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Research on the Development Trend of Copyright Protection Technology Based on Patent Analysis*

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Abstract

Based on digital copyright protection technology, this paper retrieves the relevant patents of digital copyright protection technology in this time period from 1991 to 2015, and analyzes the development trend of the technology in three hierarchical systems, from patent management, patent rights and patent technology, the combination of quantitative and qualitative analyzes the development process, research and development focus and development trends of the Copyright protection technology and establish the Copyright protection technology development trend analysis system, and through patent analysis to explore China's copyright protection technology development, point out the advantages and disadvantages of China in the field of copyright protection technology, and give the theoretical basis for the development of copyright protection technology for government and Technology research and development institutions .

Keywords: Patent Analysis; Copyright Protection; Technological Trend

1 INTRODUCTION

With the development of multimedia technology and Internet technology, China has entered a new era of network communication, but the convenience of network sharing and dissemination, copyright infringement of digital media content, piracy, illegal use increasingly rampant, so that copyright owners suffered economic losses. Copyright protection technology refers to achieve the protection of digital content with a certain calculation method for the purpose of protecting digital content copyright by technology, including e-books, video, audio, pictures, promote people to use digital content through the formal channels. Common copyright protection technology is encryption technology, digital watermarking technology, digital fingerprint technology, identity authentication technology. In the circumstance of the current infringement occurs and the rights more difficult, the use of technical measures to protect the contents of copyright has become the first choice of people.

China has become a veritable intellectual property power and accumulated a wealth of patent information resources, and patents reflect the development of related technology throughout the process[1]. So the patent can be more objective and accurate reflection of the development and progress of technology, its coverage is comprehensive, content is accurate, through the patent search and analysis of the technical field to be studied, you can know the development of the technical field, analyze its development trend, And for the technical field of technical hot spots, technical gaps can provide reference to the data basis[2][3]. Foreign research on copyright protection technology has become more mature, but the domestic research started late, is still in the growth stage, the copyright protection technology research is focused on the network environment copyright protection, management system, legal level and technical level, lacking of depth and relatively thin[4], so the study of copyright protection technology needs to be developed and improved. With the respect of knowledge and the increasing concern about the protection of

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intellectual property rights, the patent analysis of copyright protection technology also becomes more practical.

This paper intends to use the method of patent analysis to study the development process and trend of copyright protection technology. Strictly follow the general process of patent analysis, trying to build the analysis model of technology development trend from patent management, technology and rights level, analyze the development process, research and development focus and development trend of copyright protection technology from quantitative and qualitative combination, and according to patent analysis to explore the development of China's copyright protection technology, point out the advantages and disadvantages of China in the field of copyright protection technology and put forward some suggestions on the development of China's copyright protection technology industry.

2 Acquisition and Arrangement of Patent Technology Patent Data

2.1 Copyright Protection Technology Patent Search

In the process of determining the search keywords, this paper draws on the key words of Liu Kejing 's research on copyright protection technology[5], and has been considered and adjusted comprehensively. Liu Kejing's key words are as follows: DRM or copyright management or copyright protection or digital encryption or rights management or digital rights management or digital rights or public key password or password security or key technology or mobile digital rights management or interoperability digital rights management or content management or digital asset management or Digital property rights or digital watermarks or streaming media copyright or identity.

Liu Kejing and other selected keywords, did not consider the copyright logo technology and copyright tracking / tracing the field of patents, which is flawed to reflect copyright protection technology through patent analysis. So this paper adds three keywords such as "digital fingerprint", "information hiding" and "identity authentication". This article search time is set from 1991 to 2015, the total number of patents received: 2944, of which the invention patents: 2559, utility model: 264, design: 53, invention patent: 1048, Taiwan, China patents: 68 pieces.

