Modeling and Analysis of Integrated Electric Energy Metering Information System Integrating Operational Behavior of Interactive Robots

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Improving the accuracy of power quality monitoring remains a challenging issue. Even if various calculation methods such as Fourier and Bayes are used, the expected prediction effect hasn't been achieved. Today, with the advancement of information processing technology and signals, based on the advantages of the previous basic calculation methods, the interactive robot model is proposed again. It is a derivation based on machine learning calculation method, which can achieve good budget value without sacrificing the essence of calculation speed and accuracy in the application environment of overload. The intelligent exercise research based on the operation specification of the interactive robot mentioned in this paper can continuously strengthen the power numerical change model by detecting the electric power value, and apply it to the electric energy calculation information integrated system platform, so as to achieve the predicted result as the most ideal state. The experimental results of the imitation experiment prove the executable direction of the interactive robot operation specification, and provide theoretical data for the future upgrade and improvement of the electric energy metering system.

Povzetek: Opisan je razvoj interaktivnega robota na osnovi strojnega učenja za boljšo točnost in hitrost merjenja kakovosti električne energije v preobremenitvenih pogojih.

1 Introduction

A stable and reliable supply of electric energy is a necessary condition for promoting economic development [1-2], because exists electric energy runs through every node of production, warehouse storage, and sales of large, medium and micro enterprises, it has an irreplaceable role in the normal life of ordinary people. Based on the substantial improvement of social life quality and the rapid development of science and technology, people have high expectations for the power supply environment, but electricity theft and machine failures occur from time to time, and long-term power outages will bring certain losses to people's property. At present, the power system is being integrated, integrating various power generation methods into small energy storage power sources such as photovoltaic power generation, water storage power generation, and wind power generation, and decentralized access to major power grid systems. There are various bad factors such as direct current and noise waves in the electric energy generated by different power generation methods, and the grid connection of centralized and decentralized energy sources will bring an impact on the power grid, and the power quality waveform may be affected. The current social economy is developing rapidly, and computer technology and Internet of Things technology are constantly being developed and improved. The transmission of information has become extremely effective and simple, and many methods can be updated through network resources and knowledge [3-4]. In detail, more software is developed and designed with the programs of various countries to achieve updates. Specifically, the development and application planning can be carried out through the newly-built software, and the specific implementation investment [5-6]. Electric energy metering devices have also achieved new changes and analysis due to the introduction of computers and intelligent development and design. It can not only realize the collection of power interruption data with reliability and accuracy, but also ensure the intelligent analysis of electric energy measurement information, and realize the further protection of the interests of power customers and the people [7-8]. The production and modification of visual components, such as graphics and images, for use in multimedia projects is referred to as multimedia image design. To communicate information or tell a narrative, multimedia integrates a variety of media, such as text, images, audio, video, and interactive features. Enhancing the visual appeal and efficacy of multimedia material is largely dependent on multimedia image design. Graphic design, image editing, animation, and other visual aspects are all combined in the interdisciplinary discipline of multimedia image design to produce engaging and useful multimedia content. To further realize the intelligent and comprehensive analysis of electric energy measurement information, experts and scholars within the industry have introduced many methods for exploratory research, such as the DEA approach, weight entropy method, AHP analytic hierarchy process, fuzzy comprehensive assessment strategy, etc. [9-10]. To effectively solve the troubles in the modeling process of the control metering information integrated system, combined with the data mining algorithm, combined with the bidirectional long-term and short-term network and random conditions, the modeling of the power metering information integrated system was completed. Power system parts defects are troubleshooter by using the interactive robot operation behavior to build an understanding graph ontology model of the equipment. Superior harmonic identification and mitigation are predicated on precise system frequency detection. It is, however, also the primary issue with using active filtering. The active filter's ability to effectively achieve harmonic adjustment is strongly influenced by the quality of recognition, so it is necessary to obtain the information of harmonics accurately and in real time. The identification and reduction of higher frequencies can be achieved if the fundamental component can be rapidly and precisely recorded from the deformed waveform. These methods are used to transform the electric energy metering device, realize the evaluation of the comprehensive benefit of the project, realize the effective exploration and analysis, and provide feasible and accurate methods and means. However, the determination of the weight value by these methods often focuses on subjective judgment, and it is easy to ignore the characteristics and exercises of the electric energy metering information [11-13]. At the same time, for electric energy metering information, it is complex and diversified data. These data are not independent and fragmented, but can reflect a certain overlapping relationship of data. Therefore, these data need to be effectively analyzed and processed, and the relevant information can be fed back to the corresponding power companies in a timely and effective manner.

