*Research Article*

# Application of Machine Learning Algorithm in Stadium Engineering Building Information Model Management System

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BIM (building information modeling) is a building information modeling technology. It is a modeling technology that has quietly emerged in the architectural design and construction industry and will gradually replace the traditional CAD drawing technology. In addition to carrying geometric information of graphics, it can also carry buildings and building components. The engineering and nonengineering information of the building space has a higher degree of visualization and a stronger sense of three-dimensionality, and all the building information can be put into a model. The model can provide dynamic information on engineering construction cost management processes and can be processed by a computer in real time. The purpose of this paper is to study the new method of stadium project building information model management after the introduction of deep learning technology. This article first introduces the artificial neural network under machine learning algorithms by building a neural network model and combining it with the engineering construction information model and then integrating machine learning algorithms into the construction information model technology so that the originally three-dimensional model can further information integration. Compared with the original building information model, the data processing is more efficient and the management level has greatly improved. The experimental results of this paper show that machine learning algorithms can optimize the construction information model of stadium engineering and increase the efficiency of project management by 20%.

## 1. Introduction

With the rapid development of the Internet economy today, transactions from all walks of life have been added to the Internet track, leading to new developments such as original business innovation and administrative management. Affected by innovation and development, the sports industry has come to life in the collision with the Internet. As a result, the sports industry is moving toward a new track. At the same time, the business model of the integration of the Internet and the stadium has been sought after by more investors. The entry of building information models into China has not only brought a new technological atmosphere to the domestic construction industry but also a revolution in the production and management methods of the construction field. The BIM technology, which originated in the United States and developed in the United States, has already made a certain contribution to the construction industry in the United States. The Chinese government vigorously advocates and promotes the application of BIM in China, hoping to develop and popularize the use of BIM technology as soon as possible. The company has responded vigorously from the owner, design unit, project management company, and construction company, and has successively carried out BIM technology training and development within the company. Based on the characteristics of digital visualization, collaborative consistency, simulation, scheme optimization, and information mapping, BIM technology has gradually been accepted by construction engineering and has been continuously promoted, applied, and upgraded. BIM has brought an impact on various interest companies in the construction field. BIM technology has brought revolutionary progress in new management methods for engineering management companies that provide professional

technical service consulting services. BIM technology can participate in various services throughout the project life cycle, can fully penetrate into all aspects of the services provided by engineering management companies to customers, and provide customers with more exquisite professional knowledge consulting services and other value-added services, which can assist in optimizing design, improving construction productivity and efficiency, quality, safety, and budget. For example, the use of BIM model for comprehensive pipeline collision detection to guide construction, the use of BIM model for engineering quantity statistics and change accounting, and BIM model-based operation and maintenance management, etc., are the revolutionary use of BIM technology by engineering management companies to provide customers. As a part of the engineering management company, the establishment of the BIM model exists as a business product with the core competitiveness value of the engineering management consulting company. BIM technology provides customers with value-added services and also enhances the core competitiveness of the engineering management company itself. Although BIM is becoming mature internationally, BIM technology in China is only a "small lotus just showing its sharp corners." At this stage, the informatization level of many construction companies is still very backward. Many engineering projects have not applied IT systems for management, and have not introduced BIM technology. The on-site engineering volume data collection is still carried out by the original manual filling method, and the project progress is difficult. Control, project quality, safety, etc., rely too much on traditional methods to manage and fail to effectively prevent and monitor, and key process methods cannot be simulated and verified in advance. Frequent rework makes it difficult to control construction costs. These reasons make it difficult for domestic engineering companies to effectively improve and maintain their competitiveness.

Although there are many theoretical studies on BIM applications at home and abroad, the BIM model is regarded as a product of an engineering management company. There is very little research on the service operation of BIM in engineering management companies. How to use BIM technology the research on the core competitiveness of engineering management companies and the BIM business operation strategy of engineering management companies are even rarer. Pishdad–Bozorgi P successfully implemented FM-based BIM research. This research first defines and examines one of the first pilot implementations of FM-enabled BIM, discusses the challenges encountered and the lessons learned and then proposes research framework for future researchers to systematically and strategically establish a BIM knowledge base for the FM field. The implementation process and lessons learned in the pilot project provide valuable insights for the successful implementation of FM-based BIM [1]. Zhang believes that in the process of construction project management, it is necessary to carry out new changes to the management model, improve the effectiveness and versatility of management methods, and promote the construction and application of the entire project management process. BIM has done some active and effective management work in the process of full chain management, which saves expenses and increases profits [2]. Samuel et al.'s research explores and utilizes the sustainable value of BIM to realize the provision of buildings that require less energy for operation, emit less carbon dioxide, and provide a conducive living environment for residents [3]. Cui et al. discussed the relationship between BIM technology and hospital construction and discussed the comprehensive application of BIM technology in hospital logistics and administrative management. They hope to improve the BIM system and combine the development needs of the hospital so that the BIM system will further promote the development and construction of smart medical care [4]. Wang and Song studied BIM user satisfaction. Based on data collected from 118 BIM engineers, they studied the impact of five potential variables (such as attitude, perceived ease of use, perceived usefulness, senior management support, and goal management) on industry BIM user satisfaction [5]. Svalestuen and Knotten studied the advantages and challenges of BIM equipment on construction sites through a survey of respondents and used communication theory to explain, why these tools are more effective than traditional methods [6]. Keenlisi and Beange started by improving the BIM guidelines and tried to publish standardized BIM guidelines. They believe that this structured method of BIM document development will improve the efficiency of the creation and implementation of future guidelines and standards, facilitate the adoption and standardization of BIM in the industry, and provide a common baseline that many user types urgently need [7]. Based on the characteristics of the construction industry, Aitbayeva and Hossain launched an investigation into the implementation of BIM in Kazakhstan's construction industry. Identify opportunities and obstacles for implementing BIM in Kazakhstan construction companies. Although there are a lot of research materials on BIM, there is still a lack of connection between BIM and high-tech, and the current artificial intelligence technology has not yet been applied to the construction industry [8].