2.2 Copyright Protection Technology Patent Cleanup and Indexing

In order to improve the precision, use the classification number denoising and artificial denoising to carry out patent cleanup. In this paper, we disassociate 308 items of unrelated patents in the process of denoising [CN00252342.6, CN02233386.X, CN200610104687.9], and the remaining patents are 2636 items. Randomly selected 100 samples from the de-noised patent, followed by manual reading one by one, 95 of which met the requirements of the search subject, and the precision was 95%; In terms of the recall rate, this paper evaluates the recall rate with the inventor as the entrance. To Samsung Electronics Co., Ltd., the main inventor Zheng Qingren as an example, in this search, a total of 26 patent applications involving Zheng Qingren. With Zheng Qingren as the search factor, a total of 32 patents related to copyright protection technology were obtained. Therefore, the recall rate of this search is (26/32) * 100%, which is 81.3%.

3 Patent Analysis of Copyright Protection Technology

3.1 Analysis on Patent Management of Copyright Protection Technology

1) Analysis of the Number of Patent Applications

By time series analysis of the number of patent applications in the area of copyright protection technology, we can get the development process from 1991 to 2015, as shown in Figure 1.

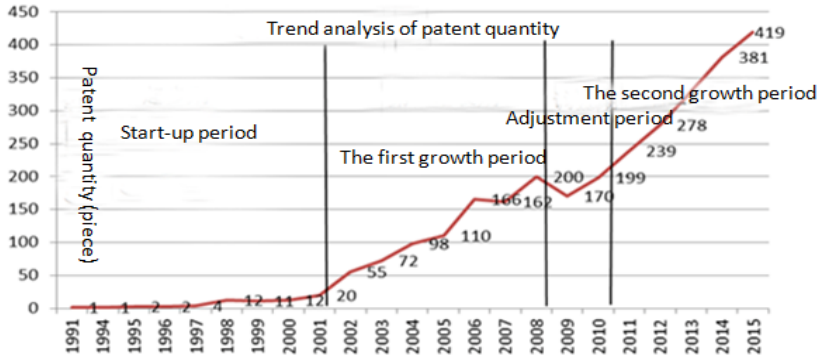

FIG 1 CHINA'S COPYRIGHT PROTECTION TECH PATENT APPLICATION ANNUAL CHANGE SITUATION

As it can be seen from Figure 1, since 1991, Sun Yat-sen University proposed an invention relating to a method and apparatus for preventing copyright infringement of video tapes, and technical patents on copyright protection begins to develop but still in the bud; nowadays, there are 419 patent applications about copyright protection technology in 2015, which has made rapid growth, indicating that China pays more and more attention on research about copyright protection technology.

In the 2636 patent applications for copyright protection technology, the invention patented 2382 items, accounting for 90%; utility model patents 204, accounting for 8%; design patents 50, accounting for only 2%, through the statistical analysis of the number of three types of patents, especially the invention patent, we can see the research and development situation of copyright protection technology.

2) The Inventor Analysis

The main analysis for inventor analysis is the major inventors and the number of their patent applications and the type of technology in the technical field. Through the analysis of the inventor, especially the number of patent applications is among the leading inventors, you can study the research and development strength and direction of such technical personnel. Related enterprises can achieve the required core technology talent introduction based on the analysis. The following describes the top 15 inventors for descriptive statistical analysis, as shown in the table below.

TABLE 1 THE MAIN INVENTOR OF CHINA'S COPYRIGHT PROTECTION TECHNOLOGY

No.	Inventor	patent volume	The main patentee involved	technical fields involved
1	Zheng Qingren	26	Samsung Electronics Co., Ltd.	Digital rights management equipment and methods
2	Yu Huazhang	21	Beijing Flying integrity Technology Co., Ltd	Identity authentication methods and systems
3	Lu Zhou	21	Beijing Flying integrity Technology Co., Ltd	Identity authentication methods and systems
4	Li Binglai	19	Samsung Electronics Co., Ltd.	Digital rights management equipment and methods
5	Wu Runxiang	18	Samsung Electronics Co., Ltd.	Digital rights management equipment and methods
6	Chen Liuzhang	18	Shenzhen City Wenting a data technology	Authentication
7	Li Yan	15	Zhejiang University of Technology, Beijing micro-wisdom panoramic information	Password safe, digital fingerprints

