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Establishment and application of intelligent city building information model based on BP neural network model

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Abstract. The construction of smart cities in our country has received extensive attention. Under the situation that smart cities are vigorously promoted nowadays, compared with traditional construction and operation and maintenance methods, building information model (BIM) technology is more suitable to serve as an important foundation for intelligent management in the whole process of construction projects. BIM is an abbreviation for building information model. BIM relies on a variety of digital technologies, which can be used to realize information modeling of urban buildings and infrastructure. The efficiency of information exchange in the process of intelligence construction ensures the integrity and accuracy of information data exchange and maintains the consistency of information data exchange. Data and information have objectivity, applicability, transferability, and sharing. Geographic data is a digital representation of various geographical features and phenomena and their relationships. BIM is a digital representation of physical and functional characteristics of a facility. It can It is used as a shared knowledge resource for facility information. It becomes a reliable basis for facility life-cycle decision-making. Input BP neural network, and then learn and train by BP neural network.

Keywords: BP neural network; smart city; building information model

Introduction

The development potential of smart city refers to a kind of goal formed by various development factors under the support of smart city information infrastructure, which aims at promoting economic growth, social management, public service and residents' living and working in peace and contentment [1]. Building a smart city is conducive to further promoting the in-depth integration of industrialization, informatization, urbanization and agricultural modernization, accelerating the construction of a "two-oriented" society, intelligently advancing the process of new urbanization, and realizing scientific urban governance [2]. The related work of construction engineering can obtain the required information from this building information model to express the interpretation of geographic data of the relationship between geographic features and geographic phenomena, thus geographic information has three major features: spatial features, temporal features and attribute features [3]. Management and mechanism innovation has become the core concept that it must follow. Among them, technological innovation provides strong support for management and mechanism innovation. It can guide the corresponding work and feedback the corresponding work information to the model [4-6]. The continuous incentives and the existence of resources indicate that the organization's sensitivity to these forces will increase and the adoption rate of new technologies will increase. From this conclusion, we can summarize the rate of diffusion of BIM technology in the industry in a smart city environment and fully reflect the wisdom of BIM technology. Requirements for building operation phase [7].

Smart city is a new concept that uses cloud computing, big data, Internet of Things, mobile Internet and spatial geographic information integration and other new generation information technologies to promote intelligent urban planning, construction, management and service. The

adaptive optimal tracking control scheme for discrete nonlinear systems with approximation errors based on neural networks was studied by relevant scholars in (2015), the use of artificial neural networks to evaluate safety factors was proposed in the same year, and the recurrent neural networks simulating crack propagation of aluminum alloy were studied by relevant scholars since (2016) [8-10]. With the development trend of intelligent buildings, building information model (BIM) technology has been widely popularized and applied. BIM is a digital expression of the entity and functional characteristics of engineering project facilities [11]. The integration of BIM and three-dimensional digital cities can greatly reduce the cost of acquiring internal space information and break through the limitations of outdoor building surface models for display purposes only. Related design and technical standards have been introduced. Evaluating the level of smart city construction can provide theoretical support for smart city construction and provide ideas for effectively dealing with unreasonable phenomena in urban construction [12]. BIM technology is developing toward the main direction of future construction industry information management, but China's application of this technology is still in the stage of learning and exploration. It requires buildings to take the road of green, low carbon, high efficiency and sustainable development from the planning period , Using information technology as a tool to change the extensive design, construction and operation model of the traditional construction industry [13]. Therefore, it is urgent to solve the problems such as the transformation of the working model of the construction industry, the comprehensive promotion of BIM technology, and the in-depth development [14]. The integration and innovation of new-generation information and communication technology and urban planning and construction management to provide support for the improvement of urban governance and sustainable development has become the core task of the current smart city construction [15].

Intelligent city building information supports the integrated management environment of construction projects, which can significantly improve the efficiency of construction projects and greatly reduce risks in the whole process [16]. In the whole life cycle of construction engineering. The development of new urban modeling techniques to better describe and express cities or communities digitally has become a new topic facing the construction of smart cities [17]. The combination of traditional architectural style and modern control system can realize intellectualization at various points that can be controlled to create a living environment suitable for and convenient for people [18- 20]. BP neural network is the most popular and effective learning model. Compared with other traditional models, BP neural network has better durability and timely predictability. BP neural network model is usually used for classification.It has high self-learning, adaptive and fault-tolerant capabilities [21]. In other words, the mapping relationship between BP neural network simulation input and output can be continuously learned, and this process is reflected in the dynamic adjustment of network weights and thresholds. After repeated training, the error rate is stable within an acceptable range. At this time, the corresponding network parameters can be finally determined to reach the local optimum [22]. The reduced index is input to the BP neural network as an input variable, and then learned and trained by the BP neural network. Therefore, this paper conducts research on the establishment and application of a smart city building information model based on the BP neural network model [23].

