characteristics construction project costs, a BP neural network structure with multiple input and hidden layers and one output layer is set up[5].

2.2. Reasonably Determine Model Parameters

First, determine the structural parameters. The determination of parameters for the BP neural network structure is a very important step in model construction, where the of nodes in the

input and output layers should be selected according to the actual needs of the construction project. Set H as the input vector (H = x1k, x2, ..., xnk), Y as the actual output vector, and set (Hk, Yk) (k = 1, 2, 3, ..., N) as training samples used to calculate the number of training samples in the model. Second, select the initial weights. There are many qualitative and quantitative factors in the input layer of the BP neural network, which need to be uniformly processed and converted into a certain range. Qualitative factors are processed using a method similar to that for quantitative factors, with their values set between -1 and 1 Third, select the node function. Set the node output function as fx(), and find its derivative, so that all input data can be converted into numbers in the interval of 01.

3. Genetic Algorithms and Artificial Neural Networks

3.1. The Combined Use of Genetic Algorithms and Artificial Neural Networks

Under the combined use of genetic algorithms and artificial neural networks, this method highly efficient and can effectively optimize the negative factors of neural networks. In engineering cost management, the method is mainly based on genetic algorithms, using neural network weights for optimization. When the connection weights of the neural network, it can be controlled solely through functions. However, during the training process of neural network connection weights, relevant personnel should pay attention to parameter selection This is because, under the joint action of multiple factors, parameter selection is highly likely to encounter certain problems, which in turn extends the training time of neural network connection weights, affects the effective of the convergence of genetic algorithms, causes the neural network to oscillate, and ultimately affects the accuracy of the engineering project cost estimation results.

Therefore, when optimizing the connection weights the neural network, relevant personnel should reasonably apply genetic algorithms to ensure that the neural network connection weights and weights are in a corresponding state, enhance the accuracy of the weights, reduce the function error, and lay a good foundation for engineering cost estimation work and subsequent control work.

3.2. Establish a Cost Database

Engineering cost work involves multiple aspects such as quantity takeoff, price calculation, budget preparation, and cost limit control, all of which are directly related data. The accuracy of data can effectively improve the quality of engineering cost estimation. Therefore, to effectively improve data quality, the engineering construction field has established multiple industry databases, all of apply artificial intelligence technology, greatly improving the speed and quality of information data collection.

From the current situation, existing industry databases in the engineering construction field include various indicators released by Huix.com, Glodon, and the Shanghai Quota Management Station, as well as Yicai.com, which mainly provide material prices and information prices. Through the establishment of databases, engineering cost-related personnel can perform data crawling and processing in an informatized manner. In the practical application of artificial intelligence technology, the main task is to create a cost system, which associates and processes data to provide a big data platform foundation for land acquisition estimation and limit design. During the use of this database, it can not only store engineering cost data but also analyze benchmark, verify, and refine the data, thereby providing a data foundation for various decisions made by engineering cost-related personnel and achieving effective control of engineering cost.

4. Artificial Intelligence Computing Models

4.1. Establishing Artificial Intelligence Computing Models

For engineering cost work, the main task is to calculate the engineering cost and control various costs within cost plan in subsequent work, so the accuracy of calculating quantities and costs is extremely important. In traditional engineering cost estimation and control work, calculation deviations are easily caused by computers and manual alone.

However, by applying the BP neural network in artificial intelligence technology to engineering cost work, comprehensive calculations of the project can be performed, thereby improving calculation efficiency while ensuring calculation. Specifically, the BP neural network intelligent software requires relevant personnel to input information parameters, after which the neurons in each part, especially the hidden layer, perform comprehensive calculations to obtain the accurate and optimal results. By applying the BP neural network software, the engineering cost can be repeatedly calculated to continuously reduce errors, thereby laying a good foundation for subsequent work.

4.2. Application of BIM Technology

Against the backdrop of continuous technological development, BIM technology has developed rapidly in the early 21st century and has been applied to the of engineering construction, including the stages of decision-making, design, bidding, construction, and completion of engineering projects. Compared with traditional engineering cost methods and processes, BIM technology in intelligence effectively avoids errors caused by manual control, greatly improving the quality and efficiency of engineering cost control.

In the practical application of BIM technology, its main foundation is computer technology, is used to intelligently and automatically analyze, process, and manipulate engineering cost-related information, thereby scientifically and reasonably estimating and controlling engineering costs, and avoiding situations such as engineering changes. addition, during the use of BIM technology, dialogue elements can be added through virtual assistants, and combined with on-site communication and sensors, relevant personnel can use this technology to additional information about various aspects of the engineering project construction in real time, thereby controlling the project schedule, construction status, and costs, and strengthening the quality of engineering management. Furthermore, technology can also collaborate with engineers, and through VA and VI, it can effectively reduce the time and cost of carrying out engineering cost-related work, thereby improving work efficiency while reducing costs.

5. Results

5.1. The Establishment of Simulation Model

Research shows that the main influencing factors in construction engineering projects include mechanical equipment, building structures, hydrogeological conditions, and construction technology. Within weight gradient space, weights are obtained with the help of a gradient algorithm and adjusted accordingly to ensure the calculation error is as small as possible. After all sample inputs, the total error is calculated and the inverse algorithm of the BP neural network is used to estimate the construction cost of the engineering project, and the collected data is organized and processed. The obtained exact data are used training samples, and then an iterative method is adopted to obtain the estimated samples of the construction project cost. The various parameters of the engineering project are processed and treated, and then input the estimation system. Since all parameters have been determined, the total cost of the construction project can be estimated.

5.2. Analysis of Experimental Results

Using a BP neural network model to estimate engineering costs, the accuracy reaches over 95%, which is a relatively satisfactory result for early-stage engineering projects. the early construction stage of building projects, there is not much data available for research, and the error in engineering cost estimation is usually around 10%.

6. Conclusion

From the current application status of artificial intelligence technology in engineering cost estimation, the technology is gradually evolving towards the development of multi-expert collaborative systems and tools. constructing a large-scale distributed artificial intelligence development environment, it provides favorable technical conditions for engineering cost estimation work. However, after introducing artificial intelligence technology into engineering cost estimation, it can not only accurately calculate various costs and the total cost of engineering projects, but also perform clash detection, thereby minimizing the volume of change orders and variations. It can be seen after applying artificial intelligence technology, the focus of engineering cost estimation work has changed. Therefore, the comprehensive abilities of the staff should be continuously strengthened to enable artificial intelligence technology to play its original.

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