8	Li Yimin	15	Huawei Technologies	Digital copyright protection systems and methods
9	Zhang Lei	13	Founder Group, Xi'an Qingsong Technology, Dalian Olympic Electronic City letter firm	Online login authentication
10	Li Chengdi	13	LG Electronics Co., Ltd.	Digital rights management methods and equipment
11	Li Lizong	13	Tianjin Yi Jie Technology, Tianjin Vocational and Technical Normal University	Multimedia copyright protection / digital watermarking
12	Tan Jianfeng	13	Shanghai everyone network security technology division	Authentication
13	Dang Pei	11	Huawei Technologies	Digital rights management equipment and methods
14	Gao Jietao	11	Beijing Qiqi Intelligent Technology	Identity authentication device

From the table we can found that Zheng Qingren has the largest number of patents in the field of copyright protection technology, mainly in the digital rights management equipment and methods, the main patent owner is Samsung Electronics Co., Ltd.. Followed by Yu Huazhang and Lu Zhou, the two collaborate on the method and system of identity authentication, the patent owner is Beijing Flying integrity Technology Limited. Li Binglai and Wu Runxiang mainly study the digital rights management equipment and methods, the patent owner is Samsung Electronics Co., Ltd.. So it can be found, Samsung Electronics Co., Ltd. has a more concentrated patented inventor, with a wealth of technical talent reserves. Meanwhile, the inventor of a patent is usually not a single person, but a R & D team. Such as Huawei Technologies Co., Ltd. patent applicants R & D team size of 139 people. ZTE Corporation, the applicant R & D team size of 102 people. Samsung Electronics Co., Ltd. R & D team size of 68 people. Moreover, the core technology of different enterprises are different, the same technology sector also has many enterprises involved in and research and development, enterprises can cooperate with each other to achieve win-win situation.

3) Analysis of Patentee

Through the statistical analysis, select the top 10 patentees in the copyright protection technology industry to analyize, we can see the leading companies and institutions in China's current research and development of copyright protection technology from Figure 2.

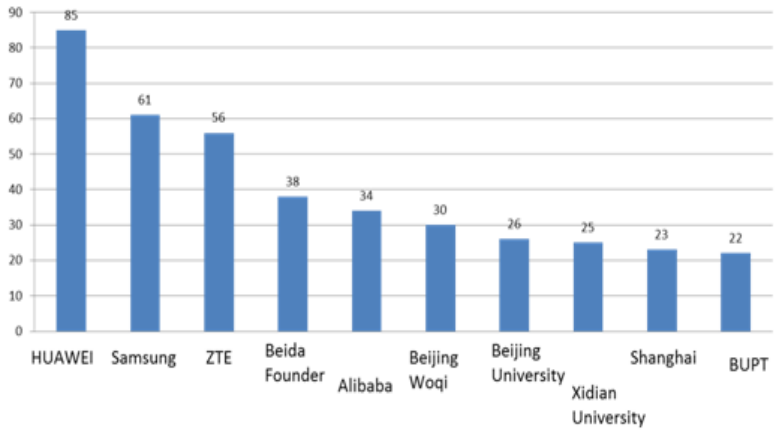

FIG 2 CHINA'S COPYRIGHT PROTECTION TECH PATENT OWNERS DISTRIBUTION

The top 10 main entrants include six large enterprises and four colleges and universities. Among them, Huawei Technologies Co., Ltd. has the largest number of patent applications, indicating that Huawei does more research in copyright protection and occupies the leading position; followed by Samsung Electronics Co., Ltd., came in third is

ZTE Corporation. In addition, in the top 10, there are four colleges and universities, indicating that institutions of higher learning have become an important force in China's copyright protection technology.