Application of Bim in smart city planning

BP neural network model

Smart city is to lead the transformation of urban development with innovation, comprehensively promote the new generation of information and communication technology and the new urbanization development strategy, deeply integrate and improve the modernization level of urban governance capability. The information model of buildings, including the behavior model of building engineering management, is the perfect integration of building information model and the behavior model of building engineering management. Information interoperability and integration, and put forward a BIM construction framework based on the whole life cycle of the project, which provides effective ways and methods for information sharing among all participants of the construction project [24]. It is oriented to the real-time integration of multi-source information and cross-domain

information sharing under the urban and regional systems, thus supporting cross-sectoral collaboration and fine management services of the city. BIM data structure and format are more suitable for architectural design, construction and operation. It is necessary to design a building information model applied in a three-dimensional digital city and realize the conversion from BIM model to this model [25].BP neural network can be used to solve complex system problems, identify and understand the direct and indirect relationships between specific items to analyze the impact between elements, and it is very suitable for system analysis with many variables and unclear structural relationships. The analysis results are intuitive. Usually refers to the forward multi-layer neural network back propagation algorithm and error back propagation algorithm based on the bit error rate. The speed is by far the most successful neural network learning algorithm. It uses the error rate output to estimate the error rate directly after the output layer of the previous layer, and then uses this error rate to estimate the error rate of the previous layer. After such a layer of backpropagation, the error rates of all other layers are estimated. The BP neural network topology includes an input layer, a hidden layer, and an output layer. The statistics of the training results of the number of nodes in different hidden layers are shown in Table 1 and Figure 1. The BP neural network model is shown in Figure 2 below.

Table 1 Statistics of training results of nodes in different hidden layers

	Operation times	Search times
Network output value	3	6
Actual branch	5	2

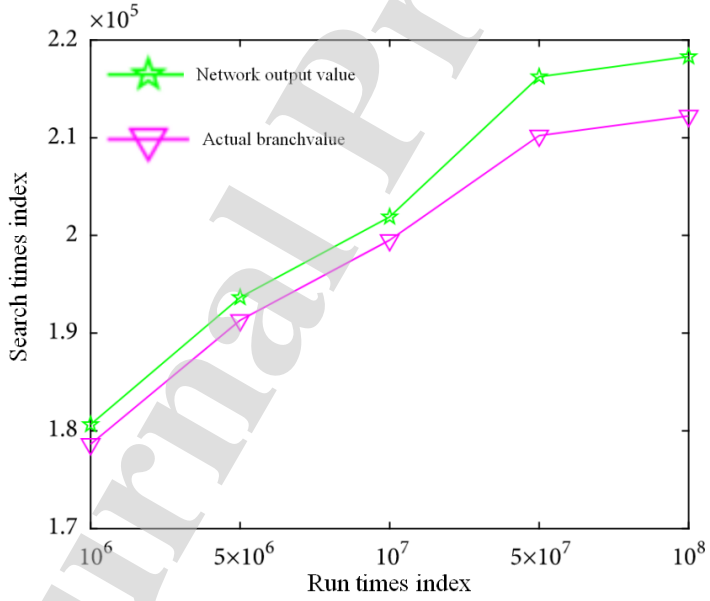


Fig. 1 Statistics of training results of nodes in different hidden layers

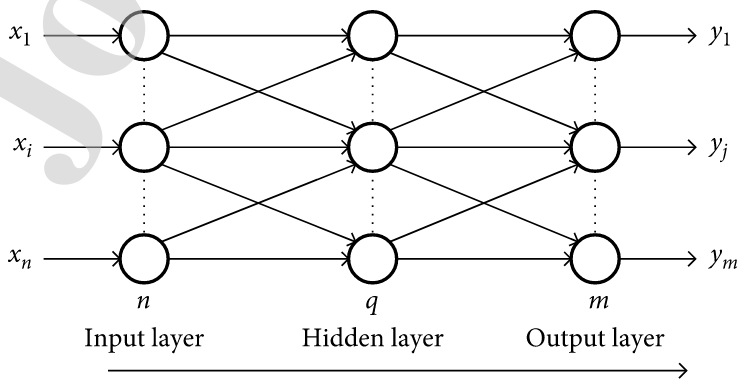


Fig. 2 BP neural network model

When modeling buildings in smart city, the whole modeling process is firstly divided into subject modeling and roof modeling, and only subject modeling is available in flat-top building models. The input sample preprocesses the ciphertext and plaintext to the modified BP neural network to obtain the output. By accepting a certain event in a certain place and its change process with time, geographic information technology can not only judge the change process of phenomena, but also predict the future and trace back the past according to the existing perceptual data. However, most existing 3D digital city platform engines support 3D surface models to facilitate browsing and spatial analysis of massive data. Therefore, it is necessary to convert solid models into surface models in integration. We compare this output expected plaintext to carry out BP neural network simulation decryption system. The output of each decimal digit converted neural network is converted into binary. If the number of digits is not enough, the high digits are filled with zeros, and then all are connected to the effect of restoring plaintext. As a training function, the default value of the function is 0.1. The function has fast convergence speed and is more effective for smaller networks. It is suitable for training and simulation of relatively smaller networks in this paper. The convergence of the function is shown in Table 2 and Figure 3. Component coding, naming standards, information classification and coding standards, and creation standards for component information and model component libraries. It is recommended that building information coding should follow basic principles such as rationality, scalability, and uniqueness. Factor data privacy and security and level 2 factor information maintenance failures are located at the top of the model, indicating that they have less impact on BIM operation and maintenance management applications in the context of smart cities, and may be greatly affected by other factors. Table 3 and Figure 4 show.

