Hindawi
Wireless Communications and Mobile Computing
Volume 2021, Article ID 1608340, 13 pages
https://doi.org/10.1155/2021/1608340

Research Article

Sports Policy and Training Decision Support Method Based on Wireless Sensor Network

Zhi Li [1,2]

[1] *Department of Education, Shaanxi Normal University, Xi'an, 710058 Shaanxi, China*
[2] *School of Physical Education, Xi'an University, Xi'an, 710065 Shaanxi, China*

Correspondence should be addressed to Zhi Li; ardonis@xawl.edu.cn

Received 27 July 2021; Revised 7 September 2021; Accepted 13 September 2021; Published 14 October 2021

Academic Editor: Zhihan Lv

In recent years, the awareness of sports departments at all levels of society to promote sports through science and has been increasing, and the scientific decision-making and management of sports have been improved to a great extent. With the application of scientific decision-making combined with a real-time sports data monitoring network, the opponent's advance information can be effectively observed during the game and reasonable decisions can be made to deal with the opponent's offense. Therefore, high-level athletes appear to be more relaxed and calm in the game. It first requires the application of advanced information collection methods to obtain sports data quickly, in real time and at low cost, and extract information about athletes' scientific management decision-making from massive data and then make scientific management decisions for sports training. The modern sports method is highly open, and big data mining also profoundly affects the relevant decision-making of sports training. How to design appropriate decision support tools to grasp the key points of the problem in sports information data and make reasonable and correct decisions is a problem that is closely watched by macro decision-makers and coaches at all levels. This article mainly introduces the training decision support method derived from data mining and intends to provide some technical directions for making scientific decisions in sports training. This paper proposes related algorithms of a training decision support method derived from data mining, including training effectiveness prediction model and decision tree algorithm, for the design of the training decision support method derived from data mining. Experimental data shows that the average error between the prediction of the effectiveness of the training method and the actual situation of the training decision support method in this paper is 0.913%, which is helpful for the management or coach to make decisions.

1. Introduction

The wireless sensor network is a comprehensive network information system for information collection, data processing, and data transmission in a designated area. It is an important foundation for the realization of the Internet of Things, and it is also a hotspot of multidisciplinary research that has attracted much attention in the world. Nodes in sensor networks are often small in size, have limited energy carried by themselves, and are vulnerable to attacks. Therefore, when designing routing protocols, how to effectively balance the energy consumption of nodes to prolong the survival time of the network and effectively identify malicious nodes is one of the main research directions of current wireless sensor networks [1, 2]. Coupled with the widespread application of computer hardware and basic data such as data collection equipment and storage media, human data collection capabilities have been significantly improved. With the advancement of science, various sectors of society have stored a large number of different production information and management volumes, and scientific research and data storage worldwide are growing rapidly. Data mining has very broad application prospects, including data statistics and analysis, synthesis and reflection on specific data, and guidance which solve practical problems and try to find the relationship between events.

On the basis of mastering the relevant theoretical knowledge of data elements, understanding the status quo of the standardization of sports information and sports information data elements, clarifying the importance of data elements in the standardization of sports information, and drawing on the experience in the development of data element standards in other industries, sports person-related information database data are collected and organized and the design of the standard framework system for sports person information data elements is completed. The decision support method is an information method with a computer as a tool. It uses the theories and method of decision science and related industries to help decision-makers solve problems in the following form: human-computer interaction. The decision support method is a scientific tool that provides decision-makers with a working environment that combines knowledge, initiative, creativity, and information processing. Through man-machine dialogue, we explore the decision-making method and make assessments, predictions, and choices. Sports is related to the health of the people and is an important part of the construction of social spiritual civilization and material civilization. Data mining pushes the research and development of the sports training decision support method to a higher level, thereby helping coaches and athletes to maintain their advantages in the competition. Data mining is recognized as the best solution for information utilization due to its powerful analysis and processing capabilities and has become an important technical means for the establishment of the modern training decision support method. It is recognized as the best solution for information use due to its powerful analysis and processing capabilities and has become an important technical tool for establishing a modern sports training decision support method [3].

With the development of science and technology, wireless sensing technology has been extensively developed. At home and abroad, meticulous research has been carried out in this field and certain results have been achieved. Joseph et al. proposed that WSN has become one of the most exciting fields in computer science research. WSN is a set of sensors integrated with the physical environment. These sensors are small and can sense and process physical phenomena. The main purpose of deploying WSN-based applications is to use sensor-perceived data to improve real-time decision-making. The main limitation of WSN is the characteristics of sensor nodes and the nature of sensor data generated by the network. Due to these limitations, traditional data mining techniques are not suitable for WSN. Because the data resources generated by wireless sensor networks are highly limited, large in quantity, and fast-changing, it is very challenging to design suitable data mining techniques for wireless sensor networks. Although Joseph et al. proposed that WSN has conducted different studies on data mining, there are still many research challenges in his research that have not been solved [4]. Lu et al. pointed out that sports forecasting is one of the areas that have attracted more and more attention recently and requires good forecasting accuracy. Among them, the coach needs a model to evaluate his own players, analyze the opponent team, and formulate winning strategies. The generation of sports comprehensive statistical data enables DM technology to be applied to extract potential prediction information. They proposed a predictive model, including data preprocessing, feature extraction, attribute selection, and the application of DM algorithms as learning strategies. To verify this model, they explained a case study on predicting the outcome of an IPL competition. The constructed model is based on the team's past performance, player performance indicators, opponent team information, and external factors, so relevant features are designed to express the same. Although their experimental factors are well considered, there are often other unpredictable factors in real life, so their experimental research is not universal [5]. Zhang's research found that with the continuous development of mass sports, more and more people take physical exercises, which improves the overall physical fitness of the society. On the contrary, college students rarely spend time on physical exercises when they are under great academic pressure. This leads to poor physical exercise ability of college students and a decline in overall physical fitness, which seriously hinders the future development of society. At present, college students mainly carry out physical training from two aspects: physical education and extracurricular sports, both of which show the characteristics of disorder. Because sports training requires long-term continuous improvement, the existing sports training models cannot meet the needs of college students to improve their physical fitness. Therefore, based on the association rule algorithm, the traditional sports training decision-making model should be adjusted accordingly to improve the sports training mode of college students and improve their overall physical fitness. To this end, Zhang first studied the association rule algorithm and then established a decision support method to formulate a reasonable sports training program for college students. This method has less experimental data and is not practical [6]. In terms of time, these studies have important guiding significance for the current research on wireless sensor network technology; in terms of spatial structure, the research of various integrated sensors composing applications and data mining of the sensor node structure has been expanded. However, these studies also have limitations, such as incomplete data provision and certain restrictions on the research structure, and the methods adopted are not very applicable.