S.No	Methods	Findings	Drawbacks
[31]	Triboelectric nanogenerators (TENGs) provide an acceptable foundation for the realization of low-power and self-sustaining devices like powered by themselves devices.	It is explored how artificial intelligence may be used to develop intelligent sensor systems for the 5G and IoT future.	Triboelectric layer material selection has a significant impact on TENG efficiency. It is difficult to find appropriate materials that have strong mechanical resilience, good triboelectric qualities, and stability over time.
[32]	The functional ease and efficacy of individuals are improved by this human-robot interaction (HRI) working style, and the educational experience of rookie welders is further enhanced by informed by data welder behavior assessment.	In addition to presenting our final a solution, nous additionally charts its evolutionary history and provide some broad remarks on the advancement of OMT-based methodologies.	HRI brings up moral concerns, particularly as robots are incorporated into everyday life more and more. Concerns about robotic technology misuse, data security, and privacy are among the issues.
[33]	Building information	These integration	Detailed BIM model

	modeling (BIM) and immediate information from Internet of Things (IoT) devices together create a potent paradigm for applications that increase development and operating efficiency.	methods are utilizing BIM tools' APIs and relational database, transform BIM data into a relational database using new data schema, create new query language, using semantic web technologies and hybrid approach.	creation and management can demand a lot of resources, including strong hardware and software. This can prove difficult for smaller businesses or initiatives with tighter budgets.
[34]	The study is to develop and evaluate a multi-dimensional Service Robot Integration Willingness (SRIW) Scale that identifies the critical factors influencing customers' long-term willingness to include service robots and artificial intelligence into routine customer interactions.	According to the results of construct accuracy and dependability testing, as well as invariance analysis conducted across four service-related sectors whereby service robots currently exist or are anticipated to be introduced, the SRIW scale exhibits rigorous psychometric qualities.	It can be costly to acquire and deploy service robots, particularly for smaller companies or sectors with tighter resources. There can be additional costs associated with routine upkeep and upgrades.

In the new power generation mode, more advanced power quality monitoring methods should be used to comprehensively analyze the entire process of power operation. As long as any abnormality is found in the circuit, the circuit can be used to transmit early warning information. Faced with these needs and imperfections, this paper analyzes the operation process of electric energy calculation according to the operation specification of interactive robots, and wants to construct a model that can fully analyze the quality of electric energy. By comparing and analyzing with previous research and testing experience, the optimal algorithm model can be tested, which can improve the timeliness and comprehensiveness of power calculation information analysis. For the electrical system to function optimally for an extended period of time is highly significant.

2 Statistical analysis of electric energy metering information

Most of the analysis and calculation methods of electric energy metering are based on various data collected on the system platform and applied to the electric energy metering management platform system to carry out balanced measurement and analysis. The collected data includes: measurement equipment status value, measurement equipment account information, current, power, voltage, voltage/current value, etc. The collected data feeds back the operation of the field equipment in a timely manner, and there is a correlation between the data and the data. The relationships between data are found, including rationalized models from input to output. Most of the models have modern learning and training skills [14-15]. To determine the accuracy of the next data, the previous equipment failures are summarized as the basis for empirical consideration and judgment. At present, the mainstream data processing algorithms include Fourier interactive method, wavelet calculation method, power error value and other methods, all of which have good prediction results.

In this paper, a modeling research platform for the integrated system of electric energy metering information is constructed, which mainly includes the data layer, the ontology layer and the application layer. The data layer is mainly based on power equipment. According to the historical records of the harmonic problems in the power system, the interactive robot operation behaviors quoted in this paper is applied to the harmonic data processing, and then provides the basis for the effective analysis of the harmonic problem in the power system. The ontology layer in the system is mainly based on the algorithm to build the relationship between the objects, and then build up the harmonic problem in the power system; the business layer is based on the ontology layer and shares the acquired data layer. The power system based on BP neural network learning is an algorithm model widely used in the field of harmonic problem analysis. The study of harmonic problems in power system can combine the advantages of bidirectional long-term storage network to extract text features and CRF to process sequence labeling tasks to complete the task of harmonic problem analysis.