Table 2 Function convergence

	Interactive quality	Feedback
Visualization	13.05	16.61
Simulation	12.82	14.58

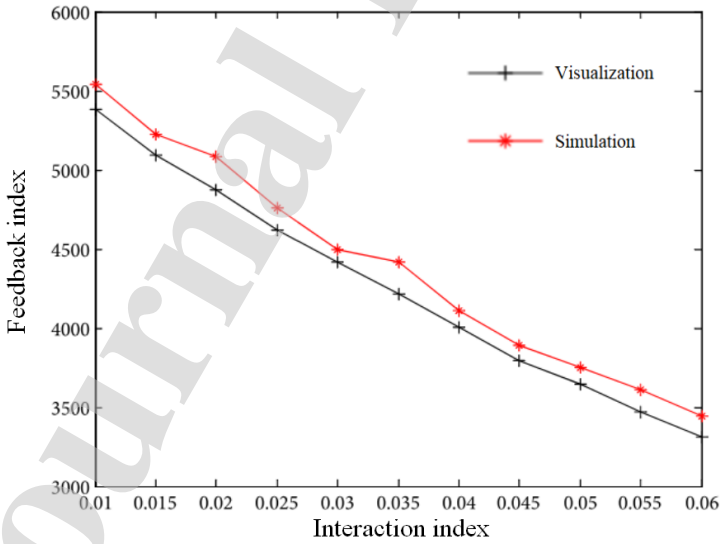


Fig. 3 Function convergence

Table 3 Interaction of influencing factors

	Connectivity	Reachable set
Data privacy security	0.35	0.42
Information retention time	0.51	0.25

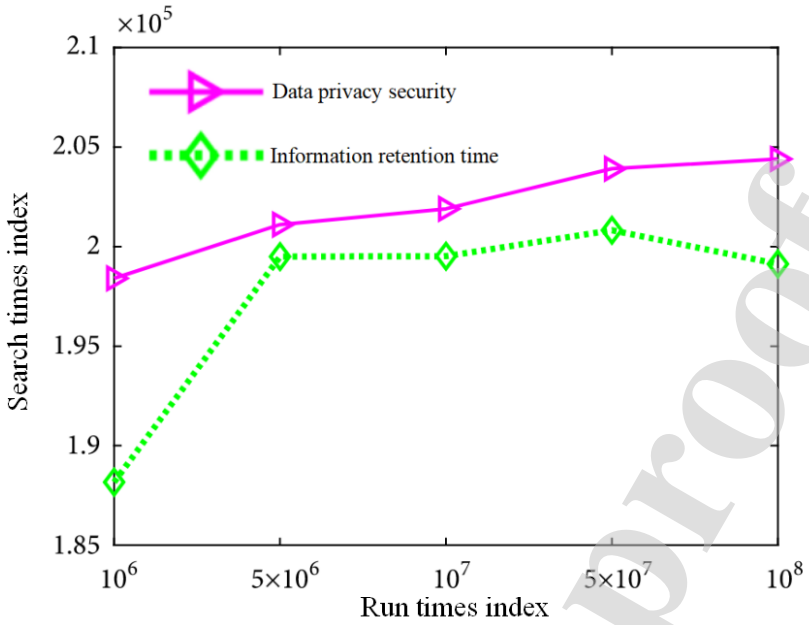


Fig. 4 Interaction of influencing factors

Training and Simulation of network model

Under the smart city environment, the informatization development of the construction industry especially depends on the information transmission standards between different stages and specialties, i.e. a standard semantic and information exchange standard for the whole industry and the supervision of relevant laws and regulations need to be established [26]. In real cities, there must be no way to directly connect the information layer in geographic space, but the crossing layer between them-the building facilities layer-is needed to complete the information structure, which points to BIM. BIM model provides information about the actual existence of buildings, including geometric information, physical information, rule information, and information about the actual existence of buildings after changes. BIM technology can provide detailed building structure information for spatial features in GIS and more detailed understanding of internal conditions of components. GIS technology can provide spatial location information for BIM. The building environment provides great opportunities and challenges for the application of this intelligent sensor system and brings practical economic, environmental and social benefits. In particular, as a symbol of the global urbanization trend, buildings have more potential to use modern technology to improve operational efficiency and provide better living and working conditions. This involves, inter alia, aspects related to energy management, occupancy detection and prediction, safety and security. On a larger scale, smart city infrastructure can enable these advances, resulting in broader benefits in environmental monitoring, traffic management, improved utility networks and social services. Edit and modify graphics and text data. Attribute data is relatively standardized and suitable for table representation. Therefore, many geographic information systems are managed by relational database management systems. Information infrastructure is both a carrier of smart city construction and a means of operation and management of smart cities, laying a material foundation for smart city construction. And prerequisites. Different simulations at different levels of organization and levels of abstraction are shown in Table 4 and Figure 5. The influence factors are compared independently from each other. According to the relationship and direction of the variables, different symbols are allocated between the elements to determine the relationship between them. direction.