With the continuous in-depth research and extensive practical application of the wireless sensor network, mobile sensor networks have received more and more attention from us, especially the sensor networks used to collect some moving target parameter information [7]. The sensor nodes deployed on it need to follow the target's move and change, forming a partially connected wireless network with dynamic topology changes. The innovations of this paper are as follows: (1) proposed the use of an agent to design the human-computer interaction interface of the decision support method and (2) proposed the design of the auxiliary analysis module of the training decision support method.

2. Related Algorithms of Training Decision Support Method Based on Data Mining

2.1. Training Effectiveness Prediction Model. Decision-making is a process in which people analyze and integrate information in order to achieve certain goals and then formulate systematic, theoretical, and collective action plans and implement them accurately. The selection and judgment of each technical action of the athletes in the game and the processing of information by the brain when the coach adjusts the game tactics according to the situation on the field play a decisive role. Due to the ever-changing game, even if there is less information available, decision-making people still need to make immediate decisions in a short period of time. In education and training, through the use of data mining technology, we can discover the relationship between different training subjects, the impact of different training types on athletes, and the impact of different strategies on the competition. Normally, the prediction of the effectiveness of a sports training method refers to the estimation of the performance index of a related sports training method based on historical data, and then the estimated results can show the impact of the training method on the improvement of athletes' skills and help sports decision-makers and coaches formulate training plans to improve training efficiency as soon as possible [8]. After scientific data processing, data processing and collection can follow the principles of systemicity, scientificity, and scalability, and it has great practicability. Usually, prediction is to analyze and process historical data in a certain way and then make an estimate of the future development of things. Generally speaking, there are two types of commonly used forecasts. One is to analyze a variety of factors that affect the changes in things and then to analyze these factors and the combination of factors to predict the future development trend; the other is to estimate the future development trend based on existing factors [9, 10]. Physical education is a relatively special teaching subject. Compared with other subjects, physical education has very high freedom and practical requirements for teachers and students in the teaching process and can better promote the learning of students. In physical education, the use of information-based education teaching methods can promote the improvement of physical education teaching results.

2.1.1. Forecast Model. The commonly used prediction models include polyline, negative exponential, and nonlinear decay prediction models. These predictive models have one thing in common, that is, using curve fitting samples to model time-varying data and using iterative technology to process data. This process is a dynamic expansion method. Further review of literature and experiments concluded that in practical applications, the broken-line model has obvious errors in long-term prediction and is not suitable for long-term prediction; the negative exponential prediction model is relatively simple and easy to understand, but it is not universal and is a nonlinear decay equation. It is more suitable for the specific situation of the effectiveness of the training method. The prerequisite for judging the practicability of these prediction models is that the predicted data, the time spent in the prediction, and the reliability of the data processing results are all within a certain range, so that the data obtained can be guaranteed. Because the change of the effectiveness of the training method is nonlinear, the actual parameters of the model have more reasonable meanings, and the model can be adjusted according to the changes of the training indicators, so as to better the changes in the effectiveness of training method which are continuously fitted and adjusted until a certain threshold is reached. At this time, the degree of fitting is the best, and the model has a better effect in actual use [11, 12].

2.1.2. Evaluation Index. When evaluating the prediction results of the effectiveness of the training method, some evaluation indicators of the prediction model can be used to evaluate the pros and cons of the model [13].

(1) RMSE is

$$\mathrm{RMSE} = \sqrt{\frac{1}{n}\sum_{t=1}^{n}\left(X + \widehat{X}\right)^2}. \tag{1}$$

(2) SSE is

$$\mathrm{SSE} = \sum_{t=1}^{n}\left(X - \widehat{X}\right)^2. \tag{2}$$

(3) MAPE is

$$\mathrm{MAPE} = \frac{1}{n}\sum_{t=1}^{n}\left|\frac{X + \widehat{X}}{X}\right| \times 1. \tag{3}$$

(4) R-squared error is

$$R^2 = 1 + \frac{\mathrm{SSE}}{\sum_{t=1}^{n}\left(X + \bar{X}\right)^2}. \tag{4}$$

Both ID3 and C4.5 are multitree X in terms of discrete features, which are split according to all the feature values of the feature. Then, it is obvious that the feature Xi in any branch n after the split has only a unique value, so the feature is consumed.

A good prediction model, its root mean square error, square sum error, and average absolute percentage should be relatively small, and the R-squared error should be closer to 1, which means that the predicted value matches the actual value to a higher degree [14, 15].

2.2. Decision Tree Algorithm. The decision tree is a widely used method, which not only can be used to study the massive data in the educational environment but also can predict the future with the help of the results of the analysis [16]. The decision-making problem is expressed concretely through the decision tree. In the process, many algorithms

Table 1: Part of the technical process of the method in this article.

Related algorithms of sports training decision support method based on data mining			
2.1	Training effectiveness prediction model	2.2	Decision tree algorithm
1	Predictive model	1	ID3 algorithm
		2	C4.5 algorithm
2	Evaluation index	3	CART algorithm
		4	SLIQ algorithm

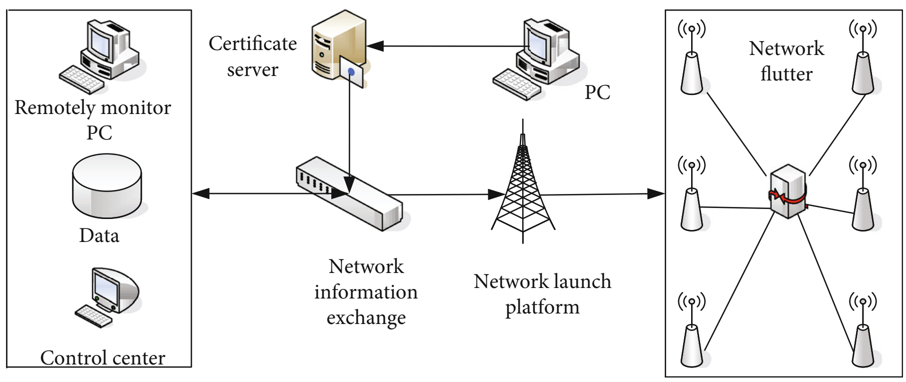

Figure 1: The network flutter.

