Data Mining and Analysis of New Energy Vehicles Based on Cluster Analysis Technology

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Abstract: Under the trend of social energy gradually moving towards clean energy, the scale of new energy vehicles has gradually increased. The use and production of new energy vehicles generates a large amount of data, such as the status of batteries and motors. Therefore, the role of data mining in the data collection and in-depth analysis of new energy vehicles is very important. However, there is a problem of inaccurate data collection, and the improvement of the battery and power output are unreasonable. Therefore, this paper proposes a cluster analysis technique to perform extensive data mining analysis. Firstly, the data preprocessing and cluster analysis in data mining are used to collect and sort out the data with poor data integrity, and the unified data with strong integrity is obtained for comprehensive analysis. Under the condition that the data evaluation criteria are fixed, the data mining accuracy and response speed of cluster analysis technology to new energy vehicle data Optimal traditional analytical techniques.

1 INTRODUCTION

The development of new energy vehicles is one of the important manifestations of social progress and is of great significance to the automotive field (Chen, You, et al. 2023). However, in the process of data mining, there is a problem of poor accuracy in data mining and analysis (Chen, Liu, et al. 2023), which brings poor experience to customers who use cars (Fu, Lan, et al. 2023). Some scholars believe that the application of cluster analysis technology to new energy vehicle data can effectively analyze new energy vehicle data information and provide corresponding support for data mining and analysis (Guo, You, et al. 2023). On this basis, this paper proposes a cluster analysis technique to optimize the data mining analysis and verify the effectiveness of the technique (Guo, Sun, et al. 2023).

With the continuous enhancement of environmental awareness, new energy vehicles have become an important direction for the development of future automobiles (Hong, Liang, et al. 2023). In the research and development process of new energy vehicles, the application of cluster analysis technology can provide important support and help for the production and sales of new energy vehicles. This paper will explain the application of cluster analysis technology in the field of new energy vehicles, the mining of relevant data and the analysis of advantages (Li, Zhou, et al. 2023).

1.1 Application of Cluster Analysis Technology in the Field of New Energy Vehicles

1.1.1 User Segmentation

Through cluster analysis technology, consumers of new energy vehicles can be grouped, and then the needs and psychology of different user groups can be deeply understood, and the market competitiveness and brand image of new energy vehicles can be improved (Li, and Zhang, 2023). For example, cluster analysis technology can be used to understand which users pay more attention to the range of the vehicle and which users value the safety performance of the vehicle, so as to launch different products and services for different user groups.

1.1.2 Failure Analysis and Resolution

Through cluster analysis technology, the fault data of new energy vehicles can be classified and analyzed, the commonality and law of faults can be found, and corresponding solutions can be proposed (Li, Ma, et

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al. 2023). For example, through cluster analysis technology, different engine faults can be classified into different categories, and corresponding solutions can be proposed according to the characteristics of each category to improve the reliability and safety performance of vehicles.

1.1.3 Product Design and Optimization

Through cluster analysis technology, the design and performance of new energy vehicles can be analyzed and evaluated, the characteristics and commonalities of different models and components can be found, and the product design and optimization of new energy vehicles can be provided (Li, Liu, et al. 2023). For example, the data of different models can be classified into different categories through cluster analysis technology, so as to provide a scientific basis for the product design and optimization of new energy vehicles.

1.2 Mining of Relevant Data

The research and production of new energy vehicles involves a large amount of data, and cluster analysis technology can mine and analyze the relevant data of new energy vehicles (Li, Peng, et al. 2023. Specifically, it includes the following two aspects:

1.2.1 Mining of User Behavior Data

The user behavior data of new energy vehicles is of great significance for the research and development of new energy vehicles (Li, Zhang, et al. 2023). Through cluster analysis technology, the behavior data of new energy vehicle users can be mined and analyzed, including car purchase time, vehicle usage, charging habits, etc., so as to better understand the use of new energy vehicles and user needs (Liu, Wang, Kim, 2023).

