

# *Investigation of the Effectiveness of Intellectual Property Law Protection Path under Big Data Evaluation*

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**Abstract:** With the continuous development of artificial intelligence technology, effective Internet of Things security certification would provide a strong guarantee for the security of intellectual property law. In the age of big data, the exchange and control of intellectual property is inevitable and more important. The exchange of intellectual property can not only promote the economic benefits of enterprises, but also provide a basis for the rights and interests of the government, which makes the value of intellectual property realized. The traditional legal protection can no longer adapt to the development of the times. This paper proposed an L-diversity algorithm based on big data analysis. This method could not only effectively prevent user identity errors, but also provide users with adequate defense mechanisms. At the same time, it could also mine the attacked web pages to protect knowledge property rights. The experimental results of this paper showed that only 17% of the people knew the intellectual property law very well in the survey results of people's cognition of the intellectual property law; only 11% of the people had a better understanding of the intellectual property law; 22% of the people did not know the intellectual property law; the proportion of people who were very ignorant of the intellectual property law was 50%. It could be found that most people did not know enough about the intellectual property law, so they could not protect their rights and interests. Therefore, the path of intellectual property law protection should be studied based on big data in the context of AI and the Internet of Things.

## 1. Introduction

After entering the era of knowledge economy, in order to maintain rapid, stable and healthy development, a sound knowledge innovation environment and a national independent innovation system must be established. The reinforcement of the protection of enterprises' Intellectual Property Rights (IPR) is an important means to promote the development of science and technology and social economy, and is also an inevitable trend to achieve knowledge innovation. As a basic industry to promote and protect innovation, the protection of intellectual property law has become increasingly prominent in China's productivity development and people's quality of life.

The advent of the big data era, first of all, is to promote the development of science and

technology. A new generation of science and technology, such as artificial intelligence, the Internet of Things, has brought support for the protection of intellectual property law. Based on this, in order to obtain greater economic benefits for private enterprises, government departments are actively collecting information and using the IPR of enterprises to achieve efficient social management. Big data is the inevitable result of technological development in the 21st century. It has a huge impact on all aspects of human society. While making full use of the convenience of science and technology, people also encounter many problems. Among them, the most prominent is the protection of intellectual property law. Due to the development of computer and other technologies, the dissemination of intellectual property information has also changed from face-to-face communication in the past to paper media later to the digitalization of information today, which has made the forms of expression of intellectual property materials more diversified and the content more abundant. Especially as the traditional object of privacy, the intellectual property law is an important part of the right to privacy. The innovation of this paper is to propose an L-diversity algorithm based on big data analysis to protect intellectual property law and to investigate people's understanding of intellectual property law.

## 2. Related Work

IPR is legal privileges granted to individuals based on the works produced by their intellectual activities and their reputation and marks in business activities. According to Tripathi Swapnil, artificial intelligence was crucial in today's rapidly developing technological environment, and the development of the network also brought about concerns about the rights of intellectual property in danger, so there was an urgent need for a remedy to protect intellectual property law [1]. Brander James A found that some enterprises failed to fulfill their responsibility to protect IPR, which seriously damaged the interests of intellectual property owners. He reviewed the cost of intellectual property right infringement and the advantages of intellectual property right law protection [2]. In order to solve the problem of infringing the broader global intellectual property law, Peng Mike W studied the discussion around IPR. However, some evil individuals failed to protect IPR. He asserted that unless people voluntarily choose to strengthen intellectual property protection, their economic development would not be completely innovative [3]. Bhat S Ravindra described many legal frameworks for management innovation and intellectual property in China. These frameworks were solved in many aspects of China's intellectual property law, especially in the legislative field. These legislative actions were carried out within the broader framework of protection [4]. According to the above professor, with the development of China's intellectual property business, risks are also increasing, so people should take adequate preventive measures to safeguard intellectual property legislation.

The development of intellectual property law protection must reflect and adapt to the needs of social development in a timely manner. Big data should be used to safeguard the protection of intellectual property law. Chopra Sheetal evaluated the growth of the department based on its innovation capacity and intellectual property production. The evaluation results showed that most industries lacked attention to innovation and intellectual property security protection, and some people believed that big data should be used to solve this problem [5]. Schneider Marius found that in the past, the protection of patents, trademarks and other IPR was not given much consideration, but in today's intellectual economy, enterprises successfully used big data analysis to solve the security problems brought about by the network to IPR, which achieved positive results [6]. According to Indradewi Anak Agung Sagung Ngurah, intellectual property was directly related to the business sector. The intellectual property law of each country in the world was different from that of international trade, but it could be protected through big data [7].

