Research Article

Data Legal Supervision of Online Car-Hailing Platform Based on Big Data Technology and Edge Computing

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There is a lack of fairness in market competition and disorder of order as a result of the lack of supervision. OCH (online car-hailing) driver accidents are also reported frequently, causing a slew of social and traffic safety issues. In this paper, we reconstruct the logical path of OCH platform data legal supervision in China’s big data era. We propose a big data encryption algorithm based on data redundancy technology that combines the characteristics of the ECC (Elliptic Curve Cryptography) and AES (Advanced Encryption Standard) block cipher modes in terms of computing speed, parallelism, and security. The system can process large amounts of network data and detect distributed denial of service (DDOS) attacks in real time. The observed feature change trend charts before and after the attacks show significant differences, demonstrating that the proposed features can better distinguish normal traffic from abnormal traffic.

1. Introduction

The combination of modern mobile communication technology and big data has created a highly connected era in the current society [1]. As a new type of transportation service format OCH (online car-hailing) service mode is the core innovation and development performance of the integration of big data and transportation. The OCH relies on the mobile internet and artificial intelligence technology [2, 3], which enables accurate and efficient matching between vehicle demand and vehicle supply, and belongs to the change of vehicle use mode brought about by technological progress. Daily travel demand is high in all parts of China, particularly in some large cities, which greatly facilitates people’s travel and, to some extent, alleviates the difficulty of taking a taxi in urban life. The introduction of OCH also helped to alleviate some of the short-distance demand for urban traffic and met market demand [4].

OCH provides citizens with a positive service experience, but it also creates a slew of issues and potential safety risks, including passenger deaths, major public safety concerns, potential hitchhiking product safety concerns, a shaky emergency management foundation, prominent illegal operation issues, insufficient implementation of the primary responsibility for production safety, serious platform integrity issues, and personal information security leakage [5, 6].

However, the process of OCH’s rapid development has not been smooth sailing, which has brought great changes to the passenger service industry and caused great contradiction with the original cruise taxi industry [7]. The research on the legal system of legal supervision of OCH platform data is conducive to solving the contradictions caused by the operation of OCH, coordinating the development of OCH and traditional taxis, creating a diversified development model of taxi industry, guiding the development of new industries, and promoting economic transformation. The means of supervision are more specific and operable, and passenger safety is improved [8, 9]. This paper begins by examining the existing issues with OCH security supervision and then seeks a legal supervision strategy for OCH platform data that is consistent with the current state of OCH in China and the situation, as well as a reasonable and legal supervision mode. These tools and measures will safeguard passengers’ information and personal safety,
increase passengers’ sense of gain, take into account passen-
gers’ feelings and experiences, and protect people’s interests [10]. The interaction of new technology and the legal system is a common occurrence, and it provides an opportunity to reflect on and improve the existing system and legal theory [11]. At the same time, OCH platform enterprises should be given more important internal supervision responsibilities, and they should be required to bear some of the responsibility for the platform’s vehicles, such as paying insurance and taking responsibility for them.

The arguments and conclusions of this study are instructive for solving the regulatory dilemma of new transportation service formats in the current era of big data and highly connected society. From the characteristics of the sharing economy, in the market transactions of the sharing economy, resource suppliers have the characteristics of amateur and temporary, which is different from the characteristics of professionalism and long-term effectiveness of resource suppliers in the traditional economic form. This paper will start with the safety problems existing in OCH, with a view to putting forward possible policy suggestions from the perspective of safety supervision: so as to speed up the transformation of government functions, strictly supervise the market, improve the administrative efficiency of the government, and enhance the executive power and credibility of the government.