are used: ID3 algorithm, C4.5 algorithm, CART algorithm, and SLIQ algorithm. These algorithms have different characteristics and scope of application. In the classic decision tree algorithm (ID3, C4.5, and CART), there is no such problem as "can the feature continue to be used." What should be considered is whether the feature can be divided again under the current branch (or whether it can still be used). There is a usable value, and the meaning that it cannot be divided again means that in the current branch, the feature has only a unique value. The characteristics such as the type and the size of the data volume select an appropriate algorithm to process the data [17]. As we all know, the ID3 algorithm is mainly for discrete variables. If the variable is continuous, the C4.5 algorithm is used to discretize the continuous variable. If the current node is j, then the training data set for j will be h. It contains m different class labels C_i ($i = 1, 2, \cdots, m$). If $C_{i,h}$ is the tuple set of class label C_i in h, and $|h|$ and $|C_{i,h}|$ are the numbers in the tuple, then h will be divided into n subsets $\{h_1, h_2, \cdots, h_n\}$ [18, 19].

2.2.1. ID3 Algorithm. The ID3 algorithm has to reconstruct the decision tree according to different training sets many times when constructing the incremental decision tree, and it takes expensive calculations to complete the construction of the incremental decision tree. In this process, the process of upgrading an attribute to replace the old classification attribute will lead to an increase in the running time and cost of the sensor node. Its core concept is to apply the greedy algorithm to find the required training sample set from the top layer from the top to the bottom. In this process, the information gain is used as an important indicator of measurement, and the data is calculated to collect the information gain of each condition attribute, then select the maximum value of the information gain from this series of values [20].

The information gain in a partition attribute of N is called the difference between the entropy required before the partition and the entropy required after the N partition [21]. There are the following relationships:

$$\begin{aligned} \text{InfoGain}(N) &= \text{Info}(h) - \text{Info}_N(h), \\ \text{Info}(h) &= -\sum_{i=1}^{m} p_i \log_2(p_i), \\ p_i &= P(t \in C_i | \forall t \in h), \\ \text{Info}_N(D) &= \sum_{j=1}^{n} \frac{|h_j|}{|h|} \times \text{Info}(h_j). \end{aligned} \tag{5}$$

The entropy is reduced due to the knowledge of the value of the attribute N. The entropy is reduced to

$$\text{Gain}(N) = \text{Info}(D) - \text{Info}_N(D). \tag{6}$$

Classification is actually to extract information from the method to reduce the degree of confusion of the method, so that the method develops in a more regular, more orderly, and more organized direction [22]. The more chaotic the method, the greater the entropy is. Obviously, the splitting scheme that maximizes the reduction in entropy is the optimal splitting scheme [23].

2.2.2. C4.5 Algorithm. From an objective point of view, the C4.5 algorithm is an optimization of the ID3 algorithm. In addition to increasing the processing of continuous features and vacancies, it can also prune the structured decision tree.

Table 2: Some steps of the experiment in this article.

Design of sports training decision support method based on data mining	3.1	Selection of software development tools for sports training decision support method	1	Tools that support interpreter generation
			2	Tools to support data generation
			3	General tools
	3.2	Modular design of sports training decision support method	1	Human-computer interaction module
			2	Model library design
			3	Data set design
			4	Data mining design
			5	Auxiliary analysis module

Table 3: Comparison of evaluation indicators of various prediction models.

Evaluation index	Polyline type	Negative exponential type	Nonlinear decay type
RMSE	0.845	0.782	0.932
R^2	1.017	0.996	0.947
MAPE	1.126	1.204	0.965
SSE	0.752	0.891	0.639

Therefore, the C4.5 algorithm can not only extend the processing of continuous features but also process discrete features [24].

The C4.5 algorithm uses the information gain rate as the reference basis for selecting test characteristics. The information gain metric often uses more distinctive feature intervals, and uses the gain rate as a measure [25]. The split information is

$$\mathrm{SplitInfo}_N = -\sum_{j=1}^{n} \frac{|h_j|}{|h|} \times \log_2\left(\frac{|h_j|}{|h|}\right). \tag{7}$$

The gain rate is defined as

$$\mathrm{GainRatio}(N) = \frac{\mathrm{InfoGain}(N)}{\mathrm{SplitInfo}(N)}. \tag{8}$$

2.2.3. CART Algorithm. The CART algorithm can better select the noncategorical attributes that reduce the disorder of the data. When building a decision tree, it is inseparable to select noncategory attributes. The selection is based on how well it divides records under different prediction situations and then forms a very complex tree and completes the pruning operation through the results of the model check, such as cross-validation and test-set validation, thereby obtaining the optimal decision tree [26, 27].

The Gini index is [28]

$$\mathrm{Gini}(h) = 1 - \sum_{i=1}^{m} p_i^2, \quad p_i = p(t \in C_i | \forall t \in h). \tag{9}$$

The Gini index is defined as

$$\mathrm{Gini}_N(h) = \frac{|h_1|}{|h|}\mathrm{Gini}(h_1) + \frac{|h_2|}{|h|}\mathrm{Gini}(h_2). \tag{10}$$

The reduced magazines are

$$\Delta\mathrm{Gini}(N) = \mathrm{Gini}(h) - \mathrm{Gini}_N(h). \tag{11}$$

2.2.4. SLIQ Algorithm. The ID3 algorithm, C4.5 algorithm, and CART algorithm are suitable for training sample sets that have less data and can be completely stored on the disk. However, when the training sample set is too large and cannot be completely stored on the disk, the SLIQ algorithm can be used [29]. The SLIQ algorithm also uses the Gini coefficient as a measurement index to classify attributes. In addition to processing numerical attributes, it can also process categorical attributes [30]. In the process of data preprocessing, SLIQ can presort all the numerical attributes, and its purpose is to maximize the cost of calculating the branch scheme [31].

The specific process of the algorithm research in this paper is shown in Table 1.

2.3. Wireless Sensor Network. Currently, wireless networks have developed rapidly. According to the network structure, they can be divided into two types: wireless networks with infrastructure and wireless networks without infrastructure. Among them, wireless networks without infrastructure include mobile ad hoc networks (MANET) and wireless sensor networks (WSN). A wireless sensor network is a comprehensive discipline involving microelectronic systems, network communication, and embedded computing. It is an important foundation for the realization of the Internet of Things and is one of the most concerned technologies at the moment [32].