4) IPC Classification Analysis

From the statistical analysis results, in all 2636 patents, belonging to the G class has 1298, belonging to the H class has 1282, copyright protection technology patents are almost all concentrated in the G and H Department. Then do statistical analysis according to the IPC class of copyright protection technology, and select the patent application among the top 11 IPC class analysis, as shown in Figure 3.

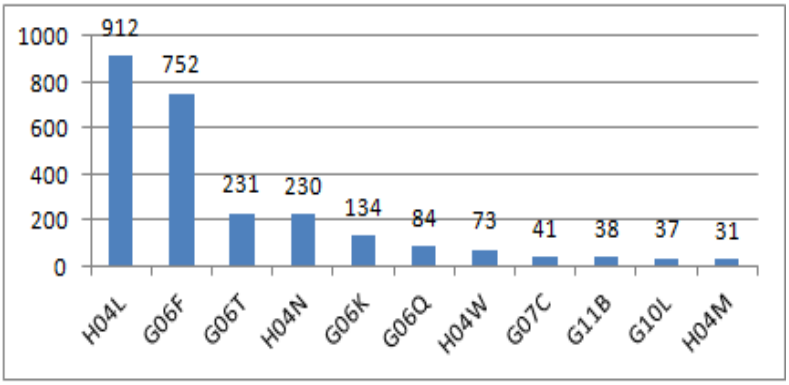

FIG 3 THE FIRST ELEVEN IPC SMALL CALSS NUMBER

The technical implications of these IPC subcategories are as follows:

H04L - Digital information transmission, such as telegraph communication; G06F - Digital data processing. G06T - General image data processing or generation. H04N - Image communication, such as television. G06K - data identification; data representation; record carrier; record carrier processing. G06Q - A data processing system or method for administrative, commercial, financial, regulatory, supervisory or predictive purposes. H04W - wireless communication network. G07C - time register or attendance register. Register or indicate the operation of the machine; generate random numbers; vote or lottery equipment. G11B - information storage based on the relative movement between the record carrier and the transducer. G10L - language analysis or synthesis; language recognition. H04M - telephone communication.

Through Figure 3, we can see that the current research in the field of copyright protection technology is mainly focused on the digital information transmission and electric digital data processing, and the research on image data processing and image communication is also the focus of research and development.

From the development of IPC subclass technology over time, it can be seen from Figure 4 that from 1991 to 1999, such technology is still in its infancy; from 2000, the relevant technology has been rapidly developing, especially H04L and G06F, and in recent years, research on the H04L class technology slightly more than G06F class technology. Other types of technology show a steady development trend.

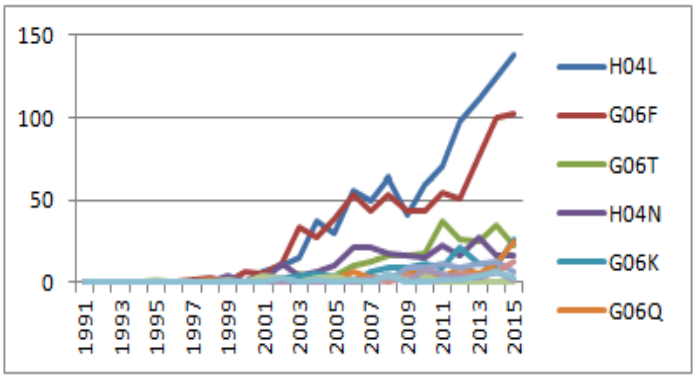

FIG 4 THE FIRST ELEVEN IPC SMALL CLASS TECHNOLOGY TRENDS

3.2 Copyright Protection Technology Patent Rights Analysis

Each legal state of the patent is valuable for patent analysis. On the one hand, an individual or an enterprise can understand the status of the patent in a particular period by examining the legal status of a patent, including its validity and patent rights; on the other hand, the patent for invalidation can be used by an individual or an enterprise, to analyze its failure reasons, and achieve its commercial value. Based on the copyright protection technology patent data from 1995 to 2015, a patent legal status chart has been drawn, as shown in Figure 5 below.