1.2.2 Mining of Vehicle Performance Data

The performance data of new energy vehicles is also of great significance for the research and development of new energy vehicles. Through cluster analysis technology, the performance data of new energy vehicles can be mined and analyzed, including energy consumption, power output, braking effect, etc., so as to better understand the performance and optimization direction of new energy vehicles (Hou, Liu, et al. 2023)

1.3 Advantage analysis

The application of cluster analysis technology in the field of new energy vehicles has the following advantages:

1.3.1 Improve Product Competitiveness

Through cluster analysis technology, we can deeply understand the needs and psychology of different user groups, and improve the market competitiveness and brand image of new energy vehicles (Pang, Ye, et al. 2023).

1.3.2 Optimize Vehicle Maintenance

Through cluster analysis technology, the fault data of new energy vehicles can be classified and analyzed, and corresponding solutions can be proposed to improve the reliability and safety performance of vehicles (Shao, Jiang, et al. 2023).

1.3.3 Improve Product Design Efficiency

Through cluster analysis technology, the design and performance of new energy vehicles can be analyzed and evaluated, so as to provide a scientific basis for the product design and optimization of new energy vehicles and improve product design efficiency (Song, and Jiang, 2023).

1.3.4 Optimize Vehicle Performance

Through cluster analysis technology, the performance data of new energy vehicles can be mined and analyzed, so as to better understand the performance and optimization direction of new energy vehicles, and improve the performance and efficiency of vehicles.

This paper elaborates from three aspects: the application of cluster analysis technology in the field of new energy vehicles, the mining of related data and the analysis of advantages, aiming to reveal the importance and application prospect of cluster analysis technology in the field of new energy vehicles (Sun, Zhang, et al. 2023). The application of cluster analysis technology can optimize the product design and performance of new energy vehicles, improve the operational efficiency and market competitiveness of new energy vehicles, and have greater social value and economic benefits (Tan, Wang, et al. 2023).

1.4 Research Status of New Energy Vehicles

1.4.1 Electric Vehicles

Electric vehicle is a kind of new energy vehicle, which has the characteristics of zero emission, no noise, low carbon and environmental protection compared with traditional internal combustion engine vehicles. At present, domestic and foreign automakers are researching and developing electric vehicles, and cities around the world have set stricter emission standards to promote the development of electric vehicles. At the same time, the cruising range, charging time, battery life, etc. of electric vehicles are still problems that electric vehicle researchers need to solve.

1.4.2 Hybrid Vehicles

Hybrid vehicles are vehicles with both internal combustion engine and electric motor powertrain, and the energy consumption and emissions of the vehicle are reduced by working together with each other. At present, domestic and foreign automakers are researching and developing hybrid vehicles, and different hybrid systems are constantly emerging.

1.4.3 Fuel Cell Vehicles

A fuel cell vehicle is a vehicle that uses hydrogen and oxygen as fuel and generates electricity through the fuel cell to drive the car. Compared to electric and hybrid vehicles, fuel cell vehicles have longer range, shorter charging times and zero emissions. At present, domestic and foreign automobile manufacturers are also researching and producing fuel cell vehicles, and the research and development of fuel cell technology is also accelerating.

1.4.4 Smart Cars

Intelligent vehicles refer to vehicles that achieve more intelligence and automation through digital, networked and intelligent means, including automatic driving, intelligent traffic management, and vehicle-mounted intelligent terminals. With the continuous development of artificial intelligence and Internet of Things technology, the research and development in the field of intelligent vehicles has also received more and more attention.

1.4.5 Internet of Vehicles

Internet of Vehicles refers to the combination of cars and the Internet to form a new Internet application ecosystem, through the information interaction between vehicles and between vehicles and the Internet, to achieve more intelligent, efficient and safe car driving. At present, the research and application of Internet of Vehicles technology is also accelerating.

The research status of new energy vehicles involves electric vehicles, hybrid vehicles, fuel cell vehicles, intelligent vehicles and Internet of Vehicles. Automakers and scientific research institutions in various countries and regions around the world are accelerating the research and development of new energy vehicles. In the future, the research and application of new energy vehicles will face more challenges and opportunities.