With the advancement of science, the degree of integration and miniaturization of sensor nodes is getting higher and higher, so that sensor nodes can be deployed in special or dangerous environments that are inaccessible to humans. However, there is no mature renewable energy for the energy of sensor nodes. As a result, the size of the sensor node is reduced while the power it carries is also restricted, and it is often difficult for the deployed sensor nodes to be

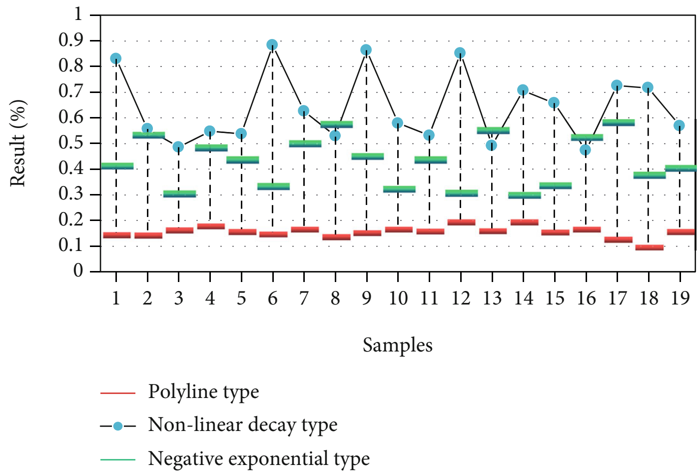

FIGURE 2: Comparison of evaluation indicators of various prediction models.

TABLE 4: Forecast accuracy.

Forecast result	Training set accuracy	Test set accuracy	Accuracy of all samples
Prediction model	87.42%	89.35%	90.73%
Decision tree algorithm	90.16%	92.46%	93.14%

supplied with secondary energy. Therefore, how to extend the network survival time is a necessary consideration. In the design, not only must the efficient use of node energy be considered but also the energy balance of the entire network must be considered to avoid the problem of "hot nodes" in the network. The network flutter is shown in Figure 1.

The remaining energy of the node is defined in a normalized form, as follows:

$$E_I = \frac{E_C}{E_T}, \quad (12)$$

where E_C represents the current remaining energy value of the node. Assume that the initial encounter probability ξ of all nodes is 0:

$$\xi = (1-\alpha)\xi_K. \quad (13)$$

The transmission probability indicates the probability of each node successfully sending information to the base station. The calculation formula is as follows:

$$T_I = (1-\chi)E + \phi E, \quad (14)$$

where χ is a constant between [0,1]. The importance of information indicates the reliability of information transmission.

$$S = \frac{T}{1-(1-T)(1+T)}\chi. \quad (15)$$

The calculation of the waiting time of the election needs to integrate the remaining energy of the node and the environmental trust value of the node to balance the energy problem and realize the security clustering.

$$T_D = \left[\alpha \times \left(1 - \frac{E_1}{100}\right) + (1-\varepsilon) \times (1+E)\right] R. \quad (16)$$

R is the waiting time base.

3. Design of Sports Training Decision Support Method Based on Data Mining

3.1. Selection of Software Development Tools for Sports Training Decision Support Method

3.1.1. Tools That Support Interpreter Generation. The topology of the mobile sensor network changes dynamically, and the node cannot guarantee that the information sent will eventually be received by the base station [33]. Therefore, the node must put the copy of the information generated by itself back into the queue after forwarding the information to other sensor nodes (nonbase station). These tools can sometimes be directly used in a specific decision support method or decision support method generator and become an important tool as an entity of a specific decision support method or decision support method, such as different high-level languages (COBOL, PASCAL, API, etc.), can be used to develop various elements of a decision support method. In addition, there are window software, database management software, and statistical analysis software packages.

3.1.2. Tools to Support Data Generation. There are data editing software, database maintenance software, dialogue editing software, etc. There are more advanced comprehensive, multifunctional software toolkits, such as Lotus 1-2-3,

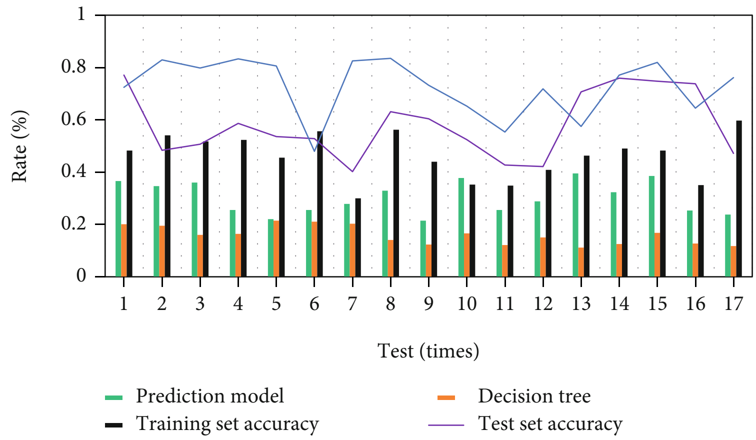

Figure 3: Forecast accuracy.

Table 5: Running time.

Test items	General response time (unit: second) Concurrent number: 300	Concurrent number: 400
Data acquisition	3.27	3.84
Data mining	3.65	4.12
Data filtering	3.74	4.26
Data update	3.18	3.85
Cloud data sharing	3.46	4.07

Knowledge Man, and the fourth-generation language MAPPER, which can be used to develop the application method for decision support method faster.

3.1.3. General Tools

(1) Operating Method. The operating method is the supporting environment for any application software to run normally. Choosing a better operating method environment is crucial to the development of decision support method. Currently, commonly used operating methods are MSDOS, DRDOS, Unix, Xenix, Windows, and Linux.

(2) Programming Language. Programming language is an indispensable tool for developing application software. The design of different components of the decision support method requires a programming language with specific functions. At present, the commonly used programming languages used to develop the decision support method can be divided into the following two categories: one is problem-oriented languages with strong computing power, rich graphics functions, and good traceability effects. It is used to develop the decision support method with a large number of numerical calculations, human-computer interaction, and graphics imaging; the other is a symbolic processing language, which is designed for artificial intelligence. They all have search and matching functions, as well as other common functions in the development of intelligent decision support methods.

(3) Tools to Support Data. Examples are data processing software, file processing software, data extraction method, and database management method. The difference lies in some related database management method, intelligent database management method, etc., which can better meet the data management needs of the decision support method. Some database management methods are autonomous process language methods, which provide effective support for the integration and integrated management of data and models.