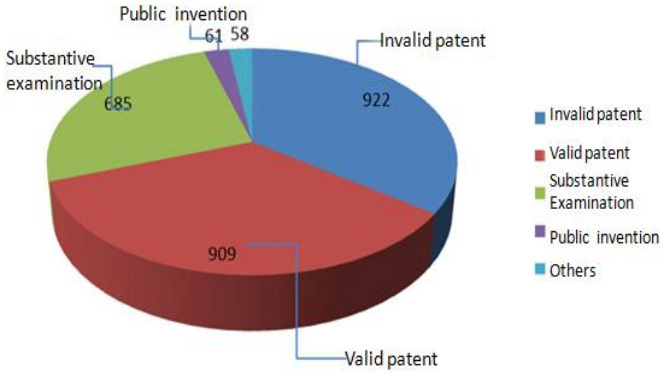

FIG 5 ANALYSIS OF PATENT LEGAL STATUS

Figure 5 can be intuitively seen, the current failure of patents and effective patents accounted for the largest, and the two are almost the same, and there are more than a quarter of the patents in the substantive review phase, this phenomenon shows the copyright protection technology patents are still in a booming, it can be predicted that copyright protection technology innovation research will remain in a rapid development trend in the next period of time.

3.3 Analysis of Patent Technology of Copyright Protection Technology

This paper analyzes the two aspects of technical efficiency analysis and technical life cycle. Among them, the technical efficiency analysis is used to construct the co-word matrix to find the technical hotspot and technical gap in the field of copyright protection technology, and guide the research and development of the enterprise. The technology life cycle method can visually observe the development process of the research technology and determine the stage of its development. Through the analysis of the current technical stage infer the future development trend. Generally speaking, technology can be divided into technological sprouting, technological growth, technological maturity and technological downturn in the development process, and if there are external factors or technical innovation after the recession, the technology will enter the growth period once again.

5) Analysis of Technical Effectiveness

Because the patent analysis of patent data is a little large, this paper uses open source R software for text mining, extracts technical words and power words from the patent summary for the text data visualization analysis. Thus finding the number of patents that contain the technical and power words, and the statistical analysis becomes the technical utility matrix and is displayed with a bubble map. The size and intensity of the bubble area is the standard to determine the patent is a key patent or technical gaps.

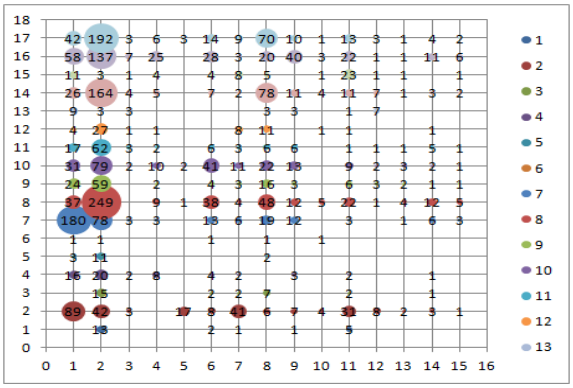

FIG 6 TECHNICAL UTILITY MATRIX

Illustration:

- X-axis: 1 - Privacy, 2 - user / account authentication, 3 - digital content distribution, 4 - digital content sharing, 5 - prevention of tampering, 6 - rights management and anti - copy, 7 - digital content security, 8 - digital content Authentication / identification, 9 - easy to use, 10 - digital content authorization, 11 - digital content delivery / transmission, 12 - digital content tracking / tracking, 13 - usage restrictions, 14 - transaction record, 15 -
- Y-axis: 1-channel technology, 2-digital watermark, 3-RFID, 4-symmetric / asymmetric encryption, 5-digit summary / message verification code / check code, 6-holography, 7 certificate / certificate, 8 12-barcode / barcode / two-dimensional code, 13-digital fingerprint, 14-biometric / iris / serial number, 10-mark / Fingerprint, 15 - information hiding, 16 - key / key management, 17 - feature / eigenvalues.