2. Related Work

By integrating the specific travel service needs of different passengers, the OCH platform enables coordinated consumption of taxi services. The emergence of OCH is viewed favorably by foreign academic circles. Literature [12] research indicates that government departments should step forward to manage the taxi industry, with the core of management being price and service level control, which should be based on market development while ensuring service level. According to literature [13], it has not only created enormous market value but also resulted in fierce regulatory conflicts, endangering taxis’ monopoly position throughout the system. According to literature [14], the most significant difference between OCH and previous taxis is the government’s attitude toward the two modes, not the different ways of providing services. According to the literature [15], self-discipline supervision must be strengthened, which is inextricably linked to the government’s top-down rule of law and policy oversight. According to the literature [16], the traditional taxi business model should be reformed and improved, and the transformation and upgrading process should be accelerated to improve the taxi’s ability to compete. According to literature [17], government intervention should be avoided or avoided to the greatest extent possible by relying on the support of a large number of passengers and their monopoly position. According to the literature [18], the OCH platform should be the primary focus of government oversight, with unfair standards reduced and the use of information technology strengthened to ensure the safety of OCH operations. In literature [19], through sorting out and analyzing the OCH management measures formulated by various cities, it is considered that it is necessary and reasonable for OCH authorities to adopt safety supervision measures. At the same time, it is considered that the legal supervision of OCH platform data should pay attention to the problem of information asymmetry and truly implement the safety supervision system. Literature [20] holds that in the supervision of OCH, appropriate measures should be taken to solve the contradiction between OCH legislation and existing laws, so that OCH safety supervision can be governed by laws.

In a big data environment, data sources are abundant and data types are diverse, and data processing efficiency and availability are prioritized. Literature [21] investigates big data security from the standpoint of assisting scientific research, as well as new software and hardware platforms for big data security analysis. Literature [22] investigates the technical methods for effectively protecting, managing, analyzing, and processing large amounts of data by leveraging massive web content and user access log data. This paper examines the key features of big data analysis platforms such as parallel databases, MapReduce, and their hybrid architecture in the context of big data, as well as the benefits and drawbacks of each platform. Literature [23] examines the challenges posed by technologies, standards, supervision, and other factors in the field of big data security in the cloud computing environment, and proposes a reference framework for cloud computing security as well as the major research topics within it. Literature [24], combined with the application of real-time collection and processing of large-scale data, proposed a real-time processing method of large-scale data for high-speed data stream and provided an effective means for speed optimization and real-time processing of big data encryption and decryption algorithm.

3. Research Method

3.1. The Path Choice of Legal System of Data Legal Supervision on OCH Platform. Although OCH safety supervision has made some achievements, there are still many problems. Therefore, based on the analysis of the reasons for the problems in OCH safety supervision and the successful experience of foreign developed countries, the countermeasures and suggestions for further deepening the construction of OCH safety supervision are put forward. For example, to improve the laws, regulations, and standards of OCH safety supervision, establish the main structure of safety supervision with clear responsibilities, establish a strict OCH access mechanism, strengthen the daily supervision of OCH platform, and establish an efficient safety emergency rescue mechanism.

To improve the laws and regulations of legal supervision of data on OCH platform, the first step is to improve the legislative level of OCH. Bring the OCH management into the legal management system. OCH’s safety supervision of the central legislature cannot be too conservative in legislation and restrict the formulation of local specific measures, but should look at the development of OCH from the perspective of development, and be good at discovering and mastering the characteristics of the OCH industry when perfecting the existing laws and formulating new laws. The OCH
security supervision is not only related to the personal and property safety of citizens but also puts forward the requirements for information security and privacy protection, which is also a gap in the current central legislation level. This requires relevant departments to revise and explain the laws and regulations of OCH safety supervision in time, constantly revise relevant laws and regulations in time according to the development of OCH, and optimize the OCH safety supervision environment.

In terms of price formation and service quality, OCH is quite different from traditional taxis because it relies on the Internet and a big data platform. As shown in Figure 1, the car rental management platform pushes OCH operation data, OCH vehicle terminal monitoring data, and user feedback information through the Ministry of Transportation’s data interaction platform, resulting in a complete service supervision data system for complete car rental service supervision and management: ensure that the competent department of transportation industry can effectively supervise and manage the car rental industry by providing a strong foundation for the supervision requirements of providing service standards for car rental on the Internet.

OCH market and traditional taxi market belong to the passenger transport market, and there is a certain overlap in the service targets. In addition, China has incorporated the OCH market into the taxi industry and implemented the dual-track management mode, so the supervision of the two markets needs to be integrated and coordinated and should not be blind and unified. For special area vehicles and special group vehicles cannot provide good service, it is precisely because of this difference that OCH and traditional taxis need to develop together, so the supervision of these two vehicles should also grasp their respective characteristics.

Not only must we recognize the shortcomings of the traditional taxi industry’s institutional mechanisms but also actively face the new problems brought by the new Internet formats. The old and new formats meet the different levels of public demand. In the process of reform, it is necessary to make overall planning, classified management, and build a diversified service system.