This article improves the building information model and introduces artificial intelligence machine learning algorithms. While retaining the three-dimensional and efficient management model of the building information model, it uses the interactivity and scalability of machine learning algorithms to make artificial intelligence technology the building information model. Empowerment to assist the optimization and improvement of the management research of the stadium project building information model.

## 2. Introduction to Machine Learning Algorithms and BIM Methods

*2.1. Machine Learning.* Machine learning is abbreviated as ML or machine learning. It is a highly interdisciplinary subject, specifically involving probability theory, statistics, approximation theory, convex analysis, algorithm accountability theory, etc., [9]. Its research content is to enable computers to learn to simulate human behavior and actions, thereby acquiring new knowledge and skills.

This algorithm is the core of artificial intelligence technology and is widely used, such as healthcare, finance, retail, and tourism.

Artificial neural network can be referred to as neural network for short and has been a research hotspot in the field of artificial intelligence since the 1980s. The artificial neural network is inspired by the neurons of intelligent creatures and realizes the realistic effects of the human brain by observing the behavior patterns of the human brain and simulating the behavior patterns of the human brain. Several neurons are connected to form a network, which is an artificial neural network. Because the neural network can reflect part of the characteristics of the human brain, it is similar to a simulation and abstraction of the processing mode of the human brain. Its excellent self-learning, self-organization, and nonlinear characteristics enable it to simulate us at different levels. The human brain's functions such as information storage and retrieval are more suitable for solving a large number of nonlinear and complex data problems. Neuron is the smallest unit of artificial neural network, just like the biological neuron plays a role in biological neural structure. The working method of neuron [10] is to receive a group of multiple inputs, and then carry out the calculation of weighted summation. Inputs can be eigenvalues of external data samples, such as images or documents, or the outputs of other neurons. If it exceeds the set initial threshold, it will form an output. It is precise because of these interconnected neurons and the weight coefficients that reflect the strength of the correlation that they have the ability to process very complex information. Its main components include input, output, weight, threshold, and activation function, as shown in Figure 1.

The input of the neuron is derived from the $Y_1, Y_2, Y_3, \ldots, Y_i$ of the input layer. The $i$ inputs $Z_1, Z_2, Z_3, \ldots, Z_i$ are the weights corresponding to the $i$input signals. At the same time, each neuron in the artificial neural network needs to set a threshold $\omega$, once corresponding to the $Y_i$ and $Z_i$ phases when the multiplied sum is greater than $\omega$, the neuron is activated. When the activation state is changed, the neuron will form an output, the output is as in

$$S = f\left(\sum_{i=1}^{m} Z_i Y_i + \omega\right). \tag{1}$$

Among them, $f(x)$ is the activation function of the neuron, which is mainly used to add nonlinearity and other factors. Generally speaking, the linear model is not good enough to express the effect. The usual activation function should have the characteristics of nonlinearity, monotonicity, and differentiability, thereby enhancing the accuracy of the artificial neural network [11].

Commonly used activation functions are mentioned in the following.

*2.1.1. Sigmoid Function.* The advantage of this activation function is that it compresses the real numbers to the range of 0 to 1, turning large negative numbers into 0 and large positive numbers into 1.
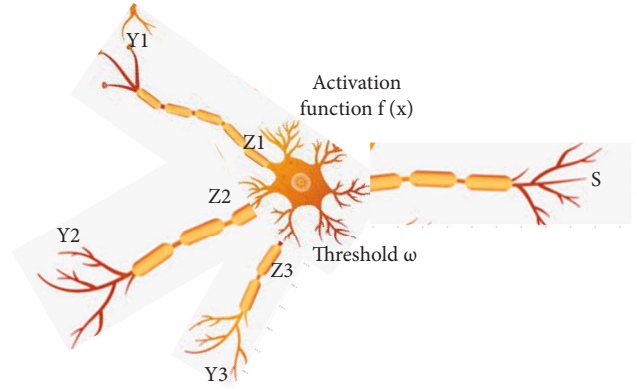


FIGURE 1: Neuron structure.

$$f(n) = \frac{1}{1 + e^{-n}}. \tag{2}$$

*2.1.2. Tanh Function.* The advantage of this activation function is that it works well for those whose features are very different.

$$f(n) = \tan g(n). \tag{3}$$

*2.1.3. ReLU Function.* The advantage of this activation function is that the convergence speed obtained is faster than the abovementioned activation function, and the operation is relatively simple.

$$f(n) = \max(0, n). \tag{4}$$

An artificial neural network is a nonlinear network formed with different hierarchical structures. It has an input layer and an output layer, with a complex hidden layer in between. There are multiple neurons on each level, and neurons are arranged in the order of input and output, but neurons on the same level are isolated. Figure 2 shows the simplest structure of the most complex hidden layer in the artificial neural network [12]. In fact, there are many other structures of neural networks, such as CNN and RNN, which have various linking rules.