2 RELATED CONCEPTS

2.1 Mathematical Description of Clustering Techniques

Cluster analysis technology is based on massive database information, and according to the data information analyzed by data mining, the internal laws of information are classified, and the data with great similarity is analyzed to sort out and form a data set. Then, the data mining analysis is used to find the most optimal data node parameter values in the data, and finally judge the feasibility of the development of new energy vehicles, to optimize the data mining and analysis of new energy vehicles (Wang, Nie, et al. 2023).

Suppose I. The data set is represented as a matrix of is k, and the data mining analysis is set_i, the vector represents data is n, and the vector property is X, As shown in Equation (1).

$$x_{nk} = \begin{pmatrix} a_{11} & a_{12} \cdots & a_{1k} \\ a_{21} & a_{22} \cdots & a_{2k} \\ \cdots & \cdots & \cdots \\ a_{n1} & a_{n2} \cdots & a_{nk} \end{pmatrix} \quad (1)$$

2.2 Selection of New Energy Vehicle Development Plan

Hypothesis II The first attribute value of the first i scheme is g, and the weight coefficient is j, then,

after the scheme is standardized, the data value is w_i , as shown in Equation is g_{ij} , (2):

$$g_{ij} = \frac{g_{ij} - g_j}{s_j} \cdot \sqrt{b - a_i c} \quad (1)$$

2.3 Data Mining Analysis

Before performing clustering techniques, perform two-dimensional analysis of data mining analysis and map the data for data mining analysis to the data database A large amount of historical data and indirectly generated data are collected to generate datasets (Wang, Chen, et al. 2023). Then, the data with high similarity and different similarity are divided into hierarchies, stored, and managed, and the sorted data is easier to be used by data mining and analysis. Finally, the use of data mining analysis to clean up the wrong data, the accurate data to integrate, transform to improve the accuracy of cluster analysis technology, improve the level of data mining, to select the data of data mining analysis, the specific selection method is shown in Figure 1.

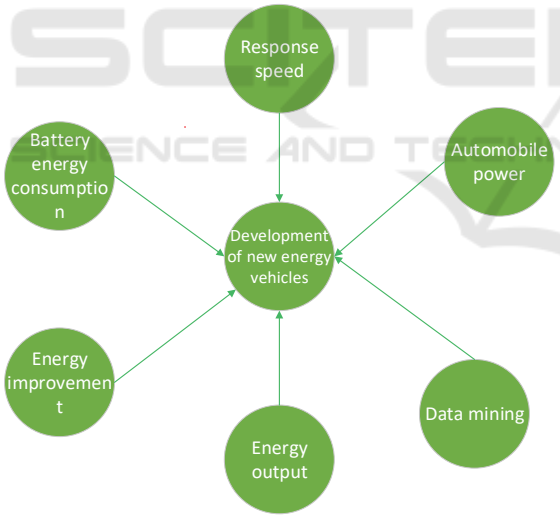

Figure 1: Results of the selection of new energy vehicle development plans

After data mining and analysis, it is shown that the development data of new energy vehicles has the characteristics of large amount of information, high dimension, and complex structure, which is easy to cause the loss and abnormality of data information (Wang, Yi, et al. 2023). The data of new energy vehicles also includes battery energy consumption data, motor power data, and motor response speed data. According to the cluster analysis technology, the feature constraint adjustment of the new energy vehicle development data is carried out, the duplicate and irrelevant data is removed, and the default data is supplemented, so that the integrity of the new energy vehicle development scheme is strong (Yu, Han, et al. 2023).

3 OPTIMIZATION STRATEGY FOR NEW ENERGY VEHICLES

The optimization strategy of cluster analysis technology for new energy vehicles, including battery energy consumption, motor power, and motor response speed. The power of new energy vehicles comes from batteries and motors, so accurate fault warning can effectively reduce the economic losses and accidents caused by failures. Cluster analysis technology divides the data of new energy vehicles into different levels and randomly selects different data for analysis. In the iterative process, data of different levels of data mining analysis is optimized and analyzed. After the optimization analysis is completed, the best parameter values of different data are compared to record the best new energy vehicle data.