Table 4 Different simulation of different organization level and abstract level

	Different organizational levels	Abstraction level
Model collection	17.33	18.61
Model checking	16.09	19.52
Engineering supervision	20.05	18.91

System application	16.82	17.03

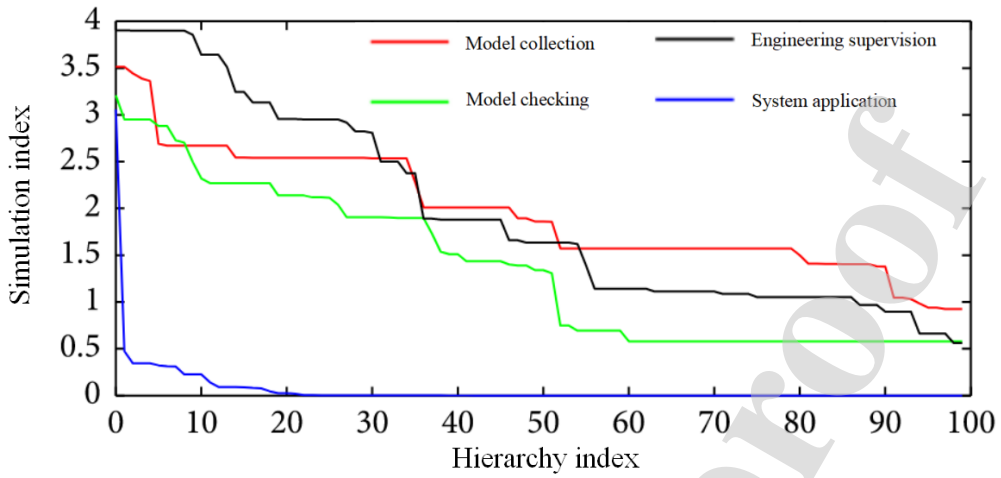


Fig. 5 Different simulation of different organization level and abstract level

After the lightweight processing of BIM model is realized, the three-dimensional visual display of BIM model in GIS system is realized through the connection between LAN or Internet and server. Intelligent system intelligent recognition, three-dimensional perception of all-round changes in the building, the perception of data fusion, analysis and processing, and then actively respond to promote the harmonious and efficient operation of all building systems. In order to make the model converge quickly, BP neural network needs a large number of training samples for learning. Using the training sample data, the data is set as training data, and the network is tested by simulation data. If the error is less than the allowable error, the learning process is terminated; otherwise, the output deviation of each layer needs to be calculated for error back propagation to modify the weight and threshold value of BP neural network. Repeat the process until the global error reaches the allowable error, then record all weight values and thresholds, and the network training is terminated. The predicted value can be obtained if the input sample data.BP neural network simulates the mapping relationship between input and output through continuous learning, which is reflected in the dynamic adjustment of network weights and thresholds. After repeated training, the error rate is stable within an acceptable range. Through the back propagation of errors, the weights and thresholds of the network are continuously adjusted to ensure the minimum sum of squares of errors between the expected output and the actual output of the neural network. At this time, the corresponding network parameters can be finally determined to reach the local optimum. If the neurons of the local BP neural network are damaged, it has little effect on the training results. If there is a relationship between the risk sources, it is used to illustrate the relationship between variables by pointing, as shown inTable 5 and Figure 6.

Table 5 Relationship between variables

	Transformation	Features
Digital information	0.05	0.21
Real information	0.13	0.32

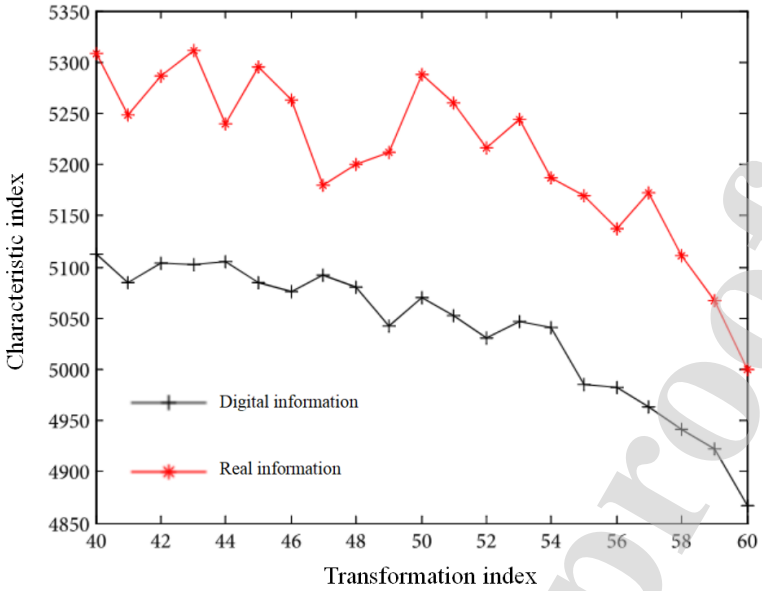
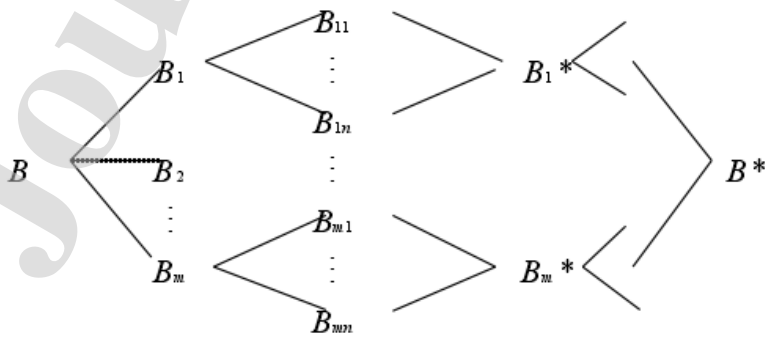


