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Retraction

Retracted: Data Mining Technology for Agricultural Equipment Machinery and Information Network Data Resources

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

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[1] Z. Fan, N. Zhang, X. Zhang, D. Wang, and G. Wu, "Data Mining Technology for Agricultural Equipment Machinery and Information Network Data Resources," *Wireless Communications and Mobile Computing*, vol. 2022, Article ID 3899618, 8 pages, 2022.

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Research Article

Data Mining Technology for Agricultural Equipment Machinery and Information Network Data Resources

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In order to realize the automation and intelligence of agricultural equipment mechanical state detection and improve the efficiency and accuracy of agricultural machinery equipment detection technology, this paper proposes an intelligent agricultural machinery equipment state detection method based on computer data mining. This method uses support vector machine to classify the equipment status and uses ant colony algorithm to solve the optimization problem. Its basic logic is to collect the status data of agricultural machinery equipment, extract the status detection characteristics of agricultural machinery equipment, and use computer data mining to establish an automatic state detection model of agricultural machinery equipment. The application results show that the correct rate of the state detection of agricultural machinery equipment is more than 95%, and the false detection rate of the state of agricultural machinery equipment is far lower than that of other current state detection methods of agricultural machinery equipment. *Conclusion*. This method can realize high-precision real-time detection of agricultural machinery equipment and has higher practical value.

1. Introduction

Agricultural mechanization and agricultural equipment are the important foundation for changing the mode of agricultural development and promoting the sustainable development of agriculture. They are the key areas and core support for promoting the construction of agricultural modernization. In 2018, the guiding opinions of the State Council on accelerating the transformation and upgrading of agricultural mechanization and agricultural machinery and equipment industry made an important judgment that "agricultural production has changed from mainly relying on human and animal resources to mainly relying on mechanical power and entered a new stage dominated by mechanization", pointing out the prominent problem of "the current unbalanced and insufficient development of agricultural mechanization and agricultural machinery and equipment industry". The general requirements of "promoting the transformation of agricultural machinery and equipment industry to high-quality development and promoting the overall, high-quality and efficient upgrading of agricultural mechanization" were clarified. The strategic plan for Rural Revitalization (2018-2022) also points out that efforts should be made to strengthen key technology research, promote the deep integration of advanced technologies such as digitalization and intelligence with agricultural mechanization, significantly improve the effective supply capacity of agricultural machinery, and lead the high-quality and efficient development of modern agriculture. It is of great significance for promoting the high-quality and efficient development of China's agriculture to implement the spirit of the above documents, carefully understand the research and application status of foreign agricultural machinery, and then find out the key objectives for the development of China's agricultural mechanization.

At present, China is in an important period of agricultural modernization, and the demand for intelligent agricultural machinery and equipment is also growing [1, 2]. However, the intelligent level of the existing agricultural machinery and equipment in China is low, which is inconsistent with the current requirements for automation and high-efficiency operation, and is not conducive to the rapid development of China's agricultural modernization [3, 4]. In the coming period, the development of agricultural equipment in China will face new opportunities, new demands, and new challenges, and there is still a broad space for the development of agricultural equipment manufacturing. Therefore, strengthening the intelligent innovation of agricultural machinery and improving the level of agricultural mechanization in China with information technology has become an urgent and crucial task for the development of agricultural mechanization [5].

Accelerating the process of agricultural informatization is an important strategic measure to promote the development of agriculture and rural economy, increase farmers' income and become rich, and stabilize rural society. As a typical model of China's agricultural development in the new era, ecological agriculture has been widely recognized and accepted in theory and practice. It is considered as an inevitable choice to solve the plight of modern agriculture, reduce the pressure on population, resources, and environment, and the basis for the marketization and internationalization of China's agricultural products [6]. Agricultural data has the characteristics of large amount, multidimensional, dynamic, incomplete, and uncertain. The information data of ecological agriculture has strong regional and timeliness. Mining data information, improving information quality, and timely providing predictive, seasonal, and instructive practical information has become an urgent problem to be studied and solved [7, 8].

