



Artificial Intelligence Patents in Digital Enterprises

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Abstract

The subject matter of this paper are patents in the field of artificial intelligence in digital enterprises. The paper analyzes the nature of artificial intelligence, providing examples from European and international practice. The influence of artificial intelligence on various spheres of activity and especially on education has been identified. The patent protection of the innovative products related to artificial intelligence of the digital enterprises is indicated. By obtaining patent protection, patent holders can be monopolists in a particular market and territory for a limited time. Examples of artificial intelligence patents for inventions have been identified. The essence of digital enterprises is revealed, and examples of digital enterprises in international aspect are given. Artificial intelligence has a strong global impact on intellectual property, and in particular on inventions. The present study will focus on the importance of artificial intelligence in the innovative activity of digital enterprises and the way which it affects digital competitiveness. New developments of companies in the area of artificial intelligence, which have obtained patent protection and have an impact on education, will be considered.

Keywords: *Artificial intelligence, patent protection, digital enterprises, digital competitiveness, intellectual property*

1. Introduction

This paper will address the topic of artificial intelligence (AI) in digital enterprises