### 3. L-diversity Algorithm Based on Big Data Evaluation

Although China is already a country with IPR, the security of its IPR is still worrying, especially core technologies [8]. In addition, the number of original brands in China is very small, and it is difficult to eradicate counterfeiting, piracy and other violations, which hinders the vigorous development of China's cultural industry [9]. At present, China's intellectual property information is stored and managed through the network, and network attack is an important issue of intellectual property protection. The types of intellectual property are shown in Figure 1.

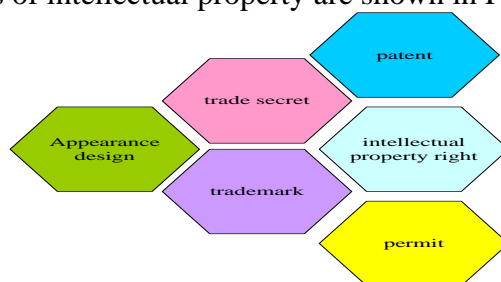


Figure 1: Types of intellectual property

As shown in Figure 1, the types of IPR include patents, trade secrets, designs, trademarks, licenses, etc. Intellectual property is a private right with obvious public welfare nature. In order to meet the needs of society for intellectual products, balance the contradiction between the proprietary interests of owners and the public interests, and safeguard the public interests of the public in obtaining advanced knowledge, the intellectual property law must be protected. In the process of implementing the intellectual property law, the granting of exclusive rights of intellectual products has set an invisible barrier for the exchange of knowledge. However, from the perspective of individuals and the public, the protection provided by the intellectual property system should be comprehensive, effective, reasonable and fair.

Intellectual property is the inevitable result of the development of human social productivity and commodity economy to a certain stage. It is the private property such as commercial credit obtained by human intellectual labor and through long-term accumulation and publicity [10-11]. Big data can also manage IPR. According to the nature, type, laws and regulations, punishment results and other factors of infringement, a set of big data analysis models suitable for infringement would be built, and a set of scientific norms would be formulated accordingly, so as to achieve the purpose of preventing excessive punishment for infringement. The use of big data technology has realized the sharing and synchronization of intellectual property management data among various units, opened up the "information island", and formed a new type of information sharing intellectual property, which not only prevented the duplication and waste of resources, but also effectively prevented the conflict of interest between IPR [12].

#### 3.1 L-diversity Algorithm Based on Privacy Protection Technology

The key to intellectual property law protection based on big data is how to protect the data source, that is, the safe distribution of data [13]. If only the privacy of intellectual property is deleted, although the privacy of data packets can be ensured, a large amount of information useful for scientific research would be lost, so as to make the release of data meaningless. Therefore, in the process of data publication, it is necessary to pay attention to the privacy of IPR and ensure that the published data has certain research value.

The existing cryptographic technology is mainly used to prevent unauthorized third-party access to ensure the security of data [14]. However, unlike this, privacy protection technology does not

restrict access to data. It can be said that the data protected by privacy technology can be accessed by everyone. Therefore, in privacy protection technology, the key is how to ensure the security of data sets. Some scholars have proposed the L-diversity algorithm, which is mainly aimed at solving the anonymity problem. The L-diversity algorithm is shown in Figure 2:

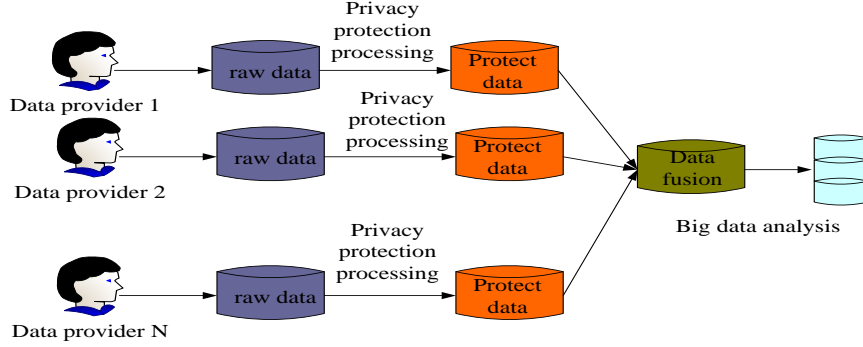


Figure 2: L-diversity algorithm

As shown in Figure 2, the basic idea is to ensure that there are at least 1 different kinds of sensitive information in an equivalent category, so that attackers can judge the relationship between specific individuals and sensitive attributes. In the same category, when a sensitive value of an attribute appears more frequently than other values, L-diversity also has the risk of being violated. The entropy  $Entropy(E)$  of the equivalent class is defined as Formula (1):

$$Entropy(E) = -\sum_{s \in S} p(E, s) \log p(E, s) \quad (1)$$

In the recursive algorithm,  $p$  is the number of different values in the equivalence class. If each equivalent class of published data contains entropy  $Entropy(E) > \log 1$ , the entropy based L-diversity method is satisfied. Furthermore, recursion  $\log p(E, s)$  is more conservative than the entropy based version.

In real life, the privacy exposure risk of intellectual property is mainly determined by the attacker's background knowledge. The attacker can easily obtain the identity information of the target, so that the attacker can judge the location of the attack target according to the background knowledge. If  $A$  is the same sensitive attribute and  $n$  is a random variable, the probability that an attacker can obtain the target's Sensitive Attribute (SA) is the Formula (2):

$$P(A = SA) = \frac{n(G, SA)}{|G|} \quad (2)$$

$|G|$  represents the total number of records, while  $n(G, SA)$  represents the number of sensitive attribute values SA.

Anonymous cost measurement is determined by Hamming distance between tuples. The calculated information loss degree  $CostRT$  is shown in Formula (3):

$$CostRT = \frac{\sum_{i=1}^n \sum_{j=1}^m HM(A_{ij}, A'_j)}{n \times m} \quad (3)$$

Among them,  $HM(A_{ij}, A'_j)$  is the hamming distance from  $A_{ij}$  to  $A'_j$  in the  $i$ th record.

Among anonymous algorithms, information entropy was first used in the system, and its basic

content is to express each attribute anonymously. Formula (4) can also be used in any record:

$$\log \frac{n(q,s)}{\sum_{s \in S} n(q,s')} \geq \log(1) \quad (4)$$

Among them,  $n(q,s)$  represents the number of times  $s$  occurs in the  $q$  cluster. The calculated entropy is inversely proportional to the difficulty of revealing specific elements from the  $q$  cluster. In the anonymous process, different penalty calculation techniques are used for numerical attributes and category attributes. The data attribute is shown in Formula (5).

$$NCP(t) = \sum_{i=1}^n \left( w_i \frac{z_i - b_i}{|A_i|} \right) \quad (5)$$

The difference between the maximum and minimum value of attribute variable  $A_i$  in the data set is  $|A_i|$ , and the weight of attribute variable is  $w_i$ . The left and right limits of interval  $A$  are  $b_i$  and  $z_i$  respectively.

The calculation formula of each corresponding Class  $G$  intellectual property is Formula (6).

$$NCP(G) = \sum_{i=1}^d w_i NCP_{A_i}(G) \quad (6)$$

$d$  is the number of variables in the quasi identifier, and the information loss level of the anonymous table is calculated as the total penalty amount of  $NCP_{A_i}(G)$  for each equivalent class.

Due to the development of confidential technology, intellectual property materials would change over time. In the past, the materials proposed by researchers were issued at one time, and the actual application and research were too ideal.

### 3.2 Necessity and Feasibility of Intellectual Property Law Protection

#### (1) Necessity

In today's era of comprehensive rule of law and innovation driven development, the improvement, publicity and implementation of the protection of intellectual property law are the overall issues of China's economic development, scientific and technological development and cultural prosperity. In the international environment of economic globalization, the improvement of China's international political relations can clear away obstacles to the development of global economic integration. It is found that the all-round and multi-level legal protection of intellectual property has played an important role in protecting innovation and preventing infringement, which is also an inevitable requirement of the rapidly developing information society. The necessity of intellectual property law protection is shown in Figure 3:

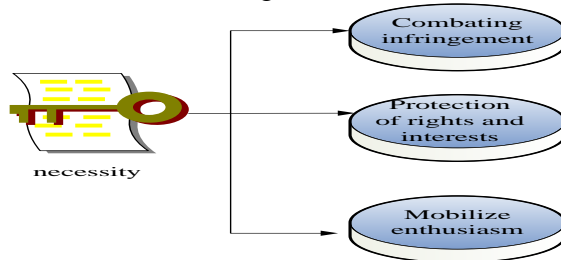


Figure 3: Necessity of intellectual property law protection

As shown in Figure 3, in order to effectively curb intellectual property infringement and protect IPR and interests to mobilize the enthusiasm of intellectual property subjects, the protection of intellectual property laws must be strengthened. It can also promote the development of IPR and advance the development and prosperity of socialist culture, science and technology. The protection of intellectual property law is the driving force of development in the new era, which provides a strong legal guarantee for China's economic development and kinetic energy transformation. Therefore, it is necessary to further improve the protection of intellectual property law, so that innovators would be able to invest more boldly in R&D. The whole society would fully support the development of intellectual property, which would help all sectors of society better understand the concept and guiding ideology of intellectual property law protection.

## (2) Feasibility

The government attaches importance to and supports the public's participation in creative creation, scientific discovery and technological progress. The public should understand the country's position on protecting intellectual property through these measures. It is far from enough to write the spirit of protecting IPR into the Constitution. It should be included in the Basic Law, which plays a great role in promoting the economic, social and cultural development of the country. The feasibility of intellectual property law is shown in Figure 4:

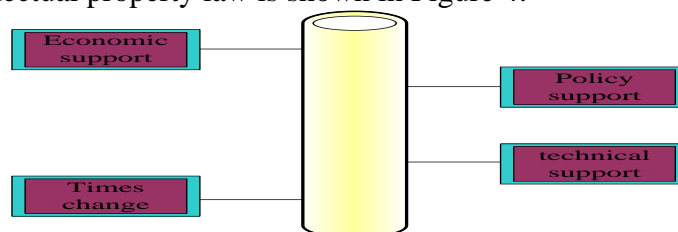


Figure 4: Feasibility of intellectual property law

As shown in Figure 4, the feasibility of intellectual property law includes economic support, policy support, era change and technical support. It can professionally protect IPR and clarify their ownership, so as to return them to economic activities. Through the legal protection of IPR, the time required for legal relief can be shortened to make it more reasonable. It minimizes the losses of enterprises and individuals, so that intellectual property can become productive forces and play its role better. Intellectual property owners can also further develop through innovation to make the entire industrial chain run smoothly, which provides a strong guarantee for the healthy and orderly development of China's economy.

## 4. Current Problems and Countermeasures of Intellectual Property Law Protection

In the information age, network services have brought great convenience to people. People can easily obtain all kinds of intellectual property information they need through the network. Each site is constantly mining data for users' browsing and retrieval to improve service quality and attract users. However, due to the high sharing of intellectual property information, it is also necessary to protect it. In this paper, 410 people who had IPR infringed and sought legal help were investigated.

### 4.1 Investigation Results on the Difficulty of Intellectual Property Law Protection

The experiment conducted an investigation on the difficulty that the public believed in the protection of intellectual property law, as shown in Table 1.

As shown in Table 1, 115 respondents thought that the protection of intellectual property law was very difficult, accounting for 28.0%; 109 people thought it was difficult to protect the intellectual property law, accounting for 26.5%; 70 people thought that the protection of intellectual property

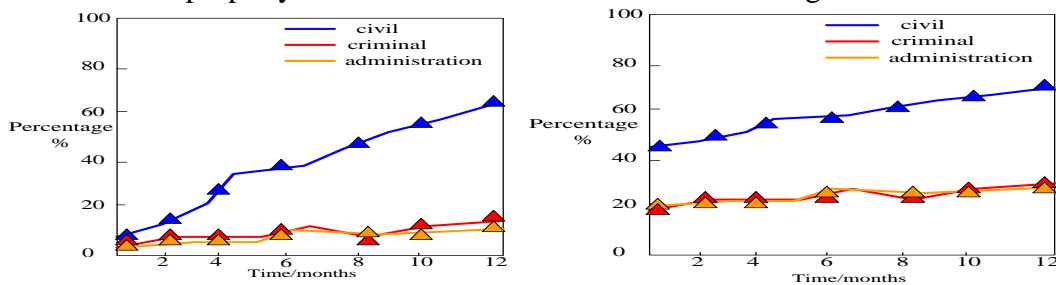
law was generally difficult, accounting for 17.1%; 66 people believed that the IPR protection law was simple, accounting for 16.1%; 50 people believed that the IPR protection law was very simple, accounting for 12.3%. The research results show that with the development of network technology, the problem of network security, especially the legal protection of intellectual property, is becoming increasingly serious.