From the comprehensive analysis of Figure 6 shows that the domestic research on copyright protection technology mainly focus on the digital content of the user's privacy protection, user authentication and rights management, the identification of digital content. As for digital content to prevent tampering, authorization and tracking technology is still in the blank or initial stage. Among them, research on the use of label or logo technology, digital fingerprint technology, information hiding technology and feature / eigenvalue technology to achieve the digital content tracking, restrictions, transactions and packaging is still relatively small, reflected in the reality is that the copyright protection technology in P2P environment is still in the research stage. The copyright protection in P2P environment may be a new research direction in the popularization of P2P and other communication technologies.

6) Analysis of Technical Life Cycle

The three-dimensional technical lifecycle plans are established around the three variables of application year, number of applicants and patent applications. The data from the following figure can be seen, before 1991 - 1999, belonging to the budding period of technology. Since then, the number of patent applications has started to rise, especially in 2006, applicants reached 105 people, and after the continuous growth, the number of patent applications also increased rapidly, reaching its peak in 2015. Indicating that research on copyright protection technology is in the growth of such kind of technology.

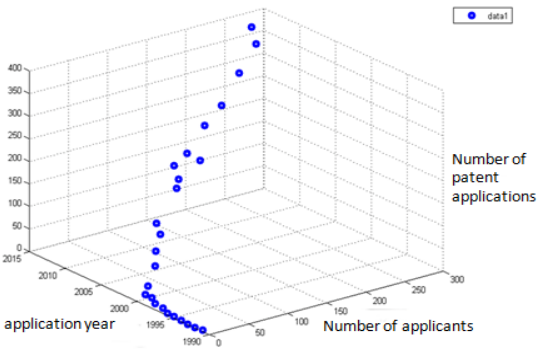

FIG 7 TECHNICAL LIFE CYCLE DIAGRAM

4 CONCLUSION

At the level of patent management, the number of patent applications will continue to be in a growing trend. Huawei, Samsung and ZTE are the leaders in the field of technology. Colleges and universities have become a vital force in technology research and development. Copyright protection technology is relatively concentrated in digital information transmission and Digital data processing and other fields. At the level of patent rights, the proportion of effective patents and invalidation patents is considerable, indicating that the technology is still booming. At the patent level, domestic research focuses on the privacy protection of digital content users, user authentication and rights management, the identification of digital content, but for digital content to prevent tampering, authorization and tracking technology is still in the blank or the initial stage; From the life cycle point of view, the technical field is in the technology growth period, and there is still huge room for development. From the general trend point of view, the patented research and development and application in this area is in a state of vigorous development, and in the next period of time will continue to maintain rapid development.

Facing the rapid development of copyright protection technology, the government should further develop its own role, improve the relevant legal system and network copyright management system; timely release patent maps, and guide the development of copyright protection technology. In the increasingly fierce competition today, enterprises out to accelerate the ability to enhance independent innovation, improve the patent licensing rate, make a reasonable patent layout for the field of technical hot spots, technical gaps; In addition, strengthen the use of the patent failure, and timely tracking of competitors, develop your own research and development strategy.

This paper analyzes the object of copyright protection technology, compared to other physical patent analysis there is a certain degree of abstraction, feature words in technical analysis of patent analysis, so this paper has a unique idea on the choice of technical words and power words on the power diagram analysis. This paper studies the development trend of copyright technology from the perspective of patent analysis, innovatively presents a model framework for analyzing the trend of technology development, analyzes the development trend of technology from multiple levels and multiple perspectives, which enriches the theoretical research system of copyright protection technology and provides the theoretical basis for the future copyright protection technology and related fields. Through the patent analysis method, from the patent management, patent rights and patent technology three levels to analyze development trends, and through patent analysis to explore the development of China's copyright protection technology, point out the advantages and disadvantages of China in the field of copyright protection technology, which puts forward the idea of copyright technology research and development for the government and technology research and development institutions.

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