Data mining technology is a data management technology based on information technology. From the root, this technology belongs to the category of database technology. It is an advanced processing process to extract various valuable data for a large number of one-sided, fuzzy, and interfering practical application data [9, 10]. The rules for processing these data include the integration of a series of technologies such as statistics, artificial intelligence, and database. It is a typical interdisciplinary and has made great achievements in many fields [11, 12]. As for the quality control of agricultural machinery, data mining technology can comprehensively classify and manage the application and fault information of agricultural machinery, so that a large number of messy information of the whole agricultural machinery quality control can be rationalized. The results are helpful to the overhaul and maintenance of agricultural machinery and improve the working stability and service life of agricultural machinery [13, 14], as shown in Figure 1.

2. Literature Review

Lamrhari et al. processed and analyzed the collected environmental data, built an effective agricultural big data architecture, assisted producers and consulting companies in making decisions, improved agricultural productivity and monitoring ability, improved the decision-making process, and achieved the goal of better management of natural resources [15]. Wu et al. elaborated that the agricultural information age cannot be driven by big data. Driven by data, the agricultural monitoring and early warning system is expected to move towards full automation, real-time management, and accurate service [16]. Alves and Cruvinel developed a system with data source, big data processing environment and application program in 2016. The system can monitor soil data in real time, analyze soil fertility, and provide farmers with soil testing and formula fertilization suggestions [17]. Kim et al. analyzed the huge amount of data on the circulation of agricultural products, established a sales strategy suitable for local festival planning, and made a sales decision support system using the big data of agricultural products [18]. Wang et al. conducted research on the collection of agricultural data platform, built a network capture system based on jsoup, and provided consumers with valuable market information through correlation analysis and regression analysis, which helped to improve the common awareness of the agricultural product market [19]. In the processing of agricultural big data, foreign countries have also put forward many new technical methods. Tsai et al. published an article on MapReduce in 2004 introducing the distributed principle of the technology and its advantages in processing big data [20]. In terms of data calculation, Gil-Garcia et al. proposed an environmental domain planning and decision-making process based on spectral clustering algorithm, which effectively improved the clustering efficiency and accuracy of data. In terms of data presentation, the authors of [21] applied data visualization technology to the impact of agricultural activities and climate change on water resources, providing a new solution for places lacking water resources.

According to the randomness of the state change of agricultural machinery equipment, in order to solve the shortcomings of current agricultural machinery equipment state detection methods, an intelligent agricultural machinery equipment state detection method based on computer data mining is designed. First, collect the status data of agricultural machinery equipment and extract the status detection features of agricultural machinery equipment. Then, the self-test model of agricultural machinery equipment state is established by using computer data mining. Finally, the simulation test of agricultural machinery equipment status detection is carried out to analyze the feasibility and superiority of this method.

3. Research Methods

3.1. Data Mining Technology

3.1.1. Support Vector Machine Classification Method. Computer data mining technology is the result of the integration of computer technology and data analysis technology. Support vector machine is a classical computer data mining technology, which has not only classification ability, but also regression ability [22–24]. Because the state detection of agricultural machinery equipment is a classification problem, this paper focuses on the classification principle of support vector machine. The state of agricultural machinery equipment is usually classified as normal state or abnormal state, and the abnormal state is mainly shown as fault state. If H1 represents normal state and H2 represents abnormal state, support vector machine can distinguish the normal

