Scheduling Strategy of Real-Time Charging Optimization of Electric Vehicles Based on Deep Learning

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Abstract. With the development of the times, more and more kinds of energy, and now, the country is vigorously advocating the use of new energy and clean energy, so electric vehicles came into being. Its main purpose is to replace the traditional car fuel consumption and use the new car power consumption to achieve the role of protecting the environment. But for electric cars, it needs to solve a problem with real-time charging compared to conventional cars. Because with the development of the industrial age, gas stations have been basically spread around the main road and various large residential areas, to facilitate the traditional car refueling. But electric vehicles have only been proposed and manufactured for a few years, and the charging piles have not yet been fully distributed everywhere to meet the charging needs of electric vehicles. Therefore, the charging of electric vehicles is one of the core issues of whether electric vehicles can be popularized. Therefore, the purpose of this paper is to use deep learning algorithm to optimize the scheduling of real-time charging of electric vehicles. This paper refers to the planning ideas of gas station establishment at home and abroad, and after collecting the data on the purchase and growth rate of electric vehicles in recent years, the statistical research is carried out, and then the deep learning algorithm is used to unify and study all the data, so as to get a roughly needed charging pile size and distribution map. Then the sandbox simulation is carried out to get the experimental results. Experimental results show that the strategy of charging optimization scheduling based on deep learning algorithm can help electric vehicles to realize real-time charging better, more convenient and more user-friendly.

Keywords: Deep Learning, Electric Vehicles, Real-Time Charging, Optimized Scheduling

1. Introduction
Because of the development of the industrial age, especially in recent decades, resource collection and industrial development have caused great damage to the environment, causing considerable damage to the sky and river soil [1]. Therefore, the state has been conducting research and Discussion on the issue of environmental protection in recent decades. Now, with the proposal and development of new energy, electric vehicles are proposed in this context as a way to replace cars in the future [2].
However, due to the short time of putting forward electric vehicles, various manufacturing technologies are not mature, and various supporting measures are not perfect. Because the electric vehicle is powered by rechargeable batteries, it needs to be charged and powered, so it needs to set up a centralized charging station similar to the gas station on the side of the road to provide power for the rechargeable vehicle [3]. However, because of the complexity of the types of charging vehicles and the different power supply modes, the scale of each charging station may be larger than that of the gas station. Because of the need for land, electricity and other aspects, the implementation of charging optimization is still a problem to be discussed [4].

However, problems need to be solved. Therefore, based on the current situation, after investigating various data research reports about the country in recent years, and observing the changes of the stock market trend, policy demand of new energy vehicles and the output, purchase volume and growth trend of various industrial products in recent years, we finally make a statistical table of them and make a rough summary Scale chart, to comprehensively analyze the situation of the whole industry [5]. Then compare the demand of electric vehicles in different places, and observe which part of the demand is large and which part is small. Then, the deep learning algorithm is used to plan them automatically, classify them automatically, and make the final statistics [6].

At present, Shanghai, Shenzhen, Hangzhou and other intelligent cities with rapid economic development and more developed science and technology are widely used for new energy vehicles in China [7]. Because cities in these places are more intelligent, some national strategic measures can be implemented. Therefore, as one of the future strategic measures of the country, new energy vehicles are naturally placed in Shanghai and other places [8]. Therefore, we focused on the demand for new energy strategic measures in Shanghai and other places. The survey found that in Shanghai, Hangzhou and other places, there are certain policy support for new energy vehicles, and with the development of these years, there are more new energy vehicles on the road than before, and some relevant laws and regulations and cluster charging piles and other equipment have been implemented for new energy vehicles [9]. But there are still many deficiencies, in the final analysis, it is caused by the complex types of new energy vehicles. Because this leads to different charging methods, we will mainly solve this kind of problem in the future [10].