A key component of computer vision is the ability to identify edges in multimedia images. A variety of techniques are used to enhance this procedure. While GPT-3.5 isn't specifically designed with image processing in mind, we will inform them about certain techniques that might improve edge identification in multimedia images, such as machine learning. To assure multi-objective data, the optimal power data conversion range can be created randomly, provided that it stays within the restrictions, and compared before and after the harmonic signal transmission and optimized combine. The randomly generated approach is applied to adjust the optimal target if it beyond the boundary range [16–17]. Single-point targeting of harmonic signals can be changed both before and after optimization thanks to harmonic signal modification. To ensure that the optimization target can transform the data, it is necessary to select any optimization target h_r as this conversion factor and leave it to the subsequent target. The arbitrary number R for the additional convert targets can be created randomly within the interval 0 to 1. Based on the random number and the likelihood of the harmonic signal, it is decided if multi-target dynamic signal handling is necessary.

$$u_{h,n,g+1} = \begin{cases} v_{h,n,g+1}, R \le P \ or \ h = h_r \\ x_{h,n,g}, R > p \end{cases} \qquad (1)$$

In expression (1), $u_{h,n,g+1}$ represent the h-th objective of the (g+1) th making obtain after the vocal indication action; $v_{h,n,g+1}$ represents the (g+1)-th making neuron purpose after multi-objective optimization, $x_{h,n,g}$ represent the h-th target of the g-th making neuron before implementation the vocal gesture, and p represent the prospect value of the harmonic signal.

By judging the harmonic power part entered in the electric energy metering information and comparing it with the quality requirements of electric energy, the difference of the fault level is determined. The Fourier transform calculation method can be used to calculate the power of the electrical energy. Because the Fourier change suppression speed is relatively slow, and it has to go through a relatively complex calculation process, it takes a long time, which leads to a prolonged time for grid fault inspection and repair. The monitoring analysis and calculation method can change the data angle through the diffusion theory of the metered data flow, so as to extract the abnormal conditions in the flow. For most of the nonlinear values in the metering values of distributed energy grid-connected, there is no way to identify the problematic values, so this method is not suitable for nonlinear problems; the wavelet algorithm can be used to extract the shape of the fundamental wave and the harmonic wave from the mixed measurement data. Therefore, to determine whether the harmonic amplitude is greater than the numerical range, the choice of the scaling factor is determined by the wavelet transform, so the measurement accuracy is low [18-19]. The current analysis algorithms are problematic, including limited measurement scenarios, a long measurement time limit, and low measurement accuracy through comprehensive analysis. to avoid these problems as much as possible, the operation behavior mode of the interactive-type robot researched by the shortest distance stroke is strengthened and improved at the level of neural network and machine calculation method, which is suitable for the evaluation of electric energy quality in the electric energy calculation system with high requirements.

3 Performance analysis of interactive robot operation behavior

For the operation behavior of interactive robots, its essence is machine learning, that is, multi-layer neural network, which uses different nonlinear functions to realize data distribution and function model fitting, aiming to solve the decision analysis of specific neural network continuity. The problem is achieved through the specific setting of goals in an uncertain environment. From a statistical point of view, the interactive robot knowledge recognition model can be considered as a prediction of the data generated in the future, using the existing sample data to build a model, and then analyze the data that may be generated in the future.

Named entity identification data is an important factor in information acquisition. It is necessary to find the corresponding entity orientation from the corresponding text value database, and to effectively distinguish the corresponding entity type. The identification of named entities is an important part of the composition. From the perspective of natural language processing, the three categories of text processing are traditional naming methods and seven sub-categories of named entities. The main naming methods mainly include two kinds, one is naming based on rules and the other is naming based on statistics [20-21]. By comparing the two naming rules, the rule-based naming method has a higher accurate recognition rate, but the setting of such rules is uncontrollable. Simple and plain rules cannot adapt to specific, complex and diverse entity naming and recognition tasks.

With the continuous development of interactive robots and the continuous improvement of computer technology, the use of machine learning for entity naming has become the main method. The essence of the so-called interactive robot is an important branch of machine learning, which uses the specific complex structure to abstract the original data and realize the extraction of the feature layer. From a theoretical point of view, interactive robots are methods of representational learning, which can achieve semi-supervised and unsupervised learning by setting corresponding input data sets and achieve effective automatic extraction of hierarchical features [22-23]. Typical technical methods including deep convolutional neural networks and deep belief networks have achieved great applications and success in natural language processing. It has been a long time since the research on the behavior of interactive robots began, and the method of unsupervised neural network training has also been adopted by many other methods, and this method can be used to excellently and steadily realize the reflection of valuable characteristics. The following calculation process mostly uses the reverse direction transmission algorithm to perform supervised distinction between the values. The interactive robot model can be divided into three layers: input, hidden, and output, in which the input features of the interactive robot model can be used as independent variables. After the nonlinear transformation of the hidden layer, the specific structure and process of the output label (dependent variable) are shown in Figure 1.