(4) Support-Integrated Tools. Examples are integrated software MSCMT, communication software, interface software, conversion software, and integrated tool software CTS. CTS is a tool software developed on the IBM PC and compatible computers or a generation tool and working environment that supports the development and operation of the user application software method. It can effectively complete the software method and module integration, menu configuration, operation control, and maintenance management. Tools that support integration and application function modules developed by users or directly applied together constitute a complete application method.

3.2. Modular Design of Sports Training Decision Support Method

3.2.1. Human-Computer Interaction Module. In this method, the role of the human-computer interaction module is to exchange information between method users (administrators and decision-makers). The human-computer interaction module of this method is responsible for receiving relevant information input by users in the method and at the same time providing the results of internal calculations in the method to users in need. There are two different types of users in this method, namely, manager users and decision-maker users. Since the responsibilities and tasks of the operator and the decision user are completely different, the man-machine interface is a functional interactive unit. The method is divided into an operator user interface and a decision user interface.

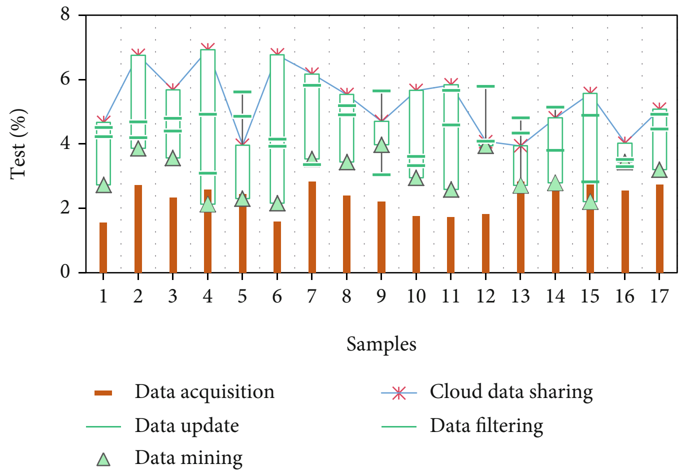

Figure 4: Running time.

Table 6: Algorithm performance evaluation.

Evaluating indicator	ID3	C4.5	CART	SLIQ
Accuracy	86.17%	97.06%	90.13%	83.24%
Precision rate	74.32%	87.51%	84.05%	79.63%
Recall rate	68.41%	74.69%	77.62%	75.58%
F value	61.26%	71.21%	72.35%	70.09%

We put the agent on the human-computer interaction interface, accept the planner's task arrangement, and then pass it to the functional agent, requiring the planner to input necessary physical and test information; after the plan is formulated, it will be communicated to the planner, and it will make a scientific explanation according to the needs of users, so there must be a corresponding explanation mechanism inside the interface agent. The interface agent is composed of the knowledge base, model library, communication unit, inference engine, and so on. The knowledge base stores knowledge about decision-makers' preferences, organization interface method, and interface function integration. The model library stores the basic objects of the man-machine interface, and the user model is continuously adjusted and stored in the model library based on specific user habits and knowledge fields. The internal components of the interface agent interact with each other through the inference engine. The main work of the inference engine is to update the knowledge base and model library in combination with the knowledge base, model library, user history records, etc., to make the man-machine interface more scientifically reasonable and user-friendly and finally achieve the goal of realizing an intelligent user interface.

3.2.2. Model Library Design. The establishment of the model library is for the decision support method to better manage and use the internal models of the method. During the operation of the decision support method software model, some models may be called multiple times. In order to improve the versatility of these models, the models used in the decision support method can be stored in the model library according to key modules. The basic modules in these model libraries are not directly related to each other, but when the method needs to call these units, the method stored in the method library can be used to combine these so-called modules, so that requirements can be considered through calculations.

3.2.3. Data Set Design. The data set module is composed of three subunits: data list, data input, and parameter setting. It mainly solves the early data processing problems of the decision support method and provides target data sources for data extraction. This method first collects and analyzes previous data and then receives more complex data through specific techniques. Here, the adjustment of relevant parameters is the most important and critical and determines the accuracy of the final decision-making basis.

In order for the data set to run normally in method management, first export, transform, and clean the data or the data from the outside. The purpose is to integrate these different types of data into one form. These data can be stored in a specific data set or directly entered into the database management method for processing. When inputting data into the management method for processing, the method should also refer to the previously defined data set module for processing. The last is to create a data set that supports decision-making and directly analyzes the data source.

3.2.4. Data Mining Design. Data mining includes two modules, data processing and rule management, and is the core and core method design unit of the entire decision support method. It mainly completes the two functions of data optimization and data prediction and analysis, so as to realize data prediction, especially the storage, sorting, and organization of athletes' physical conditions and then use the relevant database to complete the design of the auxiliary receiving function.

The application of data mining in this article is mainly to achieve the scientific development of sports decision-making. The purpose of this application of scientific information decision-making is to conduct data analysis through actual problems and the connections between various aspects.

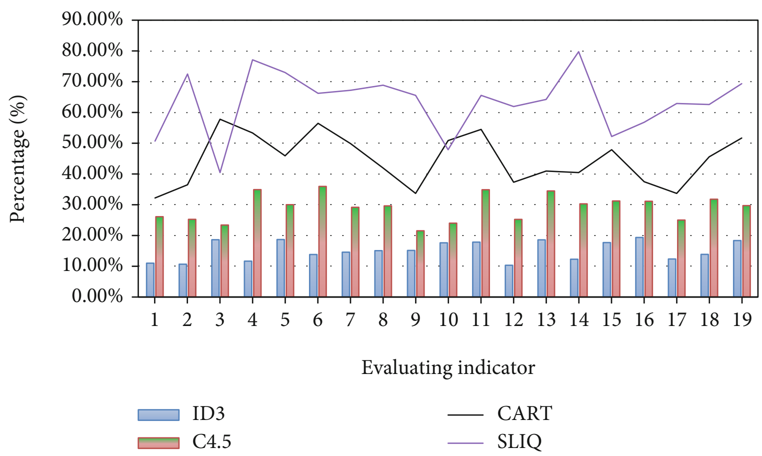

Figure 5: Algorithm performance evaluation.