2. Deep Learning Algorithms

Cell( Cs1 Cs2 nC O) is at six-cell group used to represent a grid, where C represents a hypervelast that exists in k-dimensional data space; nC represents the total number of data points that fall in super square C; O represents a collection of candidate outlier points that exist in the grid; Represents time; Grid statistics in which elements are \( t_{i\alpha} S^1 = \left[ s^1_{1}, ..., s^1_{k} \right] \) calculated as follows:

\[
s^1_k = \sum_{C} \theta^t_{\alpha} - t_{\alpha}r_i \tag{1}
\]

Represents \( r_i \) the data point Grid statistics, \( S^2 = \left[ s^2_{1}, ..., s^2_{k} \right] \) the element is \( s^2_k \) calculated as follows:

\[
s^2_k = \sum_{C} \theta^t_{\alpha} - t_{\alpha}r^2_i \tag{2}
\]

Grid \( S^1 \) statistics, meet \( S^2 \) the following style at t-moment:

\[
S^1_t = \theta^t - t_{\alpha} \times S^1_{t_{\alpha}} \tag{3}
\]

\[
S^2_t = \theta^t - t_{\alpha} \times S^2_{t_{\alpha}} \tag{4}
\]

Set \( t_{\alpha} \) as the current time. Depending on the nature described above, the statistics for incremental update data in Grid \( rC \) are as follows:

\[
n_{C} = \theta^t_{\alpha} - t_{\alpha} \times n_{C} + 1 \tag{5}
\]
\[ s^1 = \theta^{t_c-t_{ia}} \times s^1_i + r_i \]  
\[ s^2 = \theta^{t_c-t_{ia}} \times s^2_i + r_i^2 \]  
\[ t_{ia} = t_c \]  

During initial processing, the grid of the data is split, the initial grid is obtained, and the average value and standard deviation of the data in the grid can be calculated according to the grid statistics \( \sigma_i \)

\[ \mu_i = \frac{s^1_i}{n_c} \]  
\[ \sigma_i = \sqrt{\frac{(s^1_i - 2 \mu_i)^2}{n_c}} + \mu_i^2 \]  

3. Experiment

3.1 Selection of Experimental Data
Our experiment is mainly about the real-time charging optimization scheduling strategy of electric vehicles. Because in our country at present, Shanghai, Shenzhen, Hangzhou and other places of electric vehicle applications are wide and laws and regulations are more perfect, so we mainly chose these three places as our main data source, our experiment is also to analyze and simulate this.

3.2 The Validity of the Experimental Data
Because electric vehicles are growing on different scales everywhere, some of the experimental data we collected may have caused huge fluctuations for some particular reason at the time. For example, the sale of electric vehicles, big promotions and other activities will lead to the day's turnover is particularly large, so we cut it and the surrounding experimental data to avoid interfering with our overall experimental situation.

4. Evaluation Results

4.1 Data Analysis

Table 1. Evaluates the results of the user data analysis used in electric vehicles

|          | 2018 years | 2019 years | 2020 years |
|----------|------------|------------|------------|
| Shanghai | 12         | 14         | 23         |
| Hangzhou | 8          | 10         | 11         |
| Shenzhen | 10         | 16         | 22         |

Using data from the last three years, as shown in Table 1, we find that the ownership of electric vehicles is on the rise, but the growth rate is not very fast, indicating that the current measures for electric vehicles are not yet complete. We calculated the data by using the Deep Learning algorithm and modeled and analyzed the data to produce the results in Figure 1. And the experimental data for predictive analysis processing, get the data shown in the following Figure.
The results of Figure 1 are based on a forecast of the number of electric vehicles in Shanghai, Hangzhou and Shenzhen for 2020, 2021 and 2023. Figure 2 is a predictive analysis of the number of vehicles owned in Shanghai, Hangzhou and Shenzhen from 2020 to 2022 after we optimize the scheduling based on improved real-time charging. According to the results of the forecast analysis, the number of people buying electric vehicles will increase significantly after the improvement. If our
predictions are consistent with the real situation, then our improvement measures are successful and our experiments are successful.