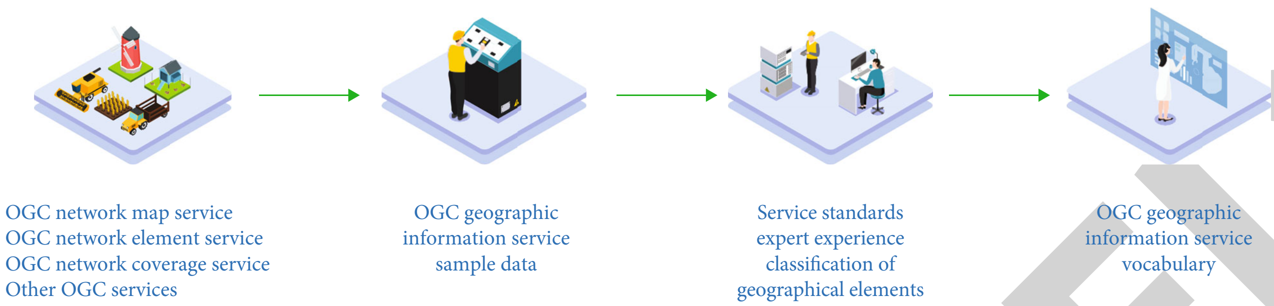

FIGURE 1: Information network data resources.

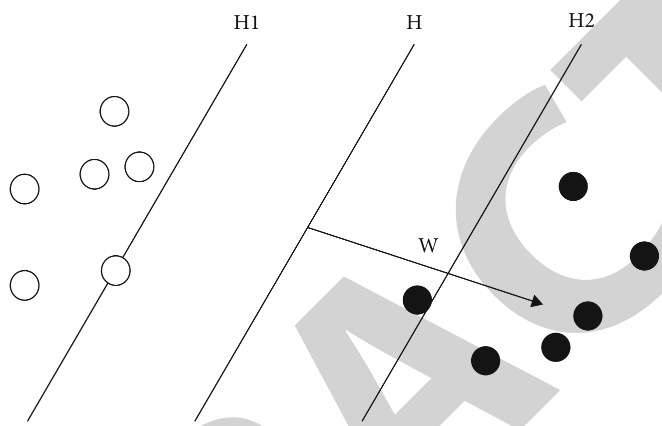

FIGURE 2: Classification principle of support vector machine.

state and abnormal state of agricultural machinery equipment by establishing a classification plane. For details, as shown in Figure 2, the electric energy data acquisition system of power users is a system for real-time collection, processing, and monitoring of power consumption information of power customers [25]. Based on this system, the useful functions such as automatic collection of power information, anomaly monitoring, power quality monitoring, power analysis and management, relevant information release, distributed energy monitoring, and information exchange of intelligent power equipment can be realized.

Set the data set of agricultural machinery equipment status detection as $\{x_i, y_i\}$, $(i = 1, 2, \cdots, l)$, $x \in R^n$, and $y \in \{+1, -1\}$, where l is the data scale of agricultural machinery equipment status detection, n is the number of characteristics of agricultural machinery equipment status detection, and y is the status type of agricultural machinery equipment. It supports mapping data to a high-dimensional space to a processor. At this time, the classification plane can be described as follows:

$$\omega \cdot \psi(x) + b = 0, \tag{1}$$

where $\psi(x)$ is the mapping function, and the following conditions shall be met:

$$\begin{aligned} \omega \cdot \psi(x_i) + b \geq 0, \quad & \text{if } y_i = 1, \\ \omega \cdot \psi(x_i) + b \leq 0, \quad & \text{if } y_i = -1, \end{aligned} \tag{2}$$

where ω is the normal vector used to describe the straight line. In the process of condition detection of agricultural machinery equipment, the established classification plane has a certain error. Therefore, relaxation variable ξ_i and penalty parameter C are introduced to stabilize the classification error and calculation complexity. In this way, the solution of equation (3) can change a basic optimization problem, specifically

$$\begin{aligned} & \min_{\omega,b,\xi} \frac{1}{2} \|\omega\| + C \sum_{i=1}^{l} \xi_i, \\ & \text{s.t. } y_i[(\omega \cdot x_i) + b] \geq 1 - \xi_i. \end{aligned} \tag{3}$$