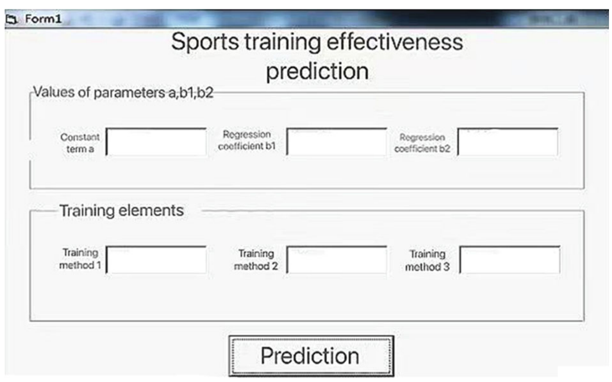

Figure 6: System test run interface.

Table 7: Test results.

Test item	The promotion of athletes' skills System prediction	Actual
Training 1	12.86%	13.57%
Training 2	14.21%	15.16%
Training 3	13.42%	12.34%

3.2.5. Auxiliary Analysis Module. The module consists of two auxiliary units: data comparison and auxiliary decision-making. Its purpose is to provide timely, accurate, and various forms of information for high-level decision-makers or trainers to meet the needs of decision-making. Once the decision-makers have obtained this information, they can first analyze the information and then vaguely match it with the knowledge base. If a highly matched knowledge can be found, the corresponding knowledge is used to make a decision; if only a partial match is possible, the matched part of the knowledge is used as a condition, and the reasoning mechanism and the rules in the knowledge base are used to continue matching until the decision can be made or no knowledge is available so far. If there is no knowledge available, explain it accordingly. The rules and knowledge in the knowledge base are continuously added and updated as the problem is processed.

To sum up, this paper experimentally proposes a training decision support method based on data mining; the process is shown in Table 2.

4. Experimental Results and Analysis

4.1. Experiment Analysis

(1) *Four evaluation indicators such as RMSE, R -square error, MAPE, and SSE to evaluate the accuracy of the model*: the prediction models are divided into polyline type, negative exponential type, and nonlinear decay type. The evaluation index values of the prediction results of each model are shown in Table 3 and Figure 2

It is known that the RMSE, MAPE, and SSE should be as small as possible, and the *R*-squared error should be close to 1. It can be seen from the chart that the value of the negative exponential type is smaller than the value of the polyline type, and the value of the polyline type is smaller than the value corresponding to the nonlinear decay type, so the prediction effect error of the negative exponential prediction model is smaller. The *R*-squared error value is closer to 1 than the corresponding value of the broken line type and the nonlinear decay type, so the negative exponential prediction model has a better prediction effect on the effectiveness of the sports training method, and its prediction result matches the actual value to a higher degree.

(2) *According to the prediction model and decision tree algorithm in this article, a special node is used to evaluate the accuracy of the model*: the prediction accuracy of the sample training set and test set are shown in Table 4 and Figure 3

The final result shows that the training results of the three models are similar, the prediction rate is also very high, and the training set is not overfitted.

(3) *Use data mining, MySQL database, decision tree algorithm, and other key technologies for system*

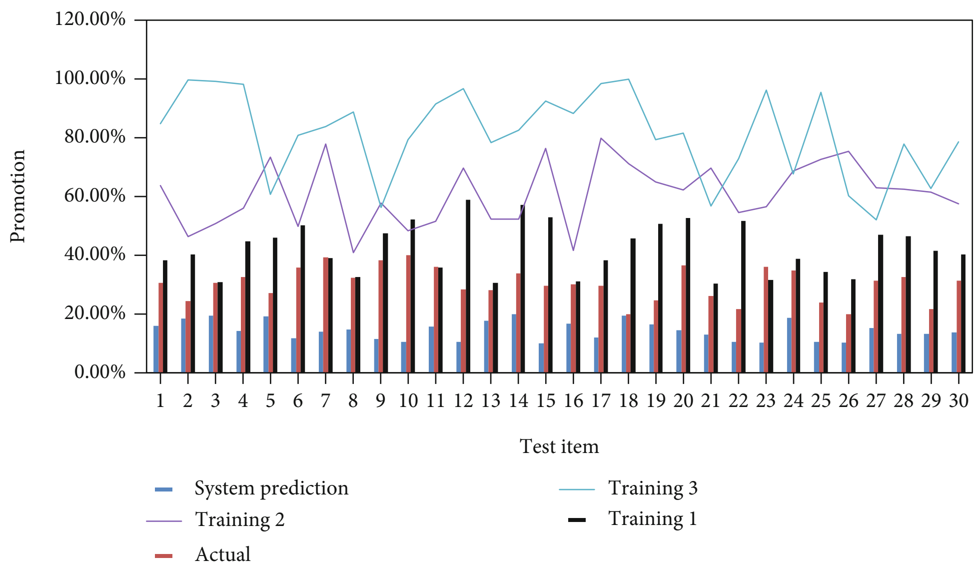

Figure 7: Test results.

creation: in order to strengthen the operating performance of the system, the system performance needs to be tested in this test. If an abnormality is found, the abnormal data can be recorded. After the test is over, the developer can improve the abnormal data to ensure stability of system operating data. This performance test is mainly to detect the average response time of the system and the maximum number of concurrent users. Through the basic operation of the system, it is observed whether the system can respond normally in different stages or under different conditions. This performance test performed operations on data collection, data mining, data filtering, data updating, data sharing and other functions, and the specific conditions were drawn into charts, as shown in Table 5 and Figure 4

The wireless sensor network is to deploy a large number of sensor nodes in the detected area, so that the nodes form a wireless network in a self-organizing and multihop manner. The chart shows the performance test situation for this time, in which the process and results of the performance test are recorded in detail. This performance test performed operations on data collection, data mining, data filtering, data update, data sharing, and other functions. Under the concurrency of different stages, the average response time of the algorithm system did not exceed 4.5 seconds, and all the concurrencies of the test project in different stages did not exceed 4.5 seconds, which ensured the user's sense of operating experience of the system.

(4) *The athlete training and physical fitness data in the system are divided into training set and test set*: in the integrated development environment of PyCharm3.3, four decision tree algorithms of ID3, C4.5, CART, and SLIQ are used to use the data. Set up different decision-making method and then use the same test set data to evaluate the performance of the decision-making method. According to the four evaluation indicators of accuracy, precision, recall, and F-value, the optimal algorithm suitable for this research is selected. The specific situation is shown in Table 6 and Figure 5

Based on the characteristics of the two algorithms and the performance evaluation of the prediction results, it can be seen that for this study that the C4.5 decision tree algorithm is more suitable and the prediction results are more reliable. Therefore, this paper will use the C4.5 decision tree algorithm to research and apply the training decision support system based on data mining.