The business information data mainly includes the single order business information of vehicles and drivers of OCH Platform Company, that is, the information summary of the business activities of this order after the end of the transaction. The data consists of two parts: the data interaction platform of the Ministry and the data uploaded by the OCH vehicle terminal in this city. As shown in Figure 2, the car rental platform takes Dubbo principle and G4Studio framework as its core, which connects business and data, and specifically consists of user layer, presentation layer, business layer, logic layer, and data layer.

The emergence of OCH is a reflection of the transportation market’s growing dynamism. On the one hand, the government’s previous oversight of traditional travel service providers was unable to meet new development needs in terms of ideas, rules, policies, laws, and so on, before the business model of new transportation service formats was summed up in commonality and could be subject to legal regulation. On the other hand, OCH platform businesses have attracted a large number of customers and service providers, resulting in the formation of a local network of high connectivity and socialized labor assistance. Platform enterprises must perform certain coordination and supervision functions for the service networks involved, such as formulating corresponding rules, standards, procedures, and agreements to punish all types of illegal activities, based on the above two considerations. Because they have mastered a large amount of information and data and have powerful computing power, platform enterprises have a significant advantage in market coordination and supervision.

According to the development of market economy, scientifically formulate the development plan of taxi industry, including OCH, and bring it into the transportation development system for coordinated development. The supervision of OCH cannot relax the follow-up supervision only by reviewing the access standards of OCH platform, vehicles, and drivers by means of administrative license beforehand, because the OCH market is a rapidly developing and changing market, and the mobility and variability of vehicles and drivers are great. In order to achieve the supervision purpose of ensuring the service quality and safety of OCH, it is necessary to supervise the whole process of OCH operation in an all-round way.

3.2. Big Data Analysis of Legal Supervision of OCH Platform Data. With the help of Internet communication technology and big data analysis technology, OCH Platform Company provides information for both the supply and demand sides of travel service, optimizes the allocation of idle, short-term, and scattered traffic supply and demand resources, effectively reduces the transaction cost of both sides, and avoids the resource waste of traditional taxi business model which mainly meets the temporary scattered demand through the wide-spread network parade. This measure is a rational use of existing resources, which can really make these resources play the best role, and it is also a rational integration of social resources. It plays a certain role in improving social welfare, enhancing employment flexibility and satisfaction, and provides convenience for revitalizing idle social resources.

For big data, there is not yet a well-developed encryption algorithm. Because big data has the following characteristics: large quantity, high speed, diversity, low density, and high value, and it is difficult to manage the key when encrypting big data using symmetric cryptographic algorithms, which cannot guarantee data security. The ECC (Elliptic Curve Cryptography) can provide greater security while requiring

![Figure 1: Information flow diagram.](Image 490x665 to 534x682)
The MixColumn function acts on each column of the State, iterating 4 times. Take a column as an example, and the operation on the column \( s(x) \) is defined as multiplying this polynomial by a fixed cubic polynomial \( c(x) \) and then moduling \( x^4 + 1 \), that is, making the following transformation:

\[
d(x) = c(x) \times s(x) \mod x^4 + 1. \tag{3}
\]

Here, the fixed polynomial \( c(x) \) is calculated as follows:

\[
c(x) = c_3 x^3 + c_2 x^2 + c_1 x + c_0 = \text{’03’} x^3 + \text{’01’} x^2 + \text{’01’} x + \text{’02’}. \tag{4}
\]

In the product \( d(x) \), the coefficient of \( x^2 \) is

\[
d_2 = c_2 s_0 + c_1 s_1 + c_0 s_2 + c_3 s_3. \tag{5}
\]

DDoS (distributed denial of service) is a network attack method which is simple to operate but extremely destructive. Attackers remotely control some puppet machines by some technical means, which greatly affects the access speed of normal users and sometimes even causes the target host to crash or downtime under the impact of heavy traffic, exceeding the running load.

In this paper, the algorithm adaptively detects the threshold value according to historical data. If the current characteristic size is greater than the threshold value, it will be judged that the system has been attacked by DDoS. If the network traffic surges at a certain moment, exceeding the network threshold, it can be judged that the system is suffering from DDoS attack. During the execution of the algorithm, the byte rate is used as a feature to judge whether DDoS attacks are suffered.