The dual form of equation (4) is obtained by using Lagrange coefficient α_i, i.e.,

$$\begin{aligned} & \min_{\alpha} \left[\sum_{i,j=1}^{n} y_i y_j \alpha_i \alpha_j \left(\psi(x_i) \psi(x_j) \right) - \sum_{i=1}^{n} \alpha_i \right], \\ & \text{s.t.} \quad 0 \leq \alpha_i \leq C, \sum_{i=1}^{l} y_i \alpha_i = 0. \end{aligned} \tag{4}$$

Among them, the vector corresponding to nonzero α_i is the support vector, which directly determines the state detection effect of agricultural machinery equipment. The discriminant function of agricultural machinery equipment state detection can be established, as shown below:

$$f(x) = \text{sgn}\left[\sum_{i=1}^{l} y_i \alpha_i (\psi(x_i) \cdot \psi(x)) + b\right], \quad (5)$$

where

$$\text{sgn}\ (x) = \begin{cases} +1, & x \geq 0, \\ -1, & x \leq 0. \end{cases} \quad (6)$$

The working process of inner product operation $(\psi(x_i) \cdot \psi(x))$ is very complex, which affects the efficiency of condition detection of agricultural machinery equipment. Therefore, kernel function $K(x_i, x)$ is introduced instead of $(\psi(x_i) \cdot \psi(x))$ to speed up the condition detection of agricultural machinery equipment. Select radial basis Gaussian function as $K(x_i, x)$, as shown below:

$$K(x_i, x) = \exp\left(-\frac{\|x_i - x\|^2}{\sigma^2}\right), \quad (7)$$

where σ is the core width.

In the modeling process of agricultural machinery equipment state detection, the parameters C and σ affect the effect of agricultural machinery equipment state detection. Ant colony algorithm is used to determine the values of C and σ.

3.1.2. Ant Colony Algorithm. Ant colony algorithm solves the problem by simulating the process of ants looking for food [26]. Let the position of ant k at the t-th time be i; then, its crawling probability to position j is as shown below:

$$p_{ij}^k(t) = \begin{cases} \dfrac{\tau_{ij}^{\alpha}(t)\eta_{ij}^{\beta}(t)}{\sum \tau_{is}^{\alpha}(t)\eta_{is}^{\beta}(t)}, & j, s \notin tabu_k, \\ 0, & \text{otherwise.} \end{cases} \quad (8)$$

Among them, η_{ij} is the pheromone heuristic factor on the path in the process of ant crawling; τ_{ij} is the pheromone on the path between position i and position j; $tabu_k$ is the path search tabu table of ant k; α is the weight of pheromone; and β is the weight of the heuristic factor, and its value changes as shown in

$$\beta = \beta_0 \left(1 - \frac{n}{N_{\max}}\right), \quad (9)$$

where n is the number of iterations; β_0 is the initial value of the weight of the heuristic factor; and $N_{\max}$ is the maximum number of cycles.

After searching all positions, the ants update the information concentration of the path, as shown in the following:

$$\tau_{ij}(t+1) = \rho \cdot \tau_{ij}(t+1) + \sum_k \Delta\tau_{ij}^k, \quad (10)$$

where ρ is the residual factor of pheromone and $\Delta\tau_{ij}^k$ represents pheromone change factor.

3.2. Intelligent Detection Method of Agricultural Machinery Equipment Status Based on Data Mining

3.2.1. Collection of Status Data of Agricultural Machinery Equipment. When the state of agricultural machinery equipment changes, many parameters will change accordingly. Vibration signal is an important parameter to describe the state change of agricultural machinery equipment. Therefore, wireless sensors are used to collect the vibration signals of agricultural machinery equipment, and the collected vibration signals of original agricultural machinery equipment are preprocessed to extract effective status data of agricultural machinery equipment.