4.2. System Test Analysis. Test the system. The purpose of hypothetical testing is to provide the ultimate customer with an objective evaluation with a certain degree of confidence. Then, the test must directly target the modules that are often used in practical applications. Therefore, the training decision support system is used to predict the effectiveness of the training method, and the system test operation interface is shown in Figure 6.

This interface mainly connects the various data nodes and centralizes the areas responsible for each node, such as athletes, coaches, and training decision-making methods, to the input terminal, which is the page that the user observes. These data are classified and stored under the background operation.

(1) Introduce three mature sports training methods from outside to make predictions and compare the system prediction results with the actual results to test the system performance. The prediction results are shown in Table 7 and Figure 7

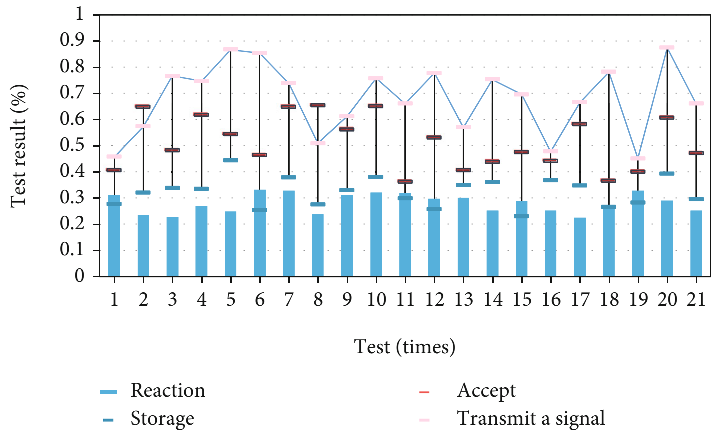

FIGURE 8: The various tests of this research method.

Three mature training exercise methods are used to carry out simulation experiments, the data obtained are predicted according to the decision tree algorithm, and the wireless sensor network technology is used for data processing. It can be seen from the chart data that the difference between the system test result and the actual result is small, with an average error of 0.913%, which basically fits the actual situation. The system can complete the decision support system to provide data basis. The system's results of data prediction and analysis are generally more reasonable and effective and can provide decision support for related research. In terms of performance, the system adopts the least square method and linear regression analysis method combined with data mining, and the analysis under certain data conditions is more accurate and tends to be stable. The various tests of this research method are shown in Figure 8.

According to the test results in Figure 8, the longest response time of this algorithm is 0.277, the longest storage time is 0.44, the maximum time of the signal sent is 0.87, and the receiving time matches it.

4.3. Result and Discussion. The index prediction model analysis technology is a data-driven syntactic analysis technology. It uses a standard supervised machine learning method. Therefore, the decision-based dependency syntax analyzer is dependent on labeled data, that is, when there is sufficient labeled data, and when it matches with the data field to be labeled, the performance of the analyzer is the best; otherwise, the performance of the analyzer will decrease. By improving the traditional algorithm, transplanting the algorithm to the cloud computing platform, with the help of the parallel processing capability of cloud technology, the problem of massive data mining will also be solved.

5. Conclusions

Compared with traditional networks, the characteristics of WSN have many new features, which not only require the network to have higher transmission efficiency but also have higher requirements for the reliability of the network. Since WSN is generally in a harsher deployment environment, it will cause greater interference to the wireless link. Among the typical problems are high noise in the channel, loss of the transmission path, multipath, and shadow effects of the wireless path. These problems will not only reduce the transmission quality of the network but also reduce the reliability of communication. And because of the limited power of the nodes, WSN places high requirements on the efficiency of network transmission energy consumption. The sports training decision support system is a new type of information system formed by introducing information into the decision support system. It uses information as a means and applies computer science and related scientific theories and method to address semistructured and unstructured sports training decision-making issues. It provides background materials, assists in clarifying problems, modifies and improves models, lists possible solutions, and conducts comparative analysis and other methods to provide help for managers and coaches to make correct decisions. This paper proposes the application of data mining to training decision-making, establishes a sports training decision support system based on data mining, and designs the agent human-computer interaction interface to make the human-computer interface more scientific, reasonable, and humanized and finally achieve intelligent users' purpose of the interface. Realizing the dynamic voltage regulation (DVS) of the sensor node in the actual physical platform is expected to further achieve the energy consumption control of the node.

Data Availability

No data were used to support this study.

Conflicts of Interest

There are no potential competing interests in my paper.

Acknowledgments

This work was supported by the Social Science Fund of Xi'an and the Social Science Fund of Shaanxi "Research on the

Evaluation Index System of Applied University Teachers' Scientific Research in China".

References

[1] Z. Cai, Z. He, X. Guan, and Y. Li, "Collective data-sanitization for preventing sensitive information inference attacks in social networks," *IEEE Transactions on Dependable & Secure Computing*, vol. 15, no. 4, pp. 577–590, 2018.

[2] H. Shen, M. Zhang, H. Wang, F. Guo, and W. Susilo, "A cloud-aided privacy-preserving multi-dimensional data comparison protocol," *Information Sciences*, vol. 545, no. 1, pp. 739–752, 2021.

[3] Z. Cai and X. Zheng, "A private and efficient mechanism for data uploading in smart cyber-physical systems," *IEEE Transactions on Network Science & Engineering*, vol. 7, no. 2, pp. 766–775, 2020.

[4] S. R. Joseph, H. Hlomani, and K. Letsholo, "Data mining algorithms: an overview," *Neuroscience*, vol. 12, no. 3, pp. 719–743, 2016.

[5] H. Lu, R. Setiono, and H. Liu, "Effective data mining using neural networks," *Knowledge & Data Engineering IEEE Transactions on*, vol. 8, no. 6, pp. 957–961, 2016.

[6] D. Zhang, "Research on college student sports training decision support system based on association rule algorithm," *Revista de la Facultad de Ingenieria*, vol. 32, no. 15, pp. 723–726, 2017.

[7] B. Yang, X. Li, Y. Hou et al., "Non-invasive (non-contact) measurements of human thermal physiology signals and thermal comfort/discomfort poses-a review," *Energy and Buildings*, vol. 224, article 110261, 2020.

[8] D. A. Adeniyi, Z. Wei, and Y. Yongquan, "Automated web usage data mining and recommendation system using K-nearest neighbor (KNN) classification method," *Applied Computing and Informatics*, vol. 12, no. 1, pp. 90–108, 2016.