The artificial neural network is actually a function from the input vector $\overrightarrow{M}$ to the output vector $\overrightarrow{N}$, namely,

$$\overrightarrow{M} = f_{\text{network}}(\overrightarrow{N}). \tag{5}$$

In the example of the artificial neural network in Figure 2, define the parameters $(J, d)$, where $J$ is the weight of the connection between the two neurons, and $d$ represents the bias value of this layer. As shown in Table 1, the calculation results of the forward propagation of the network model are as follows:

$$c_a = v_a, \quad a = 1, 2, 3, \tag{6}$$

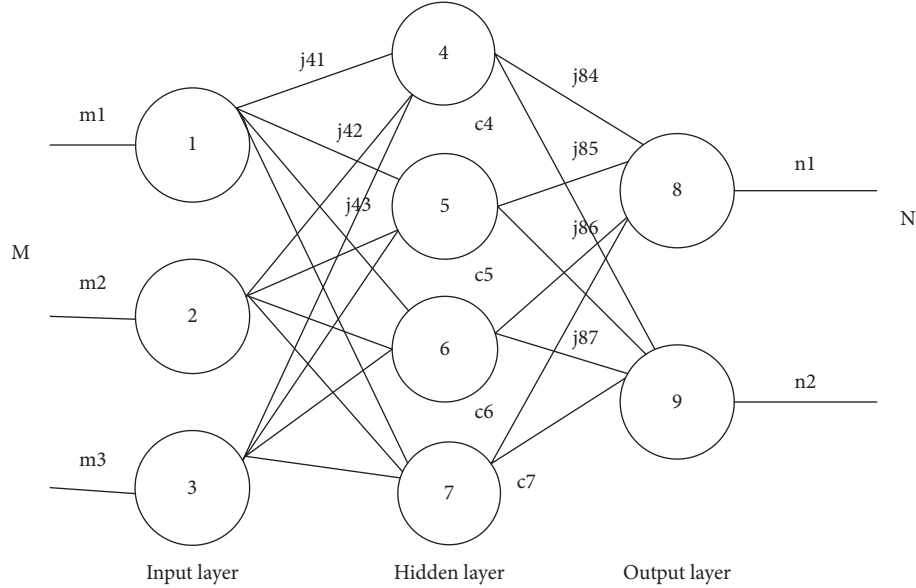$$c_4 = f(j_{41}c_1 + j_{42}c_2 + j_{43}c_3 + d_4), \tag{7}$$

FIGURE 2: Artificial neural network structure.

TABLE 1: Neural network parameter setting table.

| Parameter | Meaning |
|---|---|
| $v_a$ | Input value of the $a$th neuron |
| $J_{al}$ | The weight of the $l$th neuron to the $a$th neuron |
| $d_a$ | The bias value of the $a$th neuron |
| $c_a$ | The activation value of the $a$th neuron |
| $f(n)$ | Hidden layer activation function |
| $S_a$ | The output of the neural network |

$$c_5 = f\left(j_{51}c_1 + f_{52}c_2 + f_{53}c_3 + d_5\right). \tag{8}$$

$$c_6 = f\left(j_{61}c_1 + j_{62}c_2 + j_{63}c_3 + d_6\right), \tag{9}$$

$$c_7 = f\left(j_{71}c_1 + j_{72}c_2 + j_{73}c_3 + d_7\right),$$
$$S_1 = f\left(j_{84}c_4 + j_{85}c_5 + j_{86}c_6 + j_{87}c_7 + d_8\right), \tag{10}$$

$$S_2 = f\left(j_{94}c_4 + j_{95}c_5 + j_{96}c_6 + j_{97}c_7 + d_9\right). \tag{11}$$

We can do a generalization, and use $Q_a$ to represent the weighted sum of the neuron input of the $a$-th layer, then

$$Q_a = j_{al}c_l + d_a, \tag{12}$$

$$c_t = f\left(Q_a\right). \tag{13}$$

The abovementioned equation is a simple forward propagation process. The input $v$ obtains the output S through the parameters $(J, d)$ and the activation function. Assuming that the expected value is $e$, we need to continuously learn and adjust the parameters to make $S \approx e$ [13]. It can be said that the artificial network is a model, then these weights are the parameters of the model, which is what the model needs to learn.

In machine learning, the Minibatch method is generally used to train neural networks. Assuming that there are

$(a + b)$ samples in a batch, $\text{batch}_R$ is the original batch without marking errors, and it is $\{(m_1^R, n_1^R), (m_2^R, m_2^R), \ldots, (m_{a+b}^R, n_{a+b}^R)\}$. Batch size is a hyperparameter that defines the number of samples to process before updating internal model parameters.