Fig. 6 Relationship between variables

Determination of influencing factors of BIM operation and maintenance management application in smart city

BIM information sharing among project parties

The development of BIM application management in the whole process depends on the formulation of multi-party legal framework. Only a series of standards and regulations are formulated as the basic conditions for its application and development, so as to further optimize the relevant policy and legal environment of BIM application. Integrate big data analysis into smart city architecture. However, the proposed scheme is not a traditional smart city embedded with big data, because it uses Kalman filter to perform explicit data filtering before big data processing. Perform data filtering to further speed up data processing. Threshold based filtering is applied to distinguish valuable data from noisy data. As a result, it reduces the load that needs further processing. Geographic data and information have the characteristics of spatial distribution, massive quantity, diversity of carriers, and correspondence between location and attributes. Similarly, we occupy a cluster of nodes for big data processing. As shown in Figure 7, by reading the second domain layer and the data access layer, the BCM building component model can be read. The unification of data filtering and system architecture improves the throughput of smart cities while reducing processing time. Therefore, this solution can meet the needs of smart city architecture for data processing and real-time decision-making.



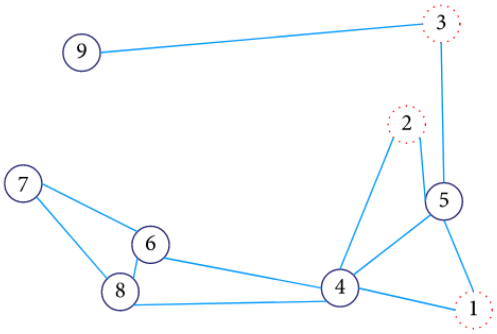


Fig. 7 Node cluster

Spatial partitioning is used to describe internal properties, dividing a spatial region containing an object into a group of smaller, non-overlapping continuous entities. The principles and methods of classification and coding of location information and equipment information form a "digital code". It is proposed that the classification and coding should adopt the principles of systematicness, stability, uniqueness, universality and expandability. Data processing objects can be divided into spatial information systems and non-spatial information systems, and can be divided into transaction processing systems, management information systems and decision support systems according to application levels. And meet that requirement of collecting and transmit state information about the objects. Therefore, IOT technology needs to be introduced to complete the correlation between dynamic information of environment and material entities and static information already described by BIM. Current state observations are represented by. Indicates the estimation of time, while the estimation accuracy is represented by. Cross management of different components is conducive to information transmission and data exchange between departments, which can effectively avoid data errors and other situations, and effectively reduce duplication of construction. It deduces valuable data from a large amount of indirect and uncertain data. Because of recursive work, it processes data when it arrives, so it ensures the real-time operation of smart cities. The data layer fusion is shown in Table 6 and Figure 8. In addition, it facilitates instant processing with minimal memory consumption. As noise is removed from the data, the level of data processing uses its ability to infer the best estimate from a larger real-time data set. Then, manipulation is performed to determine valuable data corresponding to a predetermined threshold. The information requirements for building operation and maintenance are accurately described, so as to achieve the effects of visualization of facility and equipment management, automation of maintenance and repair, accurate and precise safety supervision, intensive information management, and intelligent emergency response during the operation and maintenance stage. Determine real-time energy consumption and move to the middle tier. The data processing layer defines a threshold for the energy consumption of a particular home. The data filtering process is performed through fusion techniques to determine values that exceed a threshold value to optimize further processing.

Table 6 Data layer fusion

	Collection	Distinguish
Network interconnection	2.10	3.19
Network protocol	1.85	3.50
Mobile Internet	0.26	2.54