Table 1: The difficulty of intellectual property law protection

Quality	Number of people	Percentage%
Very difficult	115	28.0
Difficult	109	26.5
Generally difficult	70	17.1
simple	66	16.1
Very simple	50	12.3

## 4.2 Intellectual Property Cases

With the rapid development of economy and technology, the market economy system is constantly improving, and all innovation subjects pay more attention to the use of intellectual property to consolidate and expand the market, so intellectual property disputes would gradually increase. In order to cater to the increasing number of IPR of Chinese enterprises and the frequent occurrence of intellectual property disputes, the protection of intellectual property law should be strengthened and the level of law enforcement should be improved. It can not only protect the legitimate rights and interests of enterprises, but also promote the implementation of China's intellectual property strategy. However, with the protection of China's intellectual property law entering a new historical period, the number of cases is also growing. The development trend of the number of intellectual property cases from 2019 to 2020 is shown in Figure 5.



(a) The number of intellectual property cases in 2019 (left)

(b) The number of intellectual property cases in 2020 (right)

Figure 5: Trends in the number of intellectual property cases from 2019 to 2020

As shown in Figure 5: It can be seen in Figure 5 (a) that the civil incidents in 2019 would exceed 60% at the highest level, while the criminal incidents and administrative incidents would be much less, which is within 20%. It can be seen from Figure 5 (b) that the minimum civil events in 2020 would be more than 40%. Compared with the criminal events and administrative events in 2019, criminal events and administrative events have improved, but they are still far inferior to civil events. This has something to do with the fact that China has always attached great importance to civil affairs, rather than criminal matters, and less to administration.

The development trend of the number of various types of intellectual property civil cases from 2019 to 2020 is shown in Figure 6:

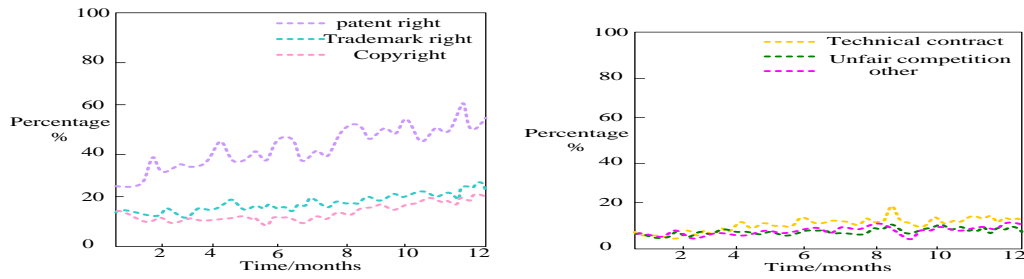


Figure 6: Number of intellectual property civil cases of various types

As shown in Figure 6, intellectual property civil events include patent rights, trademark rights, copyrights, technology contracts, unfair competition and other cases. Among them, the number of patent cases has the highest development trend. This is because the laws and regulations on intellectual property and intangible assets in patent cases are not sound enough, and the existing laws and regulations are not targeted and operational, so special laws and regulations must be formulated to protect people's intellectual property and intangible assets.

### 4.3 Evaluation on the Protection of Intellectual Property Law at the Current Stage

The comprehensively deepening reform and comprehensively governing the country according to law are important ways to build an all-round well-off society. In order to build a moderately prosperous society in an all-round way and significantly improve international competitiveness, an innovative country must be established. With innovation as the driving force, "mass entrepreneurship and innovation" continues to achieve results, which urgently require the establishment of a sound legal protection system. However, the reform of China's intellectual property system is still in progress. Due to the lack of past experience, China's intellectual property law system still has some areas to be improved.