After moving average processing of time series, the numerical value will become smooth, and this data processing method can reduce the influence of random error on
Figure 3: Big data encryption algorithm model based on data redundancy technology.

data analysis. The calculation method of the window eigenvalue is shown in formula (6):

\[ f_t = \frac{1}{N} \sum_{i=n+1}^{t} X_i, \]

(6)

where \( f \) is the eigenvalue after moving average processing.

The threshold will be relatively high when the network environment’s traffic is generally high. The threshold will be relatively low when the network environment’s traffic is low. Because of this adaptive approach, the algorithm has better network adaptability and detection accuracy.

\[ \text{threshold}_t = 1.5 \times f_t. \]

(7)

When detecting DDOS attacks, compare the byte rate at the current moment with the adaptive threshold to determine whether DDOS attacks are suffered at the current moment. The specific criteria are shown in formula (8).

\[ \text{output} = \begin{cases} 
0 & \text{if } X_t \leq \text{threshold}_t, \\
1 & \text{if } X_t > \text{threshold}_t. 
\end{cases} \]

(8)

The network’s traffic characteristics are being calculated right now and compared to the previously calculated adaptive value. If the 3 first byte rate is greater than the adaptive threshold, the network has been subjected to a DDOS attack; if the 3 first byte rate is less than the threshold, the network is considered normal. The small setting of threshold has a strong correlation with prediction accuracy, and the method of threshold setting is discussed emphatically in the experiment.

4. Results’ Analysis and Discussion

In the process of data processing and association analysis, because there is a great deal of redundancy in the massive data collected, and the data association is not obvious, it is necessary to use the data dimension reduction algorithm to transform or standardize the original data, extract the hidden, unknown, and related features in advance, and find the internal relations of the data. Accurate perception of abnormal behavior is not the ultimate goal of management but a means to realize active management of abnormal behavior and a method to promote continuous improvement of abnormal behavior management, to realize the visualization of abnormal behavior management process and results.

The experimental ECB, CBC, CFB, and OFB 4 encryption algorithms and the encryption time of this scheme algorithm are counted, respectively (Figures 4–6).

When abnormal behavior affects multiple levels of business system at the same time, after considering the factors of safety protection measures, the probability of occurrence of abnormal behavior and the degree of harm are maximized and finally get the applicable subset of business abnormal behavior and its corresponding symbol values.

According to the actual situation of the business system and the comparison of the abnormal behavior analysis template, the existence of a specific abnormal behavior at the physical level, network level, system level, and application level can be obtained. Through the interaction between users and the visual interface, the dynamic adjustment and continuous optimization of abnormal behavior strategies, management objectives, and control objectives can be realized, and the risks of different levels, ranges and levels, can be timely and effectively evaluated, monitored, and dealt with, thus improving the dynamic decision-making ability of abnormal behavior management and control.

At the same time, the encryption and decryption speeds of CBC, CFB (parameter set to 128), OFB, and CTR are tested. The test results are shown in Figure 7.

From the above analysis, the CTR is a high-speed encryption mode with faster encryption and decryption speeds, especially for the case of large packets. At the same time, CTR working mode can be preprocessed, which is suitable for parallel computing. It is the most suitable working mode for big data encryption among the five working modes. Therefore, AES is used to encrypt the preprocessed big data in the experiment, and CTR is used as its working mode.

The moving average method is used to predict the future network traffic. If the window length is too long, more historical data will be referred, and the data changes slowly, which cannot well reflect the instantaneous change of recent traffic. If the window length is too small and there is no reference to historical data, the predicted results will lack credibility. Therefore, choosing an appropriate size of sliding window length is very important to the accuracy of detection results. It is proved that the threshold selection in DDOS attack detection has a great influence on the accuracy and recall of experimental results, and the changes of accuracy and recall when the threshold parameters are adjusted are shown in Figure 8. When choosing parameters in this experiment, increase the recall rate as much as possible on the basis of maintaining a high accuracy rate.

As can be seen in Figure 8, the accuracy curve and the recall curve are negatively correlated. With the increase of threshold multiple, the accuracy rate increases, while the recall rate increases, which requires choosing a balance
point. After observing the changing trend of the curve, it is found that when the threshold multiple is greater than 1.5, the accuracy tends to be stable, while the recall rate drops rapidly. A value around 1.5 can ensure a relatively high recall rate on the premise of high accuracy, so it is most appropriate to choose a threshold multiple of 1.5.