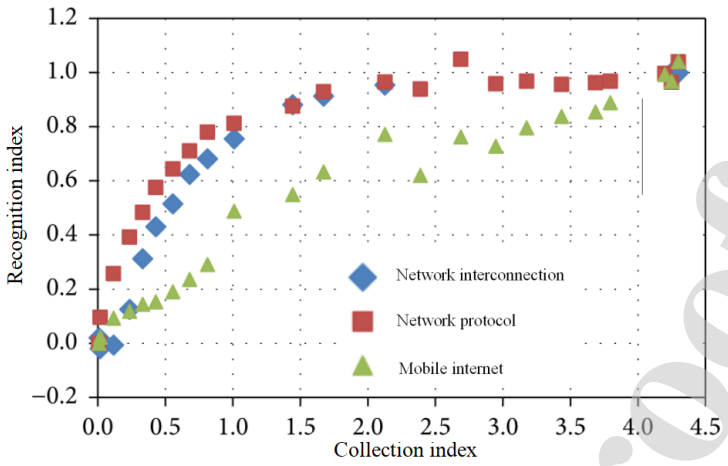


Fig. 8 Data layer fusion

Determine the number of hidden layer nodes. The number of hidden layer nodes has a great influence on the performance of BP neural network. In general, it is determined according to empirical formula:

$$\left(\alpha_{MMSR},\beta_{MMSR}\right)=\left(\frac{M}{k},\frac{M}{k\left(d-k+1\right)}\right) \tag{1}$$

The number of neurons in the output layer is generally determined according to actual problems, and different learning results will adopt different number of neurons in the output layer:

$$2k\le n,k\le a,2k-1\le d\le n-r \tag{2}$$

Determine the initial value, and generally set the initial value to a smaller non-zero random value:

$$G^m=\left[G_1^T,G_2^T,...,G_k^T\right]^T \tag{3}$$

$$A^TG=\sum_i A_i^TG_i \tag{4}$$

The difference equation of the network is used to run the BP neural network, which makes the network close to the minimum as a formula:

$$G_i^{(m)}=\begin{cases}I_m,i=m\\0_m,i\ne m\end{cases} \tag{5}$$

$$S_1=R_1=\left[G^1,G^2,...,G^k\right] \tag{6}$$

Increasing the level of wisdom can control the waste of energy and water resources in the process of building from design to entity, at the same time, it can improve the degree of industrial correlation, promote the common development of the surrounding economy, and more importantly, it can gradually improve the ecological environment and the quality of life of the surrounding residents. Encouraging the development of organizational culture featuring new technological innovation is a major factor supporting the development of BIM application in the whole process. Cultivate key figures and excellent teams of BIM technology to promote intelligent changes in the construction industry. In the building model generation process of smart city, a vertex needs a series of calculations and transformations from generation to final addition to the model file to become a vertex of the model, and the data processing level generates appropriate intelligent decisions. At the same time, decisions are communicated to the application level. Therefore, the event is unicast to the application-level intelligent control department. The generated events are then forwarded to the sub-service level of the alternate path. Each component is given unique parameters in accordance with unified coding rules; in combination with existing software platforms, data is always available in the form of a stream, and the size of the data does not affect the system. But making a system that processes data directly at high speed is very important. Therefore, the proposed filtering helps to

minimize the processing time of the Hadoop system. Deepen the data exchange, information classification and process rules, and put forward the information depth level standards of BIM model components. Track, search, control, and finally bring all the objects of IoT onto this unified space platform. On this platform, you can find the information you want intuitively, vividly, and visually.

Data exchange, information classification and process rules are further expanded, and BIM model component information depth grade standards are proposed respectively. Tracking, searching and controlling, information interoperability under BIM environment is shown in Table 7 and Figure 9. In the end, all the objects of the Internet of Things are brought to this unified spatial level. There are great differences in the integration degree and content of the information contained. In the application process of the building information model, it is necessary to select targeted information according to different needs.

Table 7Information Interoperability in BIM Environment

	Space	Node
Two-way direct interoperability	3.32	2.05
One-way direct interoperability	2.18	3.03
Direct interaction in the middle	3.19	2.51

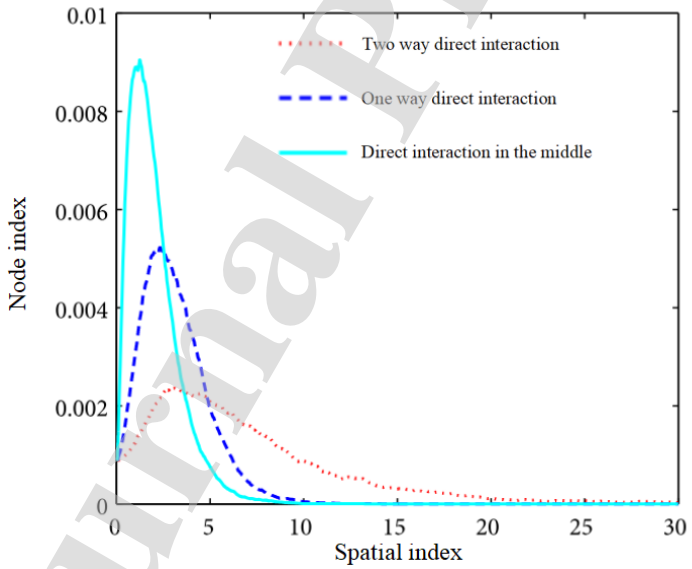


Fig. 9 Information Interoperability in BIM Environment

Certain constraints are imposed between different parameterizations to form associations or connections, which can be automatically maintained by the system. The application of the model can enable the design information to be communicated and transmitted in time, and better solve the problem of mutual cooperation among different specialties in collaborative design, thus greatly improving the quality and efficiency of design. Additional momentum can help to find better solutions, and adaptive learning can shorten network training time. The network of training sample sets should be authoritative, with high reliability of evaluation results, and the training models need to store and perform risk prediction projects. If the corresponding risk assessment value is input, the neural network system can calculate the comprehensive risk assessment value of the project through the previously calculated weight and threshold. As the output result of the network output layer, the final evaluation result can be obtained. Due to the complicated relationship between various