#### (1) The quality of intellectual property judges needs to be improved

The quality of judges directly affects the fair trial of cases. IPR involve a wide range of knowledge, and most of the information and technology are unique, so judges are often unable to fully master these complex professional knowledge. It is difficult to rely on their own ability and experience to solve this problem, which requires the intervention of a third party and the accumulation of judges in the long work. The respondents believe that the quality of intellectual property judges is as shown in Table 2:

Table 2: The quality of intellectual property judges

Quality	Number of people	Percentage%
Very high	40	9.7
Relatively high	36	8.8
Generally high	54	13.2
Not high	128	31.2
Very low	152	37.1

As shown in Table 2, 40 out of 410 respondents believed that the quality of judges was very high, accounting for 9.7%; the number of judges with relatively high quality was 36, accounting for 8.8%; the number of judges who thought that the quality was generally high was 54, accounting for 13.2%; the number of judges who believed that the quality of judges was not high was 128, accounting for 31.2%; the number of judges who thought that the quality of judges was very low was 152, accounting for 37.1%. It can be seen that the quality of judges is not very high in the eyes of the masses.



In the current legal system, the rotation system of judges makes judges change jobs frequently, which is not only detrimental to their professional skills and experience accumulation, but also reduces the quality and efficiency of trial work. In addition, the style of some judges is not optimistic. Although the attitude of the judges towards the people has changed after years of education, there are still inevitably some bad habits. Although the current corruption momentum in China has been effectively curbed, its effectiveness is mainly reflected in the goal of not daring, not being able to, and not wanting to be greedy. When judges do not take the maintenance of the legitimate rights and interests of the parties as the highest task, this gives them the opportunity to operate in the dark. In the protection of intellectual property law, even if there is no temptation of corruption, a judge who has lost his sense of responsibility and honor for the trial work would often have omissions when analyzing, identifying facts and studying laws.

(2) People's awareness of intellectual property law is insufficient

The protection of enterprise intellectual property law is directly related to the scientific research and innovation ability of enterprises, which would also have a significant impact on China's economic and social development. At present, there are still many problems in the protection of China's enterprise intellectual property law, including the reasons of intellectual property protection and management system, as well as man-made reasons. The public's understanding of the intellectual property law is shown in Figure 7:

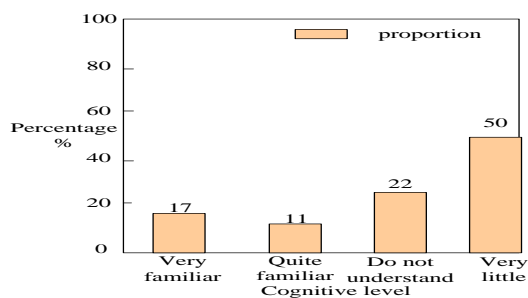


Figure 7: People's understanding of intellectual property law

As shown in Figure 7, 17% of the people thought they knew the intellectual property law very well; the proportion of people who thought they had a better understanding of the intellectual property law was 11%; the proportion of people who thought they did not know the intellectual property law was 22%; the proportion of people who thought they were very ignorant of the intellectual property law was 50%. All enterprises should actively organize and carry out intellectual property education, and hold various lectures and trainings, etc., to enhance people's understanding of IPR. Only when people know the law can they abide by the law and use the law to safeguard their own interests. Therefore, it is an important part of the current work to strengthen the legal publicity of intellectual property and improve the understanding of intellectual property. Through the understanding and research of IPR, this can not only avoid the damage to personal interests, but also protect the interests of the country.

(3) Lack of intellectual property talents

For various reasons, there are many redundant management teams in enterprises, so it is particularly important to strengthen the protection and management of IPR within enterprises. However, the protection of intellectual property law is very different from ordinary administrative work, which requires special talents in intellectual property. At present, Chinese enterprises are short of professional and technical personnel, so the protection of IPR is facing severe challenges and difficulties. The lack of intellectual property talents is shown in Table 3:

As shown in Table 3, 38 people thought that there were very rich intellectual property professionals at present, accounting for 9.2%; the number of people who thought that there were

rich talents was 39, accounting for 9.5%; the number of people who thought that talents were generally rich was 83, accounting for 20.2%; the number of people who thought that there was a shortage of talents was 102, accounting for 24.9%; the number of people who thought that talents were very scarce was 148, accounting for 36.2%. It can be seen that there are few intellectual property professionals.