3.2.2. Extracting the State Characteristics of Agricultural Machinery Equipment. The vibration signal of agricultural machinery equipment is decomposed by wavelet packet. The decomposed signal of the i-th layer is $f_{ij}(t_j)$, and the vibration signal $x(t)$ of agricultural machinery equipment can be expressed as follows:

$$x(t) = \sum_{j=0}^{2^i-1} f_{ij}(t_j). \quad (11)$$

$f_{ij}(t_j)$ represents the reconstructed signal of the wavelet packet decomposition of the motor signal on the node (i, j) of the i-th layer. After the state changes, the energy of the vibration signal will change accordingly. The state of agricultural machinery equipment can be detected according to the energy spectrum. The energy spectrum calculation formula is shown as follows:

$$E_{ij}(t_j) = \int_T \left|f_{ij}(t_j)\right|^2 \mathrm{d}t = \sum_{j=1}^{m} \left|x_{ij}\right|^2, \quad (12)$$

where x_{ij} is the amplitude of $f_{ij}(t_j)$.

The total energy of agricultural machinery equipment status vibration signal is shown in the following:

$$E = \sum_{j=1}^{2^i-1} E_{ij}(t_j). \quad (13)$$

The proportion of subband energy of vibration signal of agricultural machinery equipment decomposed by the i-th wavelet packet to the total energy is shown in

$$P_{ij} = \frac{E_{ij}}{E} \times 100\%. \quad (14)$$

P_{ij} is used as the detection feature of agricultural machinery equipment state, that is, the input vector of support vector machine classification, and the agricultural machinery equipment state is used as the output vector of support vector machine.

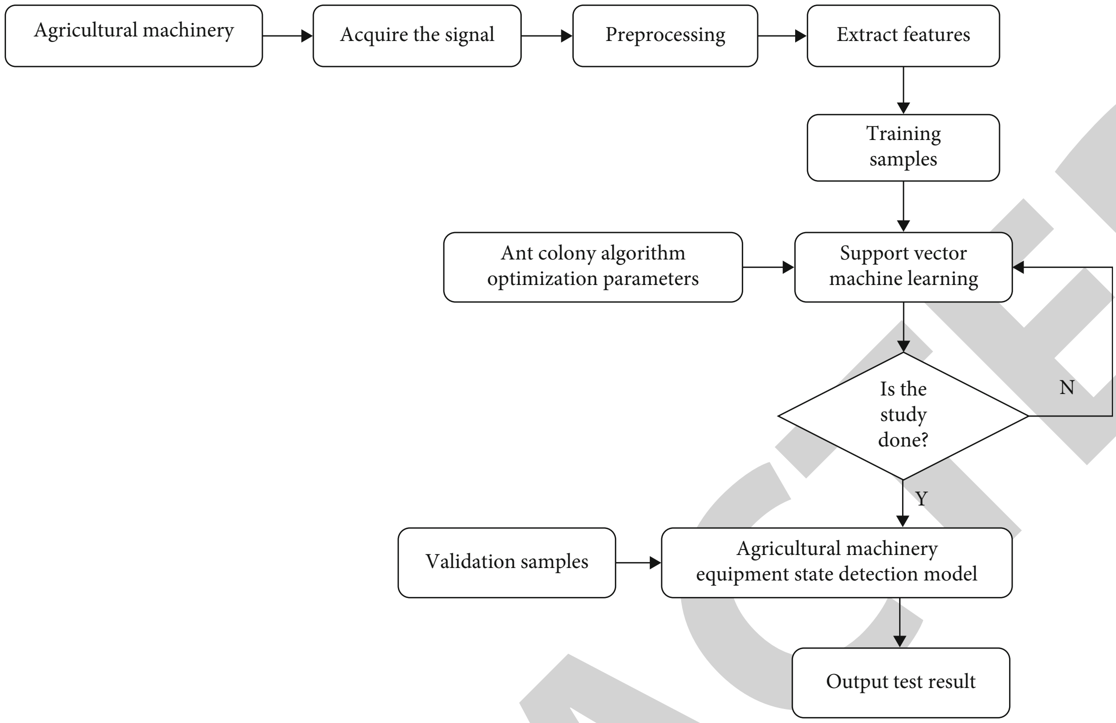

Figure 3: Intelligent detection process of agricultural machinery equipment status based on computer data mining.