Intraindustry dispute resolution mechanism, in which OCH industry participants spontaneously form intraindustry organizations, can meet the needs of different OCH industry members through intraindustry self-discipline rules and intraindustry dispute resolution mechanisms. These rules are based on years of industry experience and judgments and can be used to solve problems that are difficult to solve by law and to resolve disputes in a flexible and convenient manner, allowing the OCH industry to achieve self-discipline and introspection.

Figure 9 shows the characteristic data and labels of TCP (Transmission Control Protocol) sessions in the experiment. The first three are the sessions initiated by DDOS attackers, and the last three are the sessions established by normal access users. According to the table, it is difficult to distinguish whether a session is a TCP session initiated by the attacking host by using only one feature. Therefore, considering judging one thing from multiple dimensions, it usually shows high accuracy.

Using big data technology to create scientific legal oversight and decision-making procedures for OCH platform data, the dynamic process of public opinion collection, public opinion analysis, and public opinion supervision for regulatory decision-making is completed through the collection, storage, and analysis of important OCH risk event data. The loopholes and risks in legal supervision of OCH platform data can be judged more scientifically and accurately, and the prejudgment and decision-making mechanism can be established, by relying on objective, real-time, and large amounts of OCH data. To improve the transparency and scientificity of decision-making, make the scientificity of legal supervision decision-making on OCH platform data and the integrity of policy trial not be hampered by the apparent game of different stakeholders and prevent the policy from being distorted and out of shape in
the process of supervision decision-making and breaking away from the law of intelligent transportation development.

Figure 10 shows the change trend of AUC (Area Under Curve) of quasi-Newton method in the iteration process. After the first iteration, the AUC value reached 0.6326, and in the subsequent iteration process, the value gradually increased. After 10 iterations, the tolerance of iteration was reached, and the final AUC result was 0.7224.

It can be clearly seen from Figure 10 that the growth rate of the previous iterations is fast. With the increase of the number of iterations, the growth rate of AUC is decreasing, reaching the iteration tolerance in the 10th iteration, and the algorithm ends, finally stabilizing at the AUC value of 0.7224.

A large amount of user registration information is required for the OCH operation service. Many people will be impacted if it is illegally used or leaked, the majority of whom will remain anonymous. As a result, administrative bodies or public utilities in charge of information security oversight should file public interest lawsuits in order to effectively protect the information security of the vast majority of OCH users. Its regulations define the scope, method, and time for OCH operation platform companies, government departments, and other credit-reporting departments to collect and use personal information, as well as the basic obligations and legal responsibilities. It should bear the corresponding legal responsibilities for the behaviors that fail to take security obligations and cause user information leakage, so that OCH user information protection has a logical starting point of legal protection.

The government can make full use of the role played by industry associations in the management of OCH industry, so that industry associations can actively control OCH services through industry self-discipline, and also formulate corresponding industry standards or put forward normative standards for vehicle inspection, driver credit reporting, service training, safety equipment, etc. The government should not only bring network platform companies into the scope of regulation but also make good use of the advantages of network platform management, establish the OCH service supervision mode of “government plus enterprise,” and actively guide industry associations to play their due supervision functions, so as to achieve multidirectional supervision of “government, enterprises, and society.”

5. Conclusion

OCH is a product of the Internet era’s combination of information technology and travel services, reflecting the nature of the sharing economy. This new format has its own development advantages, and in just a few years of China’s development, it has occupied a large number of markets and generated significant economic value. The era of high connectivity brought on by big data pushes the provision of public transportation services to the original boundary between government and market, allowing OCH platform enterprises to take on some regulatory responsibilities: select the supervision mode based on the nature of the OCH sharing economy, integrate OCH platform data legal supervision
with traditional taxi supervision, clarify OCH platform data legal supervision legal principles, and improve relevant laws and regulations to improve the legal system of OCH platform data legal supervision. The encryption time, key space, and security of the new algorithm are all evaluated using the encryption algorithm evaluation system. To achieve the effect of rapid convergence, select the best optimization method through experiments. The detection model with adjusted parameters can accurately detect DDOS attacks, according to experimental results.

**Data Availability**

The data used to support the findings of this study are included within the article.

**Conflicts of Interest**

The authors do not have any possible conflicts of interest.

**References**