influencing factors, it is not intuitive in this project, and a linear expression is used for risk prediction. Choosing BP neural network to process data non-linearly to get the value of quantitative risk assessment. The BP neural network does not need a set of data for the corresponding non-linear function equation; instead, it iterates the corresponding results that meet the requirements, and obtains an equation model that can meet the requirements of the project through its own training. It is more effective and convenient than traditional methods; neural networks have broad application prospects in nonlinear and other fields. Variables are used in prediction problems, and the main goal is to predict, and some related variables are selected according to their degree of correlation. Components in a composite network correspond to different types of variables. The main network is to build structural variables based on predicted objects, and assist the network to construct related variables that provide references. Auxiliary network, the main input variables and object related variables. The network mainly sets the structure of time series trends and feedback. In the feedback, the data change gradient is also set as an input to compensate the prediction, and the auxiliary network implements univariate regression. In addition, it is not just a variable that affects a variable object. Therefore, there are some auxiliary networks in practice, and the number of auxiliary networks is equal to the number of variables.

Adjust the weighting coefficients of the output layer and the hidden layer until the global error function of the network is less than the preset fitting error, the network training ends, or the next learning cycle is performed until the curve converges to reach the set error:

$$S^* = \arg\left\{ f(S) \right\} = \sum_{i=1}^{n} \max\left\{ \left(T_{s_{m,j},m} - D_{s_{m,j}} \right), 0 \right\} \to \min \tag{7}$$

The overall network error function of the network is less than the pre-set fitting error, the network training is over, or the next learning cycle is performed:

$$c\left(j_1, 1 \right) = t_{j_1 1} \tag{8}$$

$$c\left(j_1, k \right) = c\left(j_1, k-1 \right) + t_{j_1 k}, k = 2, \cdots, m \tag{9}$$

The actual output and the expected output result are very close, and the error between the actual output value and the expected output value reaches the preset target:

$$c_{\max} = c\left(j_n, m \right) \tag{10}$$

$$a_i = (\tau_{\mathrm{i}} - \tau_{i-1}) / (\rho_i \, \mathrm{h_i}) \tag{11}$$

Consider the dynamic properties of a BP neural network model with two neurons simulated in the following form of building information model:

$$x_l = \left\langle w, g_l \right\rangle \tag{12}$$

Start learning and training, and output results:

$$l = \left(i, x, y \right) \tag{13}$$

$$z_l = v_i \cdot x_l + t_i \tag{14}$$

Model generation parameters

In the whole building information model, the model and a complete set of design documents are stored in the same database, and all contents are parameterized and interrelated. From the birth of the building, it provides reliable knowledge resources for information sharing for the whole life cycle of the building. It is based on IFC standard and is the integration of various information in the building life cycle. BIM can perform simulation experiments on some items that need to be simulated in the design, such as: energy saving simulation, emergency evacuation simulation, sunlight simulation, thermal energy transmission simulation, etc. A mutually-recognized data exchange format is required between any profession and participants in a construction project, confirming that the IFC data exchange format is the only and effective data exchange format.BIM is a powerful engineering information database. The model completed by BIM modeling includes information in the existing two-dimensional data and automatically generates indoor navigation ontology and context-aware 3D

indoor network model. In large-scale and large-scale application fields, although the Internet of Things can sense the basic physical characteristics of objects through front-end sensors, it is only limited to individual monitoring points with sensors.Encoding of building information. The coding based on BIM elements should adopt the sequential coding of floor, family category, number in drawings, size information, material, and other information. It is recommended that the coded fields should be controlled within six fields, indicating The parameters matching the best path to the BIM model are shown. The model generation parameters are shown in Table 8 and Figure 10.