Table 1: Number of status samples of various agricultural machineries and equipment.

Agricultural machinery equipment no.	Name of agricultural machinery	Normal sample	Abnormal sample
1	Peanut sheller	40	15
2	Small rotary cultivator	30	10
3	Rice harvester	100	40
4	Crop straw crusher	20	8
5	Soil tiller	50	20

Table 2: Value of C and Q determined by ant colony algorithm.

Agricultural machinery equipment no.	Name of agricultural machinery	C	σ
1	Peanut sheller	350.266	1.658
2	Small rotary cultivator	218.602	1.923
3	Rice harvester	272.863	1.817
4	Crop straw crusher	665.457	1.584
5	Soil tiller	630.898	1.393

3.2.3. Condition Detection Model of Agricultural Machinery Equipment. The working steps of the intelligent detection method of agricultural machinery equipment status based on computer data mining are as follows:

(1) Wireless sensor is used to collect vibration signals of agricultural machinery equipment, extract effective vibration signals of agricultural machinery equipment, and remove some invalid signals

(2) Wavelet packet is used to process and analyze the vibration signal of agricultural machinery equipment, calculate the energy value of different subfrequency signals, and then calculate the proportion of subfrequency signal energy in the total energy, and get the characteristic vector of agricultural machinery equipment detection

(3) The feature vector of agricultural machinery equipment detection is used as the input, and the status of agricultural machinery equipment is used as the output to establish the sample set of agricultural machinery equipment detection

(4) A certain number of samples are randomly selected from the sample set to form the training, and the unselected samples are used as the verification set. Generally, the number of training samples is much more than the verification samples

(5) Ant colony algorithm and support vector machine learn the training set of agricultural machinery equipment detection, determine the values of C and Q, and establish the agricultural machinery equipment detection model

(6) Using the validation samples to calculate the detection accuracy and false detection rate of the detection model of agricultural machinery equipment and

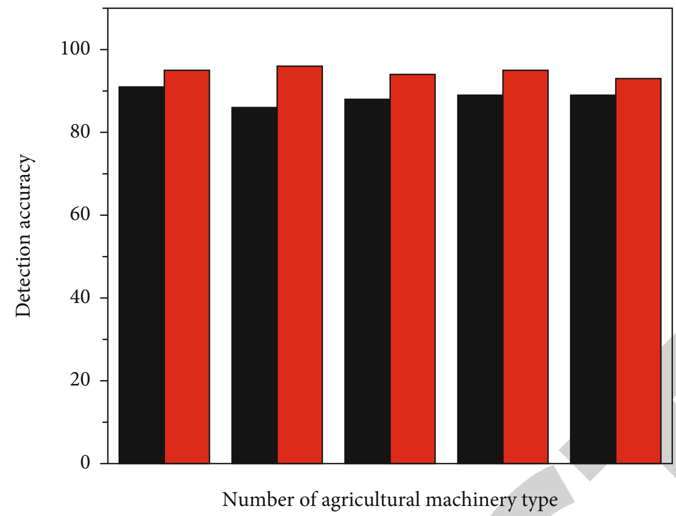

Figure 4: Accuracy of intelligent detection of agricultural machinery equipment status.