$\text{batch}_E$ is a batch with incorrect labeling, in which a sample is correctly labeled, and $b$ sample is incorrectly labeled, which is $\{(m_1^E, n_1^E), (m_2^E, n_2^E), \ldots, (m_{a+b}^E, n_{a+b}^E)\}$. $\text{batch}_M$ is the modified label. $S_R(\gamma), S_E(\gamma), S_M(\gamma)$ is the loss function value of $\text{batch}_R, \text{batch}_E, \text{batch}_M$ in the network state $\gamma$, respectively, as follows:

$$S_R(\gamma) = \frac{1}{a+b}\sum_{l=1}^{a+b}\left\{\left(m_l^R, n_l^R\right), \gamma\right\}, \tag{14}$$

$$S_E(\gamma) = \frac{1}{a+b}\sum_{l=1}^{a+b}\left\{S\left(m_l^E, n_l^E\right), \gamma\right\}, \tag{15}$$

$$S_M(\gamma) = \frac{1}{a+b}\sum_{l=1}^{a+b}\left\{S\left(m_l^M, n_l^M\right), \gamma\right\}. \tag{16}$$

If the batch after the label is modified by the algorithm, it reduces the impact of labeling errors on the neural network training. Then the algorithm is effective, which is

$$\left|S_R(\gamma) - S_E(\gamma)\right| > \left|S_R(\gamma) - S_M(\gamma)\right|. \tag{17}$$

The negative impact on the neural network is brought about by the wrong label. Therefore, if the algorithm can reduce the number of wrong tags, it can effectively improve the algorithm's robustness to tag errors. $P_M$ is the probability that the algorithm modifies the label, and $P_R$ is the probability that the sample label in $\text{batch}_E$ is modified to the corresponding label in $\text{batch}_R$. Then when the following formula holds, the algorithm can reduce the number of false tags.

$$b - b \times P_M \times P_R + a \times P_M \times \left(1 - P_R\right) < a. \quad (18)$$

Simplify and get

$$\frac{a}{a + b} < P_R. \quad (19)$$

Therefore, when the proportion of the correct label in $\text{batch}_E$ the satisfies is less than that $P_R$, the algorithm can effectively improve the performance of the neural network when the label is incorrectly labeled.

*2.2. Introduction to BIM-Related Concepts.* NBIMS's complete definition of BIM is as follows: BIM [14] is a standardized computer-readable model, which is the ontology of a construction project combined with the digital expression of the built environment, and it also integrates the construction project information and equipment and facility information of the construction project, a collection of shared information resources. It can provide a reference for the decision-making and management behaviors of the construction project from the conceptual design stage to the demolition and scrapping stage. At different stages of the project, practitioners in various professional fields and links use BIM to input, output, modify and update the information to complete their own functional tasks and achieve synergy with other professions. The generation and application of BIM technology are essential to the realization of the full life of the building. Cycle management is of great help. It can also improve the labor productivity of various professions in the construction industry and reduce the collision and friction between professions. The core of BIM is to establish a virtual three-dimensional model of construction engineering and use digital technology to provide a complete construction engineering information database consistent with the actual situation for this model.

The BIM model is shown in Figure 3. It has a wide range of information, a high level of intelligence, and strong interactivity. It has realized graphical parameterization and has the characteristics of high information integration, high reducibility, strong simulation, and secondary development. In detail, BIM can highly integrate information involved in construction projects, and can use BIM software to retrieve, count, and analyze project information based on models, and assist different stakeholders in the design, construction, and management of problems in the process of decision-making; able to view and troubleshoot the model dynamically, subsystem, subfloor, or subregion. At the same time, it can summarize the parts and component lists in the model, which is helpful for budget and final accounts auditing; it can simulate the status of the building after completion, or based on The BIM model is used to simulate and demonstrate various indicators of the internal built environment; in addition, the most prominent and most potential point of BIM is: the BIM platform can be redeveloped, and the building that the software user wants to complete based on the BIM model Design, construction collision inspection, problem-solving and construction management work [15]. With the help of this three-dimensional model containing
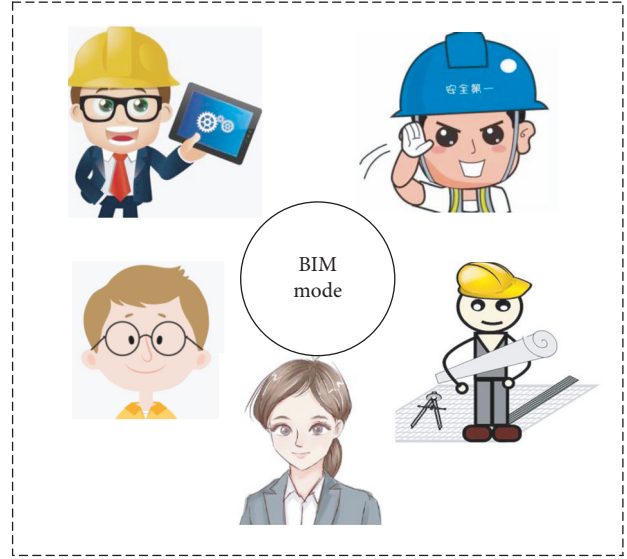


Figure 3: BIM structure model.

construction engineering information, the information integration degree of construction engineering is greatly improved, thereby providing a platform for the exchange and sharing of engineering information for stakeholders of construction projects. It can also be seen from the above-mentioned literature summary that BIM has the ability or potential to solve most of the various problems in the entire life cycle of a building.

*2.3. Project Management.* Modern project management system [16] refers to the use of various cognitive and practical tools to satisfy managers' management of operations, which is the latest development in the field of international management. The project management system effectively integrates financial control, human resource management, risk control, quality management, communication management, procurement management, etc. in enterprise management, so as to achieve the purpose of completing various tasks or projects within the enterprise with high quality and low cost. Different from traditional project management, modern project management can be divided into management methods and theoretical management, which are the core of modern project management. It includes a variety of universal management laws and methods, not only applicable to traditional project management but also compatible with other types of project management. As the application section of modern project management system-engineering project management, it is an indispensable part of modern project management system. Its structure is shown in Figure 4.