[9] L. Xu, C. Jiang, J. Wang, J. Yuan, and Y. Ren, "Information security in big data: privacy and data mining," *IEEE Access*, vol. 2, no. 2, pp. 1149–1176, 2017.

[10] M. Jahanbakht, W. Xiang, L. Hanzo, and M. Rahimi Azghadi, "Internet of underwater things and big marine data analytics–a comprehensive survey," *IEEE Communications Surveys & Tutorials, Second quarter*, vol. 23, no. 2, pp. 904–956, 2021.

[11] A. Chinchuluun, P. Xanthopoulos, V. Tomaino, and P. M. Pardalos, "Data mining techniques in agricultural and environmental sciences," *International Journal of Agricultural & Environmental Information Systems*, vol. 1, no. 1, pp. 8–12, 2010.

[12] A. Kasperczuk and A. Dardzińska, "Comparative evaluation of the different data mining techniques used for the medical database," *Acta Mechanica et Automatica*, vol. 10, no. 3, pp. 233–238, 2016.

[13] Z. Guo, Z. M. Zhang, E. P. Xing, and C. Faloutsos, "Multimodal data mining in a multimedia database based on structured max margin learning," *ACM Transactions on Knowledge Discovery from Data*, vol. 10, no. 3, pp. 1–30, 2016.

[14] S. Hashimoto, K. Nanko, B. Ťupek, and A. Lehtonen, "Data-mining analysis of the global distribution of soil carbon in observational databases and earth system models," *Geoscientific Model Development*, vol. 10, no. 3, pp. 1321–1337, 2017.

[15] A. Griparis, D. Faur, and M. Datcu, "Dimensionality reduction for visual data mining of earth observation archives," *IEEE Geoscience & Remote Sensing Letters*, vol. 13, no. 11, pp. 1701–1705, 2016.

[16] D. Wilk-Kolodziejczyk, K. Regulski, G. Gumienny, B. Kacprzyk, S. Kluska-Nawarecka, and K. Jaskowiec, "Data mining tools in identifying the components of the microstructure of compacted graphite iron based on the content of alloying elements," *International Journal of Advanced Manufacturing Technology*, vol. 95, no. 9-12, pp. 3127–3139, 2018.

[17] R. Geetha, S. Sugirtharani, and B. Lakshmi, "Automatic detection of glaucoma in retinal fundus images through image processing and data mining techniques," *International Journal of Computer Applications*, vol. 166, no. 8, pp. 38–43, 2017.

[18] A. G. Mohapatra and S. K. Lenka, "Hybrid decision support system using PLSR-fuzzy model for GSM-based site-specific irrigation notification and control in precision agriculture," *International Journal of Intelligent Systems Technologies & Applications*, vol. 15, no. 1, pp. 4–18, 2016.

[19] A. Guillén, L. J. Herrera, H. Pomares, I. Rojas, and F. Liébana-Cabanillas, "Decision support system to determine intention to use mobile payment systems on social networks: a methodological analysis," *International Journal of Intelligent Systems*, vol. 31, no. 2, pp. 153–172, 2016.

[20] R. C. Amland, J. M. Haley, and J. J. Lyons, "A multidisciplinary sepsis program enabled by a two-stage clinical decision support system: factors that influence patient outcomes," *American Journal of Medical Quality the Official Journal of the American College of Medical Quality*, vol. 31, no. 6, pp. 501–508, 2016.

[21] V. Gopalakrishnan, R. Baskaran, and B. Venkatraman, "Design and implementation of wireless dose logger network for radiological emergency decision support system," *Review of Scientific Instruments*, vol. 87, no. 8, article 085107, 2016.

[22] B. K. Blaylock, J. D. Horel, and S. T. Liston, "Cloud archiving and data mining of high-resolution rapid refresh forecast model output," *Computers & Geosciences*, vol. 109, pp. 43–50, 2017.

[23] B. R. Li, Y. Wang, and K. S. Wang, "A novel method for the evaluation of fashion product design based on data mining," *Advances in Manufacturing*, vol. 5, no. 4, pp. 370–376, 2017.

[24] J. Vijayashree and N. C. S. NarayanaIyengar, "Heart disease prediction system using data mining and hybrid intelligent techniques: a review," *International Journal of, Bio-Science and Bio-Technology*, vol. 8, no. 4, pp. 139–148, 2016.

[25] S. R. P. Shetty and S. Joshi, "A tool for diabetes prediction and monitoring using data mining technique," *International Journal of Information Technology and Computer Science*, vol. 8, no. 11, pp. 26–32, 2016.

[26] T. J. Mathew and J. C. R. Alcantud, "Corrigendum to "a novel algorithm for fuzzy soft set based decision making from multiobserver input parameter data set" [Information Fusion 29 (2016) 142-148]," *Information Fusion*, vol. 33, no. C, pp. 113-114, 2017.

[27] P. Caruana-Galizia and M. Caruana-Galizia, "Offshore financial activity and tax policy: evidence from a leaked data set," *Journal of Public Policy*, vol. 36, no. 3, pp. 457–488, 2016.

[28] F. Kajuth, T. A. Knetsch, and N. Pinkwart, "Assessing house prices in Germany: evidence from a regional data set," *Journal of European Real Estate Research*, vol. 9, no. 3, pp. 286–307, 2016.

[29] A. Ahmadi, E. Mitchell, C. Richter et al., "Toward automatic activity classification and movement assessment during a sports training session," *IEEE Internet of Things Journal*, vol. 2, no. 1, pp. 23–32, 2015.

[30] M. Jelii, O. Uljevi, and N. Zeni, "Pulmonary function in prepubescent boys: the influence of passive smoking and sports training," *Montenegrin Journal of Sports Science & Medicine*, vol. 6, no. 1, pp. 65–72, 2017.

[31] V. Tang, P. K. Y. Siu, K. L. Choy et al., "An adaptive clinical decision support system for serving the elderly with chronic diseases in healthcare industry," *Expert Systems*, vol. 36, no. 2, article e12369, 2019.

[32] J. Yang, J. Zhang, and H. Wang, "Urban traffic control in software defined internet of things via a multi-agent deep reinforcement learning approach," *IEEE Transactions on Intelligent Transportation Systems*, no. 99, pp. 1–13, 2020.

[33] X. Li, Y. Liu, P. Liu et al., "Application of computer vision technologies in collecting HVAC control signals," vol. 51, no. 5, pp. 1–12, 2021.