Population, Resources & Environmental Economics (2024)
Clausius Scientific Press, Canada

DOI: 10.23977/pree.2024.050217
ISSN 2616-2253 Vol. 5 Num. 2

Research on the influencing factors of the development of new energy vehicles on the ecological environment

Sun Miao

Business School, Xi'an International Studies University, Xi'an, China

Keywords: Big data analysis, new energy vehicles, grey correlation model, random forest regression model

Abstract: The development of new energy vehicles is the only way for China to move from a big automobile country to a powerful automobile country. It is also a big country for China to cope with global climate change and promote low-carbon green development. This paper mainly evaluates the impact of new energy vehicles on the ecological environment through grey correlation analysis, random forest regression model, combined with SPSS and EXCEL. In order to evaluate the role of new energy vehicles in the environment, this paper first selects ten cities with different economic levels, geographical locations and sizes in China, and analyzes the ecological environment of these ten cities, and selects the indicators that the development of new energy vehicles can promote the environment. Secondly, collect relevant data. Since it is difficult to collect data on CO2 reduction by new energy vehicles in each city, this paper establishes relevant formulas for statistics. After the data is sorted out, the missing data is averaged and filled, and then the random forest model is established through the standardization of the data. The development of new energy vehicles will effectively improve the environment.

1. Research Background

In recent years, China has proposed a "double carbon" goal to implement the "Paris Agreement" and address global climate change - carbon dioxide emissions strive to peak by 2030 and achieve carbon neutrality by 2060. In order to achieve this goal, it is necessary to take scientific and technological innovation as the basic research direction, combined with domestic and foreign scientific research methods and strategies, to explore and study new technologies. The proposal of this policy lays a foundation for the development of the domestic new energy industry. The state has injected vitality into its industry by increasing R&D funds for new energy-related industries, introducing preferential tax policies, and increasing government subsidies for new energy vehicles. In order to seize the market opportunities for the development of new energy-electric vehicles, various countries have adjusted the development policies of related industries, which has further intensified the development and competition of the industry[1].The following is about the policies in the development of new energy, as shown in Table 1 :

The development of new energy electric vehicles is inseparable from the wide application of big data, Internet and artificial intelligence. The improvement of this science and technology has injected vitality into the research and development of new energy electric vehicle industry. How to combine

big data with artificial intelligence applications and the automotive industry has become an emerging research direction for the industry to solve development problems. For example, the application of big data platform can easily obtain information such as the test data of each index of the car and the use of the user's car, and provide convenience for the enterprise to optimize the driving experience. Although with the support of the state, the production and sales of new energy vehicles have grown steadily, there are still problems in the development of the industry. The research on new energy vehicles in China started earlier, but the national investment has been insufficient for a long time and the investment in related industries has been small. In recent years, although capital investment has been increased and great development has been made, it still faces the challenge of a certain gap with the development of the international advanced level. The development level of different regions in China is quite different, and the main development is concentrated in Shenzhen, Beijing, Shanghai, Hangzhou, Linyi and other cities.[2] In the exploration of future development, China's big data analysis is still in its infancy. We should promote big data analysis technology, improve data collection, data analysis and application methods, and integrate big data analysis into the development of new energy vehicles. The realization of this initiative requires strong national subsidies to provide a platform for the healthy development of new energy electric vehicles and promote the exploration and application of big data analysis technology [3].