In the 1990s, the international engineering community defined project management (PM) as: "The entire process from the beginning of the proposed project to the end of the project, involving the process of project planning (PP) and project control (PC), completing the project cost, whole-process supervision of quality and progress." This definition is based on scientificity and has been the consensus of the
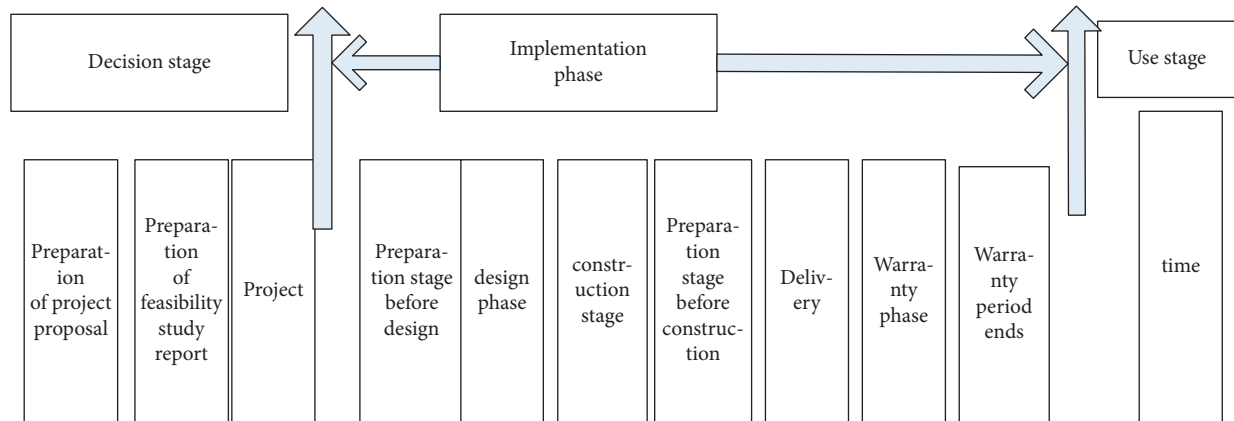
FIGURE 4: The phases of the project.

industry for a long time [17]. Project management mainly includes project scope, time, cost, quality, human resources, communication, risk, procurement, integration, and other management content. After more than 20 years of development, the project management theory system has made obvious breakthroughs and has a new understanding of project management, project process, and management work.

Project management is an uncertain dynamic change. After the scientific goal is determined, project control can ensure that the project runs and realizes according to the predetermined trajectory. First, the process perspective of project management has changed. Traditional management theory believes that the project proposal must be approved before the project starts. In other words, the follow-up work must be carried out after the project is established $(PM = PP + PC)$. At the same time, the main body of process project management has also changed. In the past, if traditional management did not establish a project, then the main body of project management could not be established and project management could not be carried out. Nowadays, modern project management has lengthened the cycle of traditional project management and refined the division of labor $(PM = DM + PP + PC + RD)$. Second, the needs of project management have changed. Modern social engineering construction pays more attention to issues such as energy conservation, environmental protection, health, safety, humanized design, and traditional management methods are difficult to match the needs of users.

## 3. Application of BIM Technology Based on Machine Learning in Gymnasium Project Management

*3.1. Status of the Stadium Project.* As a typical municipal project, the stadium project has different characteristics from general construction projects, as follows:

(1) Large scale of investment: usually, the construction of stadiums is mostly government investment, and the investment volume is large

(2) It is difficult for multiple parties to coordinate: multiple design parties, multiple construction parties, and multiple bidding sections start project construction at the same time

(3) The system is complex, management is difficult, and management requirements such as investment, progress, quality, safety, and environmental protection are high

(4) Talent shortage: in recent years, the demand for sports has grown substantially, and there is a serious shortage of technical and management talents

(5) Long construction period: usually, the construction period of the gymnasium is 1 to 3 years, and the operation period is 70 years

*3.2. Application in Pre-Engineering Management.* In order to give full play to the characteristics of BIM technology, and at the same time improve the efficiency and quality of the design work of the gymnasium project construction organization plan, it is recommended to incorporate BIM technology on the basis of the traditional construction organization plan design process, and integrate the BIM technology with the project schedule and engineering materials. The combination of material management effectively avoids construction period delays, construction organization confusion, etc., combined with the engineering BIM model data to simulate the construction organization of the station, to conduct a preconstruction preview of the construction plan and equipment input to determine the stadium engineering station and the rationality of the project construction organization plan, resources and equipment investment in the interval.

The design optimization of the construction team of the gymnasium, the use of operations research, the combination of computer simulation technology and BIM technology, and engineering construction specifications, establish a BIM model for engineering construction simulation [18]. Control the construction process, mechanical equipment investment, material supply, and other construction links through intelligent operation research algorithms, analyze the

construction schedule simulated by simulation, dynamically query and optimize the configuration of construction resource allocation, construction intensity, and duration, and according to the actual project, the iterative update of the donor design simulation of the construction situation will finally provide the construction unit with a more reasonable construction plan, resource and consumable input arrangements for the construction organization plan, thereby improving the service coordination and management level of the construction unit for the project.