4 PRACTICAL EXAMPLES OF NEW ENERGY VEHICLE OPTIMIZATION

4.1 Introduction to Data Mining

To facilitate data mining and analysis, this paper takes new energy vehicles as the research object in actual situations, with 9 paths and a test time of 24h The data mining analysis of specific new energy vehicles is shown in Table 1.

Table 1: New energy vehicle data mining analysis

Scope of application	Battery energy consumption	Car power	Speed of response
Pure electric	86.57	85.64	83.20
Oil mixed	87.86	83.37	82.90
Domestic brands	85.74	82.79	83.51
Foreign brands	87.12	87.18	87.29
joint venture	88.01	87.13	92.20
import	87.49	81.35	82.43

The data mining analysis in Table 1 is shown in Figure 2.

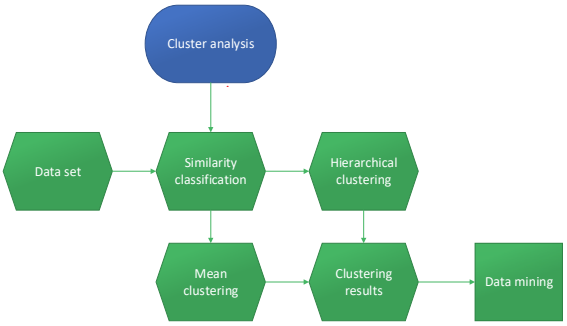

Figure 2: Analysis process of data mining of new energy vehicles

Compared with traditional technical analysis, the data mining analysis of cluster analysis technology is closer to the actual user needs. In terms of the rationality and fluctuation range of the development of new energy vehicles, cluster analysis technology is better than traditional technical analysis. Through the changes of data mining analysis in Figure 2, the stability of cluster analysis technology is better, and the response speed is faster. Therefore, the new energy vehicle development scheme analyzed by data mining and analysis of cluster analysis technology has better stability.

4.2 Development of New Energy Vehicles

The data mining analysis of the development of new energy vehicles includes battery improvement, energy efficiency output, and data mining depth. After the preselection of cluster analysis technology and the preprocessing of data mining analysis, the preliminary new energy vehicle development plan and the new energy vehicle development plan are obtained the feasibility is analyzed. To verify the improvement effect of new energy vehicle development more accurately, the new energy vehicle development scheme with different data mining and analysis levels is selected, as shown in Table 2.

Table 2: Improvement of the new energy vehicle development plan

category	Structural adjustment	Distribution adjustment
Battery improvements	84.58	81.48
Battery output reasonableness	84.82	80.25
Data mining depth	86.75	84.98
mean	86.54	89.58

4.3 Development and Stability of New Energy Vehicles for Data Mining

To verify the accuracy of clustering techniques, compared with traditional technical analysis and data mining analysis, the data mining analysis is shown in Figure 3.