Table 1: Development history of new energy vehicles

1990s to early 2000s	Starting from the traditional fuel vehicles to new energy vehicles, the country began to support the development of the industry. Mainly in municipal services, such as buses, taxis and cargo distribution vehicles.
2009 TO 2011	The state has introduced and implemented the development plan of new energy vehicles and carried out policy subsidies and tax incentives. Domestic new energy vehicle manufacturers, mainly concentrated in BYD, BAIC these emerging enterprises.
FROM 2012 TO 2014	China's new energy vehicles have ushered in a period of rapid development. The government has introduced policies to continuously improve and subsidies have been continuously strengthened. A large number of enterprises that study new energy-electric vehicles have emerged in China, and the market has continued to expand, laying the foundation for the development of the industry market.
2015 TO 2017	With the continuous breakthrough and innovation of domestic enterprise technology, although government subsidies have been reduced, their role has gradually shifted from direct financial support to policy guidance and market cultivation.
2018 TO DATE	In 2018, the policy of "double accumulation" was implemented, and the energy efficiency of new energy and traditional fuel vehicles was reformed and improved. The production and sales of new energy vehicles have also steadily increased, exceeding 3 million in 2021.

2. Analysis of the Impact of the Development of New Energy Vehicles on the Ecological Environment

In order to study the impact of the development of new energy vehicles on the ecological environment, this paper selects Beijing, Wuhan, Shanghai, Guangzhou, Chengdu, Shenzhen, Changsha, Chongqing, Xi 'an and Hangzhou according to the geographical location, economic development level, representativeness and other related reasons. The five indicators of green area, average temperature, population data, environmental noise level and the annual reduction of CO2 emissions from new energy electric vehicles are analyzed. However, the annual reduction of CO2

emissions from new energy-electric vehicles is difficult to collect. Based on this, this paper sets up a calculation method:

Reduced CO2 emissions = number of new energy electric vehicles × average annual mileage × CO2 emissions difference between new energy electric vehicles and traditional vehicles.

According to the above formula, this paper also collects the annual mileage of new energy electric vehicles, the carbon emissions of traditional vehicles, the carbon emissions of new energy electric vehicles, the population data of each region and the ownership of new energy vehicles in each region. Because the data sample sources are not uniform, there are some missing, so this paper first uses SPSS software to process the missing values of the data, and fills them in the mean way. Because there is no obvious increasing or decreasing trend in this group of data, this paper standardizes the data as a whole[4-5].

The correlation degree of new energy vehicles, the output of the correlation coefficient diagram is shown in Figure 1:

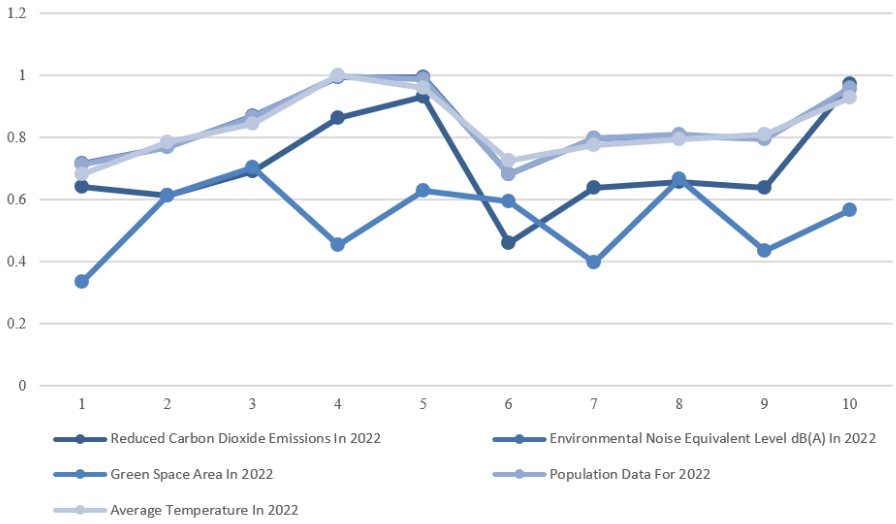

Figure 1: Correlation degree of new energy vehicles

Studying this problem, this paper first considers the use of gray correlation analysis to analyze the correlation between these five indicators and new energy vehicles. The correlation results are shown in Table 2:

Table 2: Correlation results

correlation results		
appraisal items	degree of association	rank
demographic data	0.839	1
ambient noise equivalent level dB (A)	0.839	2
mean air temperature	0.831	3
reduced carbon dioxide emissions	0.711	4
green area	0.54	5

From the data analysis of the above table, we can clearly see that among the five evaluation items, the population data in 2022 is the highest, followed by the environmental noise equivalent level dB (A) in 2022.