If you want to introduce BIM technology into an engineering project, you must first build an accurate three-dimensional model, which can allow project managers to have a more comprehensive and intuitive understanding of the entire project, and help them find out the problems before the project is officially constructed, which greatly reduces the probability of occurrence of project quality problems. The BIM model we build must have high accuracy and also have certain requirements for modeling speed, both of which will have a direct impact on the effect of the BIM technology in the entire project. The technical staff must construct the BIM three-dimensional model within the specified time, and ensure the accuracy of the model through a large number of audits and corrections. Using this model can make some engineering quality problems that are difficult to be exposed on traditional two-dimensional drawings to be more intuitively reflected, which not only helps project managers find and solve problems in time but also effectively improves project construction efficiency [19], can be divided into the following steps:

(1) In the MS Project project management software, the tasks of the construction phase are decomposed, construction cost and resource management are carried out from the perspective of work, and a construction plan composition scheme with a dynamic foundation is formed. The beginning of each work in the subsequent construction process Both mark the beginning of time, so as to realize the dynamic control of resources on the time axis. During the work process, the dynamic management of human resources, materials, and machinery is achieved while the dynamic management of construction costs is achieved so that the target management and process fully integrate management to maximize benefits.

(2) Establish the code to call the API between the project management software MS Project and the BIM 3D modeling software Autodesk Revit under the programming platform, expand the function, realize the circulation of Autodesk Revit and MS Project data, eliminate information islands, and use information maximize value.

With BIM, the implementation process is concrete and intuitive, efficiency is greatly improved, and engineers are highly satisfied. They basically recognized the BIM model under machine learning algorithms and are willing to continue using it. The results are shown in Table 2.

### 3.3. Application in Project Management.

After introducing BIM technology into project engineering, users can see the vulnerabilities and defects of engineering design in a more intuitive and accurate way. The three-dimensional visualization diagram can clearly allow users to see any node, as shown in Figure 5. After applying BIM technology, three-dimensional simulation of construction nodes, so as to determine the accurate size and location of tools, and accurate data of structural construction, to achieve more efficient construction [20, 21]. Use BIM technology to simulate the entire construction process to provide practical guidance for project managers to ensure that all project managers have a more comprehensive and intuitive understanding of the entire construction process of the project, and enable them to master each project construction method and construction process lay a solid foundation for the subsequent project construction management. In addition, the BIM technology is used to simulate the construction process, coordinate and handle the relationship between the project participants, improve their communication efficiency, and also help to further optimize the quality management level of the project.

Project managers can also use the BIM system to collect quality information items with the help of wireless devices such as iPads and mobile phones to realize data sharing and storage on the cloud network [22]. In particular, project managers can also operate and process data on the platform within their own authority, so as to further ensure the integrity and safety, and reliability of the data. This also provides a traceability channel for later engineering errors. Not only that, but on-site management personnel can also judge the transportation time and quality status based on relevant indications to ensure that on-site materials and submitted reports are in compliance. This method of integrating relevant staff responsibilities and construction site quality information based on BIM technology greatly improves the standardization of project construction sites and creates favorable conditions for project quality control [8]. It can be divided into the following steps:

(1) Introduce BIM technology and establish a dynamic management plan for the construction phase with Autodesk Revit as the core. In the formulation phase of the construction plan, the resource configuration information contained in the BIM 3D components is associated with each task node of the WBS to ensure that each task node the accuracy of resource and cost control can ensure the accuracy of the resource and cost calculation of the entire construction project.

(2) With the advancement of the construction stage, real-time dynamic monitoring of project resources and costs, as shown in Table 3, uses the earned value method to compare planned costs with actual costs, and compare planned resource usage with actual resource usage. Timely discover the risk factors that affect the construction stage and take remedial measures in real time to avoid project cost overruns and excessive resource usage at the time of completion and settlement.

TABLE 2: User experience survey report.

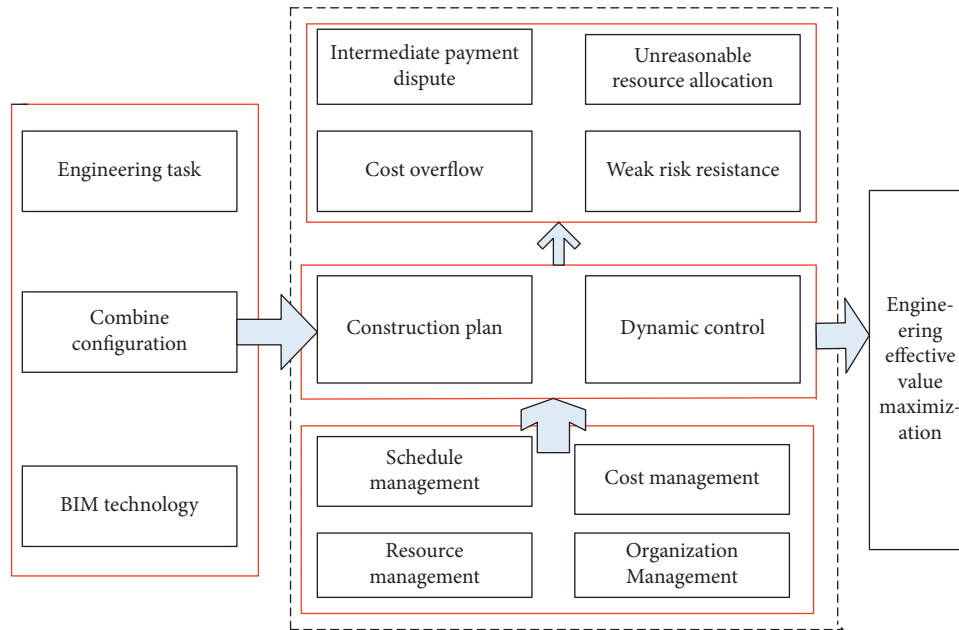| | Accuracy (%) | Construction efficiency (%) | Intuitiveness (%) | Satisfaction (%) |
|---|---|---|---|---|
| Traditional model | 70 | 77 | 60 | 72 |
| BIM model | 80 | 85 | 78 | 81 |
| BIM model of machine learning | 95 | 93 | 92 | 93 |

FIGURE 5: BIM management optimization process.