A neuron is a node in a neural network, and its structure is shown in the right figure of Figure 1. Suppose neuron input $x' = [x_1', x_2', \cdots, x_n']^T$, weight $w = [w_1, w_2, \cdots, w_n]^T$, output z, as shown in formula (2).

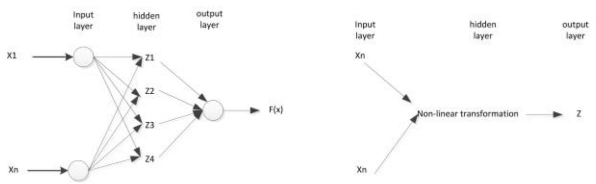

Figure 1: Neural network and neuron structure

$$z = \phi\left(w^T x'\right) \tag{2}$$

In the formula, the activation function is represented by $\phi(\cdot)$; it includes S-shaped functions, hyperbolic tangent functions, etc. The specific calculations are shown in formula (3)

$$\begin{aligned} Sigmoid(x) &= \frac{1}{1+e^{-x}} \\ Tanh(x) &= \frac{2}{1+e^{-2x}} - 1 \\ \mathrm{Re}\,LU(x) & \max(0, x) \end{aligned} \tag{3}$$

The construction of the complete graph of the model in this paper is carried out by using the interactive robot manipulation behavior. First, a specific feature layer is selected from the sample data and converted into the corresponding vector. In the second layer, the selection and retrieval of the specified characteristics are realized according to all the specimen windows, and the analysis of the comprehensive and partial methods is realized, and the inherent neural network method is integrated at the same time. The detailed model structure diagram is shown in Figure 2:

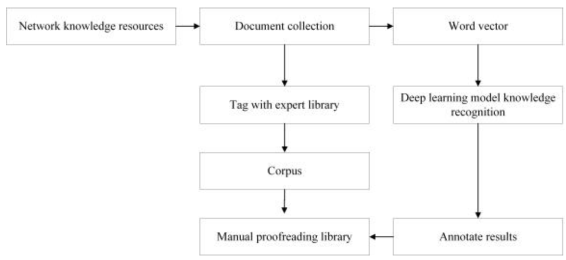

Figure 2: Overall framework of the model

Based on the single example (y_1, y_2) of the learning sample value collection T_{corpus}, the actual outgoing variance and sample values are used to measure the model's learning of the sample accuracy, and the cost function $J(W, b; x, y)$ is defined. The detailed form is shown in formula (4):

$$J(W, b; x, y) = \frac{1}{2}\left(H_{W,b}(x) - y\right)^2 \tag{4}$$

Among them, the constant of the cost function is represented by x and y.

The specific update steps of interactive robot model knowledge recognition are as follows:

1) According to the corresponding interactive robot model, obtain the corresponding output results and the activation value of each layer;

2) Calculate the corresponding output layer to obtain the corresponding partial derivative value, as shown in formula (5)

$$\delta_i^{(2)} = \frac{\partial}{\partial z_i^{(2)}} J(W,b;x,y) = \frac{\partial}{\partial z_i^{(2)}}\left(\frac{1}{2}\left(a_i^{(2)} - y_i\right)^2\right) = -\left(y_i - a_i^{(2)}\right) f'\left(z_i^{(2)}\right) \quad (5)$$

3) For the data nodes of the first layer, solve the corresponding partial derivatives, as shown in formula (6):

$$\delta_i^1 = \left(\sum_{j=1}^{m} W_{ji}^{(2)} \delta_i^2 g'\left(z_i^{(1)}\right)\right) \quad (6)$$

4) According to the given update rate η, modify the parameters of layer l, as shown in formula (7) and formula (8):

$$W_{ij}^{(l)} = W_{ij}^{(l)} - \eta a_j^{(l)} \delta_i^{(l+1)} \quad (7)$$

$$b_i^{(l)} = b_i^{(l)} - \eta \delta_i^{(l+1)} \quad (8)$$

When training the classifier, practice the classifier based on the error difference between the output vector of the model and the token vector of the training template. Through certain development, the specific network structure recognized mainly includes:

(1) Convolutional neural network: It is composed of a fully connected layer and many convolutional layers, and also includes a pooling layer and a corresponding gravity layer. After using the fixed propagation method in the opposite direction to carry out efficient exercises, compared with other algorithms, it requires fewer parameters.