Table 3: Lack of intellectual property talents

Quality	Number of people	Percentage%
Very rich	38	9.2
Quite rich	39	9.5
Generally rich	83	20.2
lack	102	24.9
Very lacking	148	36.2

To strengthen the protection of IPR of enterprises, it is necessary to strengthen the training of talents and establish a systematic talent training system. The training of enterprise intellectual property management talents should not only have basic knowledge of intellectual property law, but also apply it to practical work. Therefore, it is necessary to retrain with corresponding management experience, reform the existing training methods, and accelerate the output of intellectual property talents.

#### 4.4 Evaluation of Intellectual Property Management and Protection Path in Big Data Era

(1) Strengthen the awareness of intellectual property management and improve the management system

First of all, the understanding of big data of intellectual property management staff should be strengthened. The role of big data in intellectual property management and protection should be recognized, which is an important means to improve the level of intellectual property management and protection. Therefore, big data management must be fully implemented to create a comprehensive and organized method for managing the IPR of big data. In order to realize the unified management of data resources, it is necessary to establish a solid big data intellectual property management system. According to the composition and role of China's intellectual property institutions, they should be scientifically planned, continuously managed and optimized.

In the process of building the intellectual property law system, reasonable regional layout, horizontal and vertical resource allocation need to be paid attention to. The core of the deepening of China's intellectual property law system is to establish an intellectual property high court or an appellate court, so that it has the final review right. In the intellectual property court, civil, criminal and administrative cases should be heard, which is not only conducive to the coordination of the three parties, but also conducive to maintaining the unity of IPR and can also improve the efficiency of the trial. At the same time, experts in the field of intellectual property can be used to improve the quality of intellectual property trials and enhance the legitimate rights and interests of intellectual property, so as to safeguard social and public interests.

(2) Improve China's big data intellectual property management and protection

In terms of publicity organization, direct publicity can be conducted through online forums, radio, exhibition walls, etc. At the same time, the government should also vigorously support the intellectual property publicity of enterprises, and strengthen the knowledge of the intellectual property of enterprises. In terms of publicity means, it needs to combine multiple channels and means to form a three-dimensional publicity model. For example, large-scale intellectual property publicity is held in enterprises, or intellectual property protection manuals are distributed to

employees and the masses of enterprises. At the same time, it is necessary to actively organize symposiums and lectures, and invite intellectual property teachers of relevant majors to communicate face to face with the masses to answer their questions and make the publicity work really come into effect.

### (3) Strengthen the publicity of enterprise intellectual property protection

The use quality and efficiency of IPR are gradually decreasing, so it is necessary to strengthen the research on big data technology, improve the scientific and technological level of China's big data, create China's local big data systems, software, technology, etc., so that big data can be better applied to all industries in China. This would also encourage the improvement of work quality and efficiency in all industries, and support China's economy, science and technology and intellectual property protection, so as to enhance the objectivity and scientificity of China's intellectual property management. In order to promote people's technology and the overall development of the country, people can take advantage of big data.

The protection and management of enterprises' IPR need to be paid attention to; secondly, the publicity of intellectual property should be strengthened, so that the masses have a deeper understanding of intellectual property and can better use intellectual property laws and regulations to safeguard their rights and interests; finally, the achievements of IPR should be shown to the masses to stimulate their innovation spirit.

## 5. Conclusions

With the popularization of the Internet and the rapid development of new generation technologies such as the Internet of Things, artificial intelligence and cloud computing, the amount of data is presented in geometric multiples. In this era of big data, the rapid development of technology has had a huge impact on people's lives. The IPR of enterprises are constantly expanding, and the privacy content involved is also changing. The importance of intellectual property law protection in the construction of databases is gradually emerging, especially in economic interests. In order to analyze the effectiveness of big data on intellectual property law protection, this paper proposed L-diversity algorithm in the method to encrypt and protect intellectual property information and defend attackers, thus improving the effectiveness of protection. In the experiment, the current situation of intellectual property law protection was investigated, and it was found that people generally lacked protection awareness and did not understand intellectual property law. Through research and analysis, the current situation of China's legal protection of IPR can be seen, but some deep-seated problems still need to be understood from the analysis of policies and cases of the Party and the country.

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