This paper also establishes a random forest model for regression prediction by using the random

forest model and combining SPSS software to train the data set. The evaluation results of the output model are as follows. In this paper, we can see that MSE (mean square error) is the expected value of the square of the difference between the predicted value and the actual value, RMSE (root mean square error) is the square root of MSE and MAE (mean absolute error) is the mean value of the absolute error. They are 0.021, 0.146 and 0.111, respectively, which indicates that the model has high accuracy, and the deformation of MAPE (mean absolute percentage error) -MAE is a percentage value, and its value is relatively small, which indicates that the model in this paper is stable and reliable, but the results show that the R2 value of the test set is negative. The gap between the predicted value and the actual value is too large. In this paper, the training set and the test set are compared. The results are shown in Table 3:

Table 3: Comparison of training set and test set

	MSE	RMSE	MAE	MAPE	R^2
training sets	0.021	0.146	0.111	12.679	0.914
testing set	0.269	0.518	0.321	29.372	-0.534

According to the results of the model establishment, the development of new energy electric vehicles will have a good positive effect on the ecological environment. Among them, new energy-electric vehicles will effectively reduce CO2 emissions compared with traditional fuel vehicles. Secondly, it can promote the improvement of urban noise pollution and the increase of green areas to a certain extent. The following figure shows the importance of each parameter feature, as shown in Figure 2:

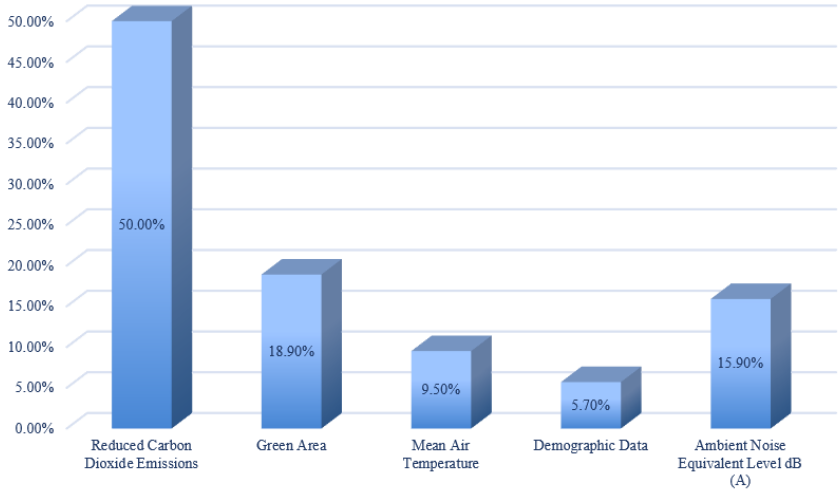

Figure 2: The proportion of importance of each parameter

3. Evaluation, Improvement and Promotion of the Model

3.1 Evaluation of Model

3.1.1 Grey Relational Analysis

Advantages: the idea of grey correlation analysis is clear, the data requirements are low, and the workload is small.

Disadvantages: the subjectivity of grey correlation analysis is too strong, the optimal value is difficult to determine.

3.1.2 Random Forest Regression

Advantages: The random forest regression model has high accuracy and can capture complex nonlinear relationships. It has good robustness to missing values and outliers in the data set and can provide the important evaluation of features to help us analyze the results.

Disadvantages: The random forest regression model is time-consuming when dealing with large-scale data sets. When the sample distribution is unbalanced, the prediction will be biased.

3.2 Improvement and Promotion of the Model

3.2.1 The Promotion of the Model

(1) Through the analysis of the new energy electric vehicle industry, this paper can promote its development model to the world, so as to protect the global ecological environment and promote the development of new energy vehicles in China according to the importance of its influencing factors.