(2) Recurrent Neural Network: For tasks with sequence input, the detailed input arrangement elements can be processed at one time, ensuring that the implicit units of the network include the previous arrangement elements. The cyclic neural network computing architecture is shown in Figure 3.

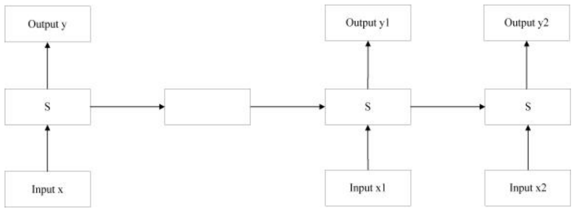

Figure 3: Recurrent neural network calculation architecture

(3) Deep belief network: It is a probability generation template including multi-layer hidden units, as shown in Figure 4.

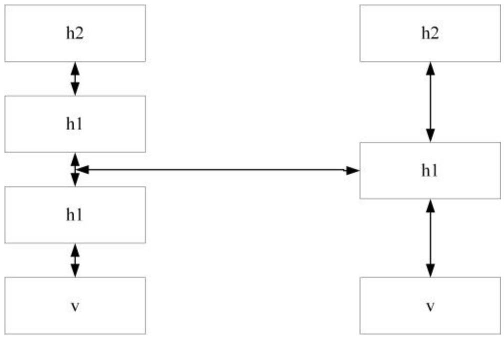

Figure 4: Graphical model of deep belief network

Each of these advantages can be manifested in the face of different real situations. There are three standard interactive robot model format characteristics. Convolutional neural network has less test parameters, the accuracy is not too high, and the calculation of output numerical correlation is missing; deep belief network usually studies incomprehensible language parsing, according to the calculation of the deep response model, it is concluded that the practice speed is relatively slow. Comprehensive analysis shows that the measurement data has strong correlation, and the data failure template also contains the sameness, so the recurrent neural network is more in line with the conditions of the measurement system platform.

4. Mining and judgment of measurement information feature based on multiple learning algorithms

In this paper, two classical calculation methods are selected for simulation verification. There are many types of practical behaviors of interactive robots using the cyclic neural network structure, and the best calculation method is selected from the final results of the test. Among them, the ideal performance is the interactive robot action mode and the DQN (Deep Q-leaming) calculation method. The performance of the two more classic interactive robots has high and low performance; however, they are all transmitted through the continuous weight training network to predict the probability of the output results of the next stage. The structure and process of the two calculation methods are briefly described below, and the advantages and disadvantages of the two methods are analyzed.

4.1 Interactive robot behavior method

See Figure 5 for the interactive robot behavior. The numerical result of the electric energy metering efficiency is to predict the power value that may appear in the same time period in the future through the behavior of the interactive robot, and transmit it to the output terminal to monitor the accuracy of the next stage of practice. According to the adaptive selection of a reasonable probability dispersion function, the stability of the calculation method is improved, and the weight value can be adjusted adaptively. In the end, the suppression effect is achieved efficiently. When the number of stacking increases, the corresponding final result will be more accurate.

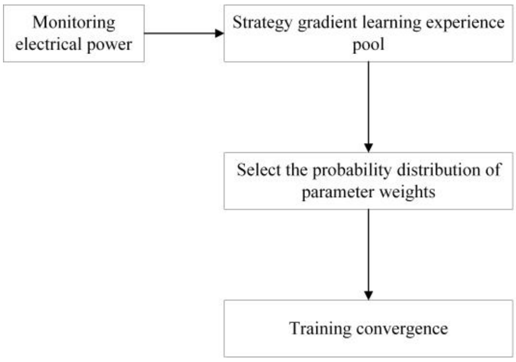

Figure 5: Model structure of interactive robot behavior method

At a certain moment t_i, the calculated power number is p_i, and the experience value analysis model from the computing management platform is stored in the learning experience pool from the strategy perspective, which becomes the learning experience pool from the strategy perspective. According to the application definition, the learning proportion of the interactive robot's action mode is initialized as w_0, and the calculated probability distribution is shown in formula (9):

$$\int \log f\left(a_n \left|\Delta t_{n-1}; w_n\right.\right) \tag{9}$$

Calculate the expected value of its decentralized function, and see the specific expectation formula as shown in formula (10):

$$\Delta w E_n\left[f\left(t_n\right)\right] = E_n\left[\nabla_n \log f\left(a_n \left|\Delta t_{n-1}\right.\right)\right] \tag{10}$$