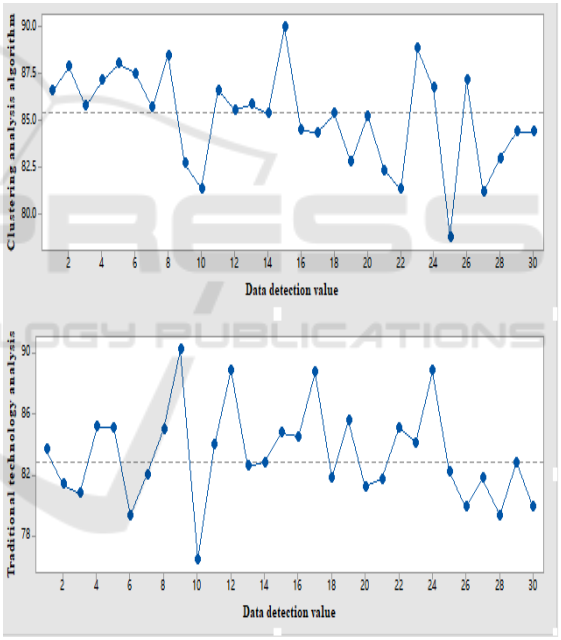

Figure 3: Development of new energy vehicles with different methods

It can be seen from Figure 3 that the development of new energy vehicles by cluster analysis technology is better than that of traditional technical analysis, and the improvement effect is obvious, indicating that the data mining of cluster analysis technology is obvious the analysis is relatively stable, while the data mining analysis of traditional analysis techniques has a single nature. The average data mining analysis for the above two methods is shown in Table 3.

Table 3: Comparison of data mining accuracy of different methods

Algorithm	Development of new energy vehicles	Magnitude of change	Error
Clusteranalysis techniques	92.64	93.82	1.20
Traditional technical analysis	79.36	83.80	4.52
P	55.21	53.28	54.62

By Table 3 It can be seen that in the development of new energy vehicles, traditional technical analysis has inaccurate data information and stability deficiencies in new energy vehicle data, and the data and information of new energy vehicle development have changed significantly, the error rate is high. The general results of cluster analysis technology have higher data information on the development of new energy vehicles, which is better than traditional technical analysis. At the same time, the new energy vehicle development data information of cluster analysis technology is greater than 2%, and the accuracy has not changed significantly. In order to further verify the superiority of clustering techniques and the effectiveness of the methods, different methods are used to perform general analysis of clustering techniques, as shown in Figure 4.

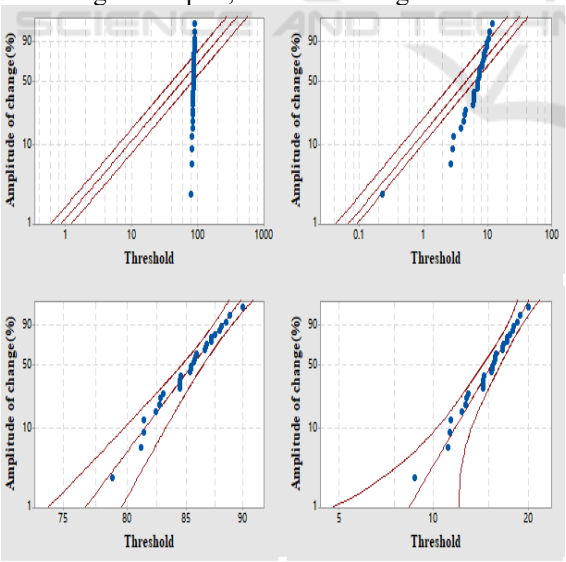

Figure 4: Cluster analysis technology: the development of new energy vehicles for data mining and analysis

By Figure 4, the development of new energy vehicles by cluster analysis technology is significantly better than traditional technical analysis, and the reason is that cluster analysis technology combines deep mining analysis It makes up for the singleness of deep mining analysis, optimizes deep mining analysis from multiple dimensions, and makes the development plan of new energy vehicles better.

5 CONCLUSIONS

With the progress and development of society, the development speed of new energy vehicles has increased in recent years, aiming at the problem that the battery energy consumption information, vehicle power information, and response speed information of new energy vehicles are not ideal, which is easy to cause errors in vehicle energy output data, response speed data, and mileage data. Based on this, this paper proposes a cluster analysis technology and combines data mining to optimize the development of new energy vehicles. At the same time, the depth, breadth and threshold innovation of data mining are analyzed in depth, breadth, and threshold, and standard and strict data sets are constructed. Studies show that cluster analysis technology can improve the accuracy and stability of new energy vehicle data information, which can improve the data information of new energy vehicles Evolutionary data mining analytics. However, with the development of new energy vehicle technology and the continuous improvement of user demand, further research should be done on the development of new energy vehicles.

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