TABLE 3: Comparison table of real-time dynamic monitoring of project resources and costs.

| | Planned cost | Actual cost | Planned resources | Actual amount of resources used | Income and expenditure |
|---|---|---|---|---|---|
| Traditional mode | 100 | 102 | 1000 | 1001 | −10 |
| BIM mode | 100 | 92 | 1000 | 988 | 12 |
| Based on BIM machine learning mode | 100 | 88 | 1000 | 968 | 25 |

(3) Refine the calculation of resources and costs to each WBS working node, the calculation is accurate, and the dispute caused by the inaccurate calculation of the intermediate payment is eliminated. The project resources and costs of the work task nodes completed every day are calculated and accounted for to form a daily work report. The payment of project progress payment can also be done weekly or monthly. When the project progress payment needs to be paid, it only needs to be based on the daily work report calculated by the project management software to reduce disputes [23, 24].

As shown in Figure 6, compared with the traditional method, the intermediate process of the BIM model can be traced, reducing excessive excuses, and at the same time, the progress of the process can be mastered throughout the process, and the management can be more efficient.

*3.4. Application in Postproject Management.* Project managers can use tools to analyze and process the project quality information in time, space, and subitems, find the quality problems in the construction in time and put forward operability solutions according to the problems [25]. By summarizing and analyzing historical project quality information, a method and path to effectively control project quality can be found. For example, a database can be introduced, and the resource configuration information contained in the BIM three-dimensional component elements can be called and output to the database to form a multi-table data structure in the database. The information in the resource configuration database can provide assistance for the cost budget of the project. It can be saved as the empirical configuration data of the project to provide a reference for the configuration work of similar projects in the later period. The resource configuration database file is saved or transferred together with the Autodesk Revit model
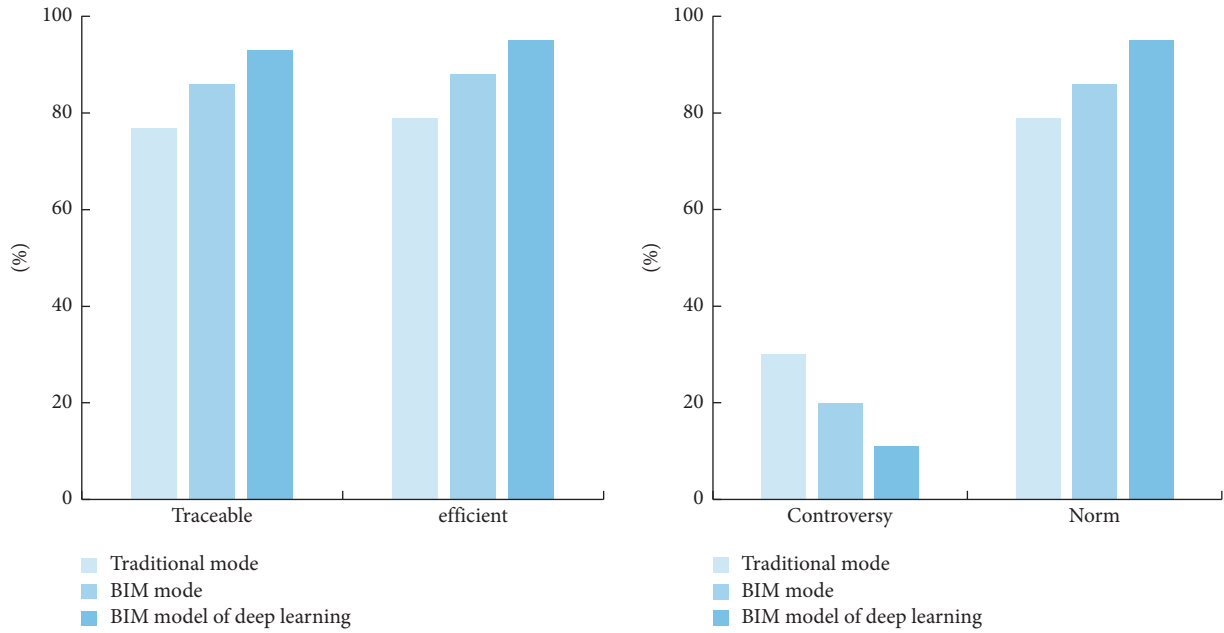
FIGURE 6: Survey on engineering practicability of the BIM model based on machine learning algorithms.
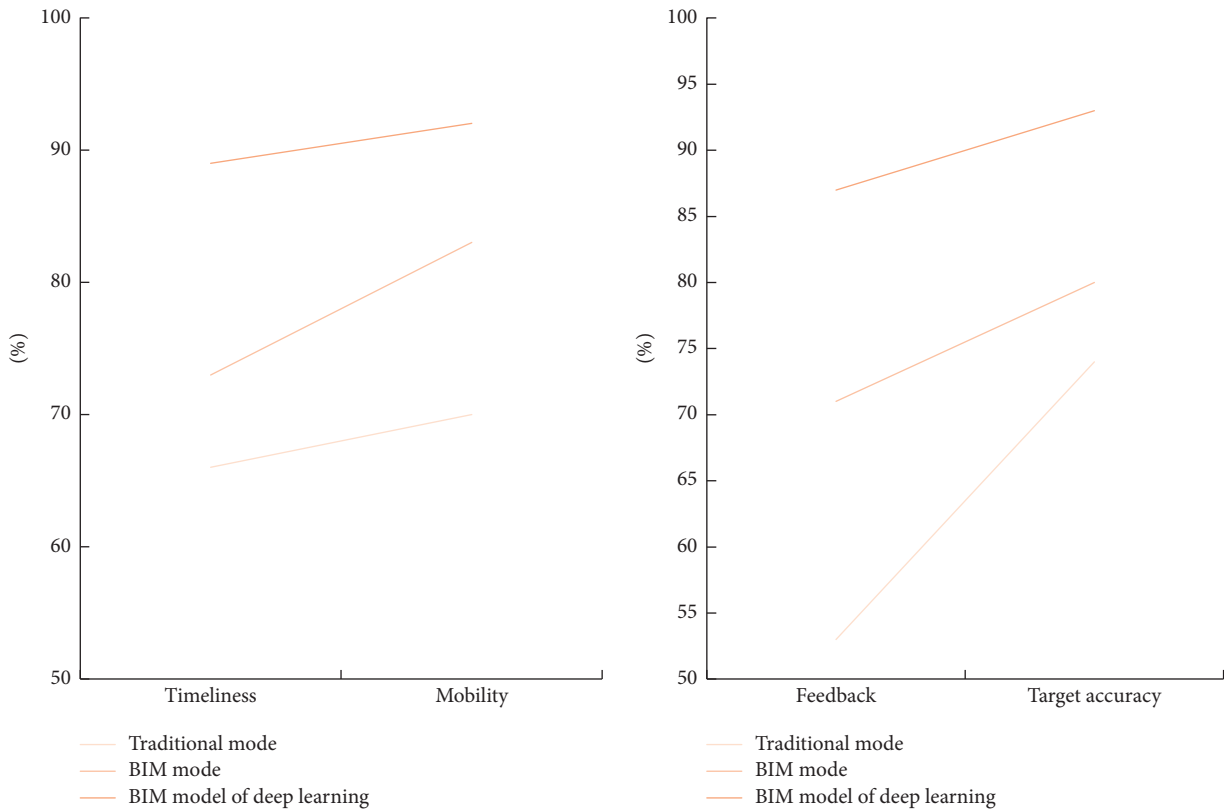