According to the discriminant results obtained from the training, the weight value and the corresponding rules of the experience pool are supervised recursively, and then the suppression performance of the algorithm is strengthened, and finally leaning, the maximum supervised learning is used as the target output value [24-25], as shown in formula (11):

$$\Delta t_n = \max_n \nabla_w E_n\left[f\left(t_n\right)\right] \tag{11}$$

On the basis of the calculation results of formula (11), the corresponding interactive robot behavior is used to update the parameters at the second time, and the performance is suppressed at the second tensioning algorithm. The recursive learning calculation method can fully complete the echo relationship between the normal range value of power and the equipment failure type, judge the accurate accuracy, and continuously complete the fault type of the experience pool. Compared with conventional computing methods, it has a more complete self-learning process.

4.2 DQN algorithm

This system outputs a value function for the DNS algorithm to determine the decision of the system, and the value function is represented by a nonlinear Q-function[26]. The current measurement and inspection result value function is Q (s, a), where s' represents the test result of the electric power at the next time point, and a' marks the best action in the next time point, and the best function value is selected in many experiments, as shown in formula (12):

$$Q(s,a) = E_{s'\to\varepsilon}\left[r + \gamma \max Q^*\left(s',a'\right)\middle| s,a\right] \tag{12}$$

Approximate the result of the judgment at the next time point to the actual state. It is necessary for r to reach the optimal weight state for the result a. Theoretically, the interactive robot behavior is updated to the weighted value w every time, and the DQN calculation method is the updated Q function. The calculation of the Q function formula requires more time in the update process. For the grid metering system, which has high requirements for time efficiency and strong correlation of input values, the interactive robot behavior mode is more suitable. While using the Q function can accurately practice the final result of the prediction, the DQN calculation method is more suitable for the application system that is not related to the input value [27-28]. Therefore, in theory, it is more inclined to choose the interactive robot behavior. The following is a demonstration of the performance advantages of these two algorithms based on experimental tests.

4.3 Simulation experiment

The corresponding mathematical software simulation platform system is used, taking a state grid platform site as an example, read the interactive robot behavior into the platform, start learning training, and monitor for 12 hours. Record the discrimination rate of the monitoring results of the calculation method and the test time in turn, and FIG. 6 is a graph of the test results.

The system is powered by an Intel Xeon E3-1230v5 CPU, 16GB of DDR4 RAM, and an NVIDIA Quadro K420 discrete GPU. It also has a 1TB SSD, guaranteeing quick and effective storage.

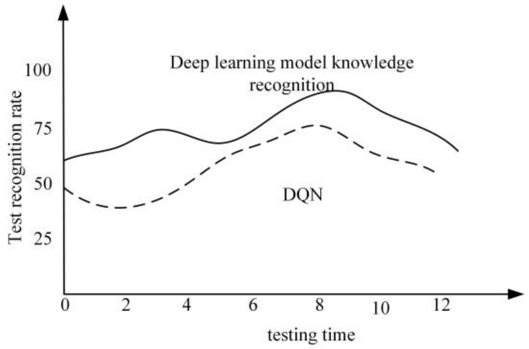

Figure 6: Test results

Table 1: The DQN and DL knowledge recognition

Test Timing	Methods	
	DQN	DL Knowledge Recognition
0	49	60
2	40	65
4	45	72
6	62	60
8	70	85
10	59	74
12	52	62

By analyzing Figure 6, it can be seen that the discrimination rate is about 50% or more, the highest is 90%, and the average discrimination rate is 75%; while the behavior of the interactive robot is significantly higher than the accuracy of the DQN calculation method, and the average discrimination rate is 64 %. There are 20 abnormal data in the interactive robot behavior. According to the results, it can be found that DQN is more suitable for application scenarios where the input parameters are not correlated. The Q (test results are compared with the calculation method of deep knowledge recognition, and the latter is more accurate. To more accurately compare the characteristics of these two calculation methods, we will make a comparison again from the direction of test efficiency. The test starts from 1000 pieces of metered data. The test time of the interactive robot behavior mode is only 9ms, and the test time of the DQN calculation method is 14ms. DQN detects abnormal data slower than interactive robot behavior.