4.2 Electric Vehicles

Electric vehicle refers to the vehicle that uses the on-board power supply as the power source of the vehicle and drives the wheels to drive the vehicle that meets the requirements of the Road Traffic Safety Regulations. Because electric vehicles have less impact on the environment than conventional cars, they are a strategic need of the country and have good market prospects. It works by using batteries to supply electric motors and then drive cars through an electric drive system for the same purpose as conventional cars. Electric vehicles are currently divided into three main types, namely, pure electric vehicles, hybrid vehicles and fuel cell vehicles.

Pure electric vehicles, which are the main difference from conventional fuel vehicles, are four components: drive motors, speed controls, power batteries and on-board chargers. It's different from fuel cars refueling gas stations in that it's typically charged with a common super-fast charging station, and then it's used for all four components. If it's a short trip like an electric bike, it's not very demanding. But if it's a car-like long-distance ride, the requirements for these four components are high. The speed and start-up speed of pure electric vehicles generally depend on the power and performance of the drive motor, its range generally depends on the capacity of the on-board battery, and the weight of the on-board battery generally depends on the type of battery selected, such as lead-acid battery, lithium battery and so on. Electric vehicle drive motor has DC brush, DC brushless, there is permanent magnet, electromagnetic and other types, and then now also introduced AC motor. Their applications are generally related to the configuration and use of the vehicle. Then drive the motor's speed control controller is also divided into a staged speed control and non-extreme speed control, reference to manual and automatic stop, as well as the use of electronic speed control controller and no speed control controller, reference intelligence. Motors are available in a variety of ways, including internal roors, single motors, multi-motors and combined motors. The main advantage of pure electric vehicles is that the technology is relatively simple and mature, and only need sufficient power supply to complete the charging target. And its disadvantage is because the battery storage energy is less, and expensive, as well as battery charging technology, range and other aspects of the development of pure electric vehicles.

Hybrid vehicles can mainly use different ways to supply energy to achieve the purpose of vehicle operation. The main advantages of hybrid electric vehicles are that the use of hybrids can keep the internal combustion engine in the lowest energy consumption, the highest output power state, and can use the surrounding potential energy to charge the battery, but also according to the needs of the environment to switch the internal combustion engine and battery energy supply, in order to protect the environmental and ecological health of certain areas. And can use the gas station refueling, no longer need to charge the pile power supply. But it has a very fatal disadvantage, that is, long-distance high-speed driving fuel consumption is no different from fuel cars, even efficiency than ordinary fuel cars, the effect is not very large.

Fuel cell electric vehicles, because of the low power supply rate of a single fuel cell, so the electric vehicles used on the market are generally powered by combined fuel cells. The main advantages of fuel cells are zero emissions, reducing environmental pollution, and improving fuel efficiency, engine efficiency and noise-free.

4.3 Charge in Real Time

Real-time charging is most widely used on devices such as mobile phones and computers, because the battery's charge and discharge performance can be affected by charge and discharge. So, in most cases, we don't recommend playing while charging. Instead, it is proposed to set aside devices such as mobile phones and remove the charging devices for activity when they are fully charged. But the batteries commonly used in electric vehicles are lead-acid, manganese-acid batteries, which work much the same as lithium batteries and are generated by internal electron migration. So, we can meet the
requirements of real-time charging by setting up multiple shared charging piles on the side of the road. Then we need to use graphene to construct a fast-charging network that protects the battery and provides efficient battery life.

5. Conclusion
In summary, due to various constraints, we can only study this issue. Experiments have found that although deep learning algorithms can automatically collect and organize information about surrounding electric vehicles, they still can't keep up with the development of the times and can only predict the general situation in the last three months. So, in the future we will update this in the future. We will certainly use a variety of algorithms to simulate artificial intelligence to make the system more intelligent, user-friendly real-time charging of electric vehicles to fully mobilize. If conditions are in the future, we try to meet the charging requirements for electric vehicles by increasing the charging rate of the battery and building a reasonable charging network without replacing the battery. For places where demand is low, we do this by implementing real-time scheduling plans through storage warehouses. This can meet the large-scale use of electric vehicles to save resources and protect the environment.

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