FIGURE 7: BIM feedback survey based on machine learning algorithms.

file. The two data are related and become the basic data file for dynamic management [26].

With the support of BIM technology, comprehensively consider and analyze the construction process start report (submission report), project acceptance quality documents, material/equipment/accessory review documents, design change documents, engineering accident handling documents, supervision work reports, and other data Information and engineering quality problems are given effective solutions to form relevant experience. I will provide a reference for future quality control [27]. The technical documents and quality inspection reports generated based on

BIM technology, as shown in Figure 7, can be directly used for auditing, eliminating the need to search for paper documents, saving working time, and improving efficiency.

## 4. Discussion

Under the fusion machine learning algorithms mode, BIM further exerts its advantages and refines the engineering resource configuration information built into the BIM three-dimensional model components into each task node, forming a new construction plan composition scheme with a dynamic foundation. In the subsequent construction process, through accurate calculation of the cost data and resource data of each WBS task node, real-time, fast, and continuous dynamic control of the engineering project is realized. Model the engineering quantity beforehand, analyze the current management status of the construction industry in the construction stage, find out the deficiencies in the management methods, propose improvement plans, analyze the needs of the dynamic planning management plan in the construction stage, and explain the plan. During the event, the three-dimensional components in the BIM model and the work tasks are related to each other to realize the combined management of project progress and project costs in a three-dimensional environment, forming a dynamic data relationship model based on BIM technology, forming a three-dimensional visualized management of costs and resources, and dynamic data relationships The model is improved. At the same time, it can provide real-time planning guidance, break information barriers, and further optimize related programs after the fact, while providing a reference for subsequent program design. It can be said that the BIM model based on machine learning algorithms will bring more profound changes to users [28].

## 5. Conclusions

With the guidance of the macro environment and the promotion and popularization of the country, the BIM business will develop like the previous and current Internet Similarly, the time of prosperity is an indispensable choice for customers. BIM has made China's construction management in the field of construction change from rough to modern and sophisticated management. Regardless of whether the BIM business starts from the current technical tools or is based on the innovation of the future smart building model, the trend of its application and promotion is unstoppable, and will provide more and more value-added services to customers of engineering management companies. With the development of computer technology, people hope that computers can calculate and analyze intelligently like the human brain, bringing further development to science and technology. The machine learning algorithms model is developed based on this expectation. With the improvement of machine learning computer technology, computers will surely further optimize performance services. This paper discusses the application method of a machine learning algorithm in engineering construction management to help realize the further development of construction

engineering management and ensure the normal progress of construction and the quality of construction. In the future, we hope that stadium-related projects can use the BIM mode of machine learning algorithms to make project construction more three-dimensional and intuitive, cost control more accurate, and coordination functions more complete, helping as soon as possible complete the construction of sports China.

## Data Availability

This article does not cover data research. No data were used to support this study.

## Conflicts of Interest

The authors declare that they have no conflicts of interest.

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