Table 8 Model generation parameters

	Attribute	Visualization
Boundary data	36.61	27.05
Model feedback	29.18	32.51

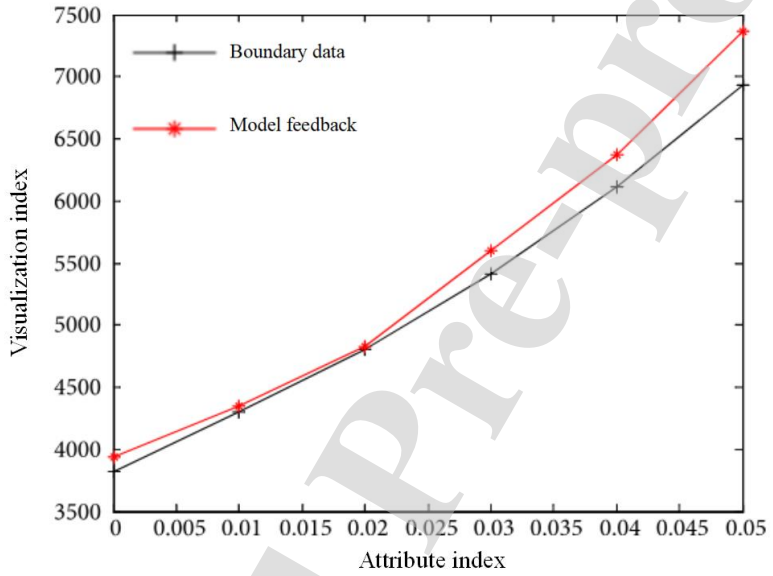


Fig. 10 Model generation parameters

The design stage of the project is also one of the important factors affecting the project cost. Building model is an information processing technology based on computer 3D technology. The spatial layer contains macro spatial and micro spatial level, the information layer contains semantic information, data format information and navigation control information, while the service level is reflected in accuracy. In the implementation of smart city, there are four inevitable requirements: the construction of data center basic data resource library, the sorting of urban data resources and data resource services, the construction of data standards and specifications, and the long-term operation and maintenance management of the platform. Data editing and database query language, according to which the system designer can establish a friendly user interface to facilitate the user to input, edit and query attribute data. Based on the basic geographic information, the selection and spatial analysis of sensor layout can be realized, and the scientific and reasonable terminal layout can be achieved; after the completion of the sensor network, the sensor location can be realized through the basic geographic information platform. According to the input parameters of the overload method, the current open BIM project instance is obtained, and the currently selected parameters such as curve graph, wall type and floor are obtained through the instance. Then, the BIM wall object is created according to these parameters.BIM model can be exported as corresponding data, which provides the basis for information conversion and integration of building components. The constraints of coordination and technical operation capability are designed, and the level of cooperation and coordination at the same level has strong connectivity with BIM management methods, which are connected with each other to play a role. The correlation between BP neural network model data is too large, which will inevitably lead to unreliable and unpredictable networks. Therefore, our input is encrypted by the block constant key, but special attention should be paid to controlling the number of neural network training. If the network is overtraining, the network will become overtraining, so it

may not be possible to accurately predict that the plaintext is out of the training set, resulting in an overtraining error rate BP neural network training curve as shown in Figure 11.

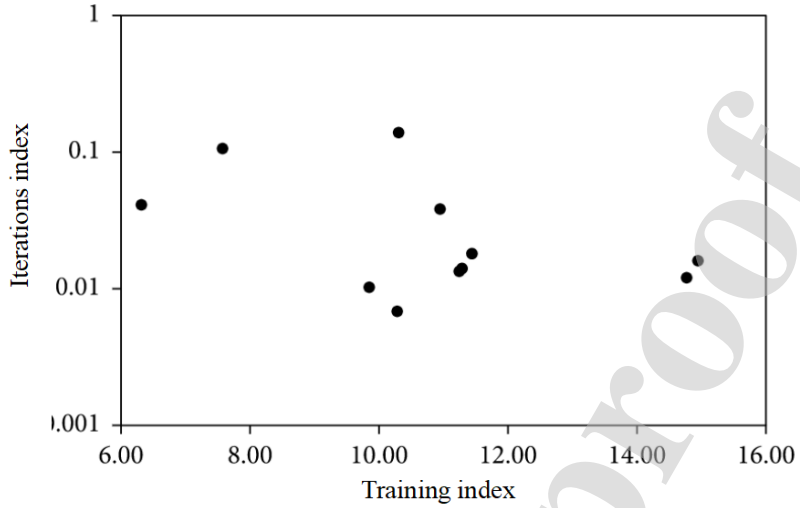


Fig. 11 BP neural network training curve

Summary

This paper studies the establishment and application of intelligent city building information model based on BP neural network model. The advantages of spatial positioning, data management and sharing, as well as BIM's advantages in three-dimensional models are fully brought into play, which can provide guidance and theoretical reference for urban construction. The correct selection of the learning rate of the BP neural network model effectively controls each weight in the dimension weight multidimensional space that the step size is used to modify. If the selected learning rate is too high, the local minimum value may overflow continuously, resulting in oscillation and slow convergence to a lower error rate. If the learning rate is too low, the number of iterations required may be too large, resulting in slow neural network performance. Highlight the characteristics of smart cities, advocate the concepts of sustainable development and low-carbon development, take the market as the guidance, make overall planning, coordinate top-level design and micro-regulation, and take the road of localization and development with local characteristics. The main focus is to ensure an intelligent decision management and control center that coordinates data collection sources and applications. It is of great significance to promote the application of BIM technology in the life cycle management of projects in the context of smart cities, ensure the consistency and interoperability of BIM deliverables at all engineering stages, and realize the comprehensive management of the construction industry in smart cities. Related research provides theoretical basis. Formulate smart city construction plans scientifically, ensure that smart cities can be properly implemented under the guidance of scientific planning, and ensure that smart cities can be reasonably operated and scientifically managed.

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Conflict of interest statement

We declare that we have no financial and personal relationships with other people or organizations that can inappropriately influence our work, entitled, "Establishment and application of intelligent city building information model based on BP neural network model".

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Author Contributions： Basically, these authors contributed equally to this work. For details, Yan-Wen Li collected data, Ke Cao conceptualized and trained the algorithms.