(2) This paper can analyze the impact of the development of new energy vehicles on the ecological environment more comprehensively by collecting data on new energy in more cities across the country[6-7].

3.2.2 Improvement of the Model

(1) This paper can collect more data, take more indicators to establish a more complete and complex model and predict future development more accurately.

(2) Although the various models used in this paper have a high degree of fitting and can obtain more reasonable results, the model is relatively simple to use, and the analysis of realistic complex factors is not comprehensive enough. There may be a certain lag, which will deviate the analysis results.

4. Conclusion and Suggestion

4.1 Conclusion

Based on the comprehensive analysis of the impact of new energy electric vehicles on five ecological environment indicators, combined with the data of 10 cities, a grey correlation analysis model and a random forest model were established.

Conclusion 1: Through the grey correlation analysis model, it is found that among the five indicators, the correlation degree of population data in 2022 is the highest, followed by the environmental noise equivalent level dB (A) in 2022. The results show that there is a certain correlation between the increase of population growth and the increase of new energy vehicle production. The increase of travel demand brought by population growth promotes the development of new energy-electric vehicle market. At the same time, the popularization and increase of new energy electric vehicles also affect the equivalent level of environmental noise to a certain extent, thus further improving the urban acoustic environment.

Conclusion 2: Through the random forest model, it is found that the development of new energy electric vehicles will have a good positive effect on the ecological environment. Compared with traditional fuel vehicles, new energy electric vehicles will effectively reduce CO2 emissions and help alleviate global climate change. In addition, the popularity of new energy electric vehicles has also promoted the improvement of urban noise pollution and the increase of green space areas to a certain extent, creating a more livable environment for urban residents[8-9].

4.2 Proposal

China's new energy vehicle enterprises should formulate a reasonable strategy and business layout before going to sea, find the optimal development path, pursue long-term win-win cooperation, improve the technical level and quality to meet the requirements of foreign market certification and environmental protection.

References

[1] Tang Baojun, Liu Jiangpeng. Development Prospect of China's New Energy Vehicle Industry [J]. Journal of Beijing Institute of Technology (Social Science Edition), 2015,17 (02): 1-6.DOI : 10.15918 / j.jbitss1009-3370.2015.020.

[2] Ku Wenjie, Fu Kuan. Research on the development of new energy automobile industry based on big data analysis [J]. Internal combustion engine and accessories, 2022, (05): 163-165. DOI : 10.19475 / J.CNKI.ISSN1674-957X.2022.05.054.

[3] Zhang Yang.Research on the development of new energy vehicles in China based on patent data mining [D].Southwest University of Finance and Economics, 2023.DOI: 10.27412 / d.cnki.gxncu.2021.001214.

[4] Shao Jianxin, Yu Hao, He Si. Research on the main factors and influence of the development of new energy electric vehicles in China based on mathematical models [J].Application of mathematical progress, 2024,13 (1) : 133-140

[5] Li Junhua. Research on the development of new energy automobile industry based on big data analysis [J].Technology Information, 2023,21 (15) : 241-244.DOI : 10.16661 / j.cnki.1672-3791.2212-5042-9963.

[6] The SPSSAU project (2024). SPSSAU. (Version 24.0) [Online Application Software]. Retrieved from https://www. spssau. com.

[7] https://xgboost.readthedocs.io/en/stable/

[8] Chen, T.Q. and Guestrin, C. (2016) Xgboost: A Scalable Tree Boosting System. Proceedings of the 22nd ACM SIGKDD International Conference on Knowledge Discovery and Data Mining, San Francisco, 13-17 August 2016, 785-794.

[9] Scientific Platform Serving for Statistics Professional 2021. SPSSPRO. (Version 1.0.11)[Online Application Software]. Retrieved from https://www.spsspro.com.