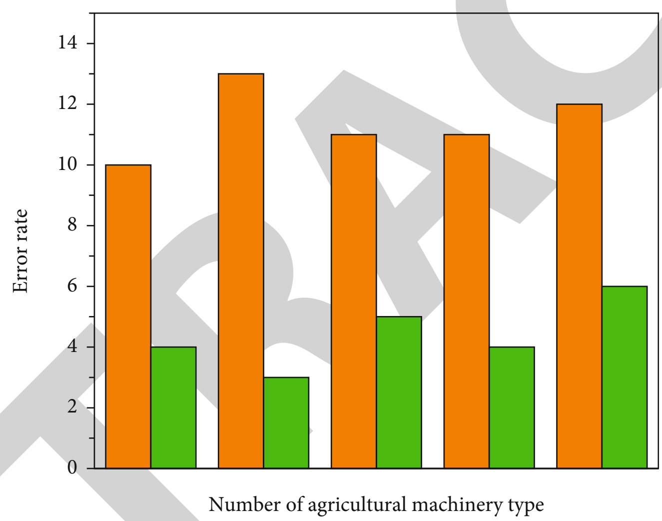

Figure 5: Error detection rate of agricultural machinery equipment status.

analyze the detection effect of agricultural machinery equipment

The intelligent detection process of agricultural machinery equipment status based on computer data mining is shown in Figure 3.

4. Result Analysis

4.1. Simulation Platform. In order to test the effectiveness of the intelligent detection method of agricultural machinery equipment status based on computer data mining, the selected simulation platforms are as follows: Intel Core i3-6100 CPU, Zhiqi Ripjaws4 DDR4 8G RAM, Intel 600P 256 GB SSD, Win 10 operating system. The intelligent detection model of agricultural machinery equipment status is realized by Java programming. The selected objects are peanut sheller, small rotary cultivator, rice harvester, crop straw crusher, and soil cultivator. The sample numbers of normal and abnormal status are shown in Table 1.

4.2. Result Analysis and Discussion. Select the intelligent detection method of agricultural machinery equipment status based on expert system for comparative test and use ant colony algorithm to determine the values of C and Q, as shown in Table 2.

The detection accuracy and false detection rate of the intelligent detection method of agricultural machinery equipment status based on expert system and computer data mining are shown in Figures 4 and 5. According to Figures 4 and 5,

(1) The state change of agricultural machinery equipment is random, and the knowledge base rules of expert system are limited, which cannot completely describe the state change law of agricultural machinery equipment. The detection accuracy is low, and the detection effect is not ideal

(2) The effect of the state detection method of agricultural machinery equipment based on computer data

Table 3: Detection time of agricultural machinery condition.

Agricultural machinery equipment no.	Name of agricultural machinery	Expert system	Paper method
1	Peanut sheller	5.851	2.192
2	Small rotary cultivator	5.192	2.726
3	Rice harvester	5.139	2.368
4	Crop straw crusher	5.765	2.525
5	Soil tiller	5.095	2.956

mining has been significantly improved, the detection accuracy is high, and the probability of detection errors is greatly reduced, which shows that the computer data mining technology can describe the randomness of the state changes of agricultural machinery equipment, and the detection results are more reliable

Finally, the state detection time of agricultural machinery equipment is counted, and the results are shown in Table 3. It can be seen from Table 3 that the state detection time of agricultural machinery equipment based on expert system is long, and the intelligent state detection time of agricultural machinery equipment based on computer data mining is short. This shows that the intelligent state detection of agricultural machinery equipment based on computer data mining is fast and meets the real-time condition of intelligent state detection of modern agricultural machinery equipment.

5. Conclusion

According to the variability of agricultural machinery equipment status, aiming at the defects of current agricultural machinery equipment status detection, a method of agricultural machinery equipment status detection based on computer data mining is designed, and the support vector machine and ant colony algorithm in computer data mining are introduced to model the agricultural machinery equipment status detection. The comparative experimental results show that this method is obviously superior to the traditional agricultural machinery equipment state detection methods in terms of the accuracy of agricultural machinery equipment state detection or the efficiency of agricultural machinery equipment state detection. This method can effectively describe the state change law of agricultural machinery equipment. It is a reliable and fast state detection method of agricultural machinery equipment.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Acknowledgments

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