From Figure 7, it can still be seen that DQN detects abnormal data slower than the interactive-type robot action mode. Based on the above evaluations, the interactive robot behavior method is used as a tool to measure the abnormality of the user's electric energy meter and the quality object, and the outlier degree of the electric energy calculation data can be defined at the next time, so as to complete the abnormal monitoring of the user's electric energy calculation, and this method is used to carry out abnormal monitoring of user power calculation, and its reliability is very good [29-30].

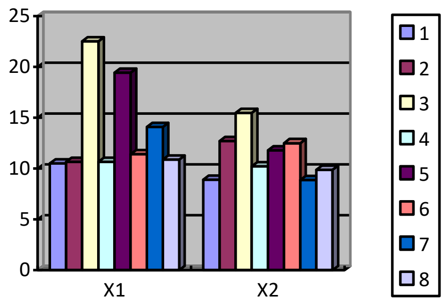

Figure 7:+ Original data (obtained through field research)

SPSS15. 0 is used to analyze the initial data, we must first carry out descriptive statistics on various variables, and the descriptive statistics are shown in Figure 8. Among them, X1 is the salvage power loss, X2 is the salvage power loss percentage rate, and X3 is the investment income amount. The principal component analysis results are shown in Figure 9.

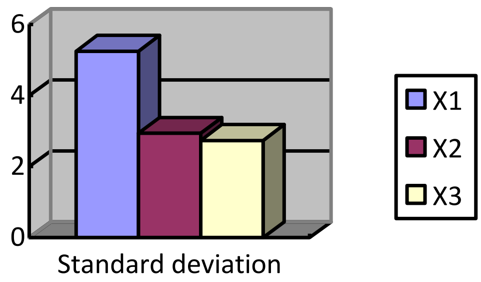

Figure 8: Descriptive statistics of each variable

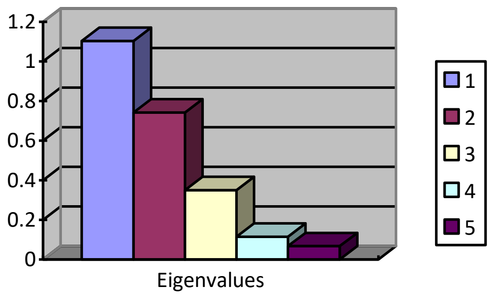

Figure 9: Principal component analysis table

The analysis results presented in Figure 9 can also be used as a horizontal axis for each component, and a gravel diagram is constructed with the characteristic value of each component on the vertical axis to visually present the importance of each component, as shown in Figure 10.

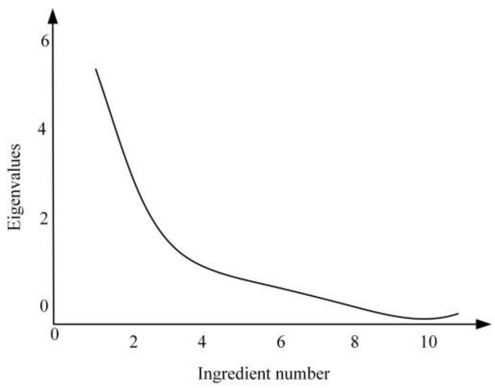

Fig. 10: Gravel diagram of characteristic values of each component

Table 2: The ingredient number and eigen value

Ingredient Number	**Eigen Value**
2	5.5
4	3
6	1
8	0.1
10	0

Finally, the principal component method is used to extract the main components, the maximum variance method is used to rotate, and after 3 iterations of suppression, according to the order of coefficients from large to small, the main component load matrix after torsion is calculated, and the load values after torsion are differentiated obviously. According to the main component score coefficient and the standardized value of the initial variable, the score of each main component of each monitoring value is calculated, and the expression formula of the main component is written based on this. According to the use of relevant statistical software, 15 electric energy metering device reconstruction projects were analyzed for statistical analysis. Therefore, it can be analyzed according to the principal components. On the one hand, the information fed back by these 11 indicators is summarized through a relatively small number of independent principal components, and on the other hand, these highly correlated variables are grouped into one category.

To realize the quantitative evaluation index of the electric energy metering configuration reconstruction project, it is necessary to use the comprehensive evaluation function F to evaluate the electric energy metering configuration reconstruction project. The larger the F, the more successful the reconstruction project of the electric energy metering device is. Using the F value of each electric energy metering device reconstruction project to compare with each other can be regarded as an important part of the comprehensive evaluation of the investment benefit of the electric energy metering device reconstruction project. Therefore, it is possible to arrange the reconstruction projects of each electric energy metering device, and rationally distinguish the pros and cons of different projects (see Table 3).

Table 3: The pros and cons of the time

Sorting	Item name	F value	Sorting	Item name	F value
1	Item 3	995.82	9	Item 8	333.98
2	Item 7	968.39	10	Item 14	284.12

3	Item 5	875.70	11	Item 4	282.86
4	Item 9	848.50	12	Item 12	230.45
5	Item 6	620.62	13	Item 13	192.34
6	Item 11	507.73	14	Item 15	183.07
7	Item 2	373.14	15	Item 10	68.08
8	Item 1	357.64			

According to the above calculation, it can be concluded that the F-value score of projects 3 is the largest, reaching 995.82 that is, among the 15 electric energy metering device reconstruction projects, and the most successful project is project 3, while the lowest F-value score is project 10, which is only 68.08. That is to say, among the 15 projects, the reconstruction effect of project 10 is the least ideal. According to a comparison of item 3 and item 10, it can be concluded that the difference between the two is mainly on the first principal component, because the first principal component accounts for the largest proportion in the F function, therefore, after the reconstruction of project 10, the effect of the first principal component is the worst, resulting in a large gap between project 10 and project 3. Therefore, project 10 should focus on improving economic benefits in the subsequent reconstruction.

5 Discussion

Pairwise comparisons and subjective assessments are essential components of the Analytic Hierarchy Process (AHP), which offers a methodical framework for making decisions. But the subjectivity itself creates vulnerability since the accuracy of the results can be greatly impacted by the personal prejudices and attitudes of the decision-makers. This vulnerability results from the possibility that little modifications to the criteria or data rankings might result in significant modifications to the ultimate priority, as demonstrated by earlier research [35]. Moreover, the efficacy of economic initiatives is closely linked to the proficiency of the Department of Economic Affairs (DEA). The expertise and credentials of the department's employees are critical to the creation and execution of effective economic policies. Effective economic tactics can be hampered if the DEA is confronted with issues like understaffing or a lack of skilled specialists and economists. Innovative approaches are needed to solve this problem, and our suggested interactive robot model looks like a viable answer. Through the integration of cutting-edge automated technologies, this approach has the potential to increase the efficacy of economic policymaking by providing the DEA with effective and strategic help in overcoming manpower shortages.

6 Conclusion

To accurately manage the quality of the huge and complex electric energy metering data, the normal empirical value analysis method can no longer meet the complex electric energy environment under the electric system transformation. This paper proposes to use the interactive robot operation mode to analyze the various types of bayonet data involved in the metering system, and find out the abnormal situation of the metering system according to the self-learning process of the typical electric power value. After statistical analysis and classification, there are many types of interactive robots, and the action mode of the interactive robot and the DNQ algorithm are selected as the main points of the research, and then from the theoretical calculation method to the experimental demonstration, and finally it is proved that the action mode of the interactive robot is more suitable for the power measurement and monitoring system platform, can quickly and accurately monitor the abnormal situation of the user's power measurement, and has good practicability. The action mode of the interactive robot in this paper can be used as the theoretical basis for the consideration of the future measurement and monitoring system platform. This issue could be solved with our suggested interactive robot model.

7 Limitations and future study

Storage and bandwidth restrictions frequently affect the quality and resolution of multimedia images. Extra resources could be needed for transmission and storage of high-quality images. There can be differences in the display capacity of various systems and handsets. It might be difficult to design multimedia images that work well with a variety of devices and resolutions. Getting permission to use specific photos or multimedia components might provide legal difficulties. Respecting copyright laws is essential for multimedia designers. As technology develops further, multimedia image design modeling has enormous possibilities in the future. Multimedia image design requires advanced tools and approaches due to the increased need for visually attractive material in many industries including virtual reality, entertainment, and marketing. This involves the creation of 3D models that are more interactive and realistic, sophisticated image processing techniques, and avant-garde design strategies that stretch the bounds of imagination.

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 no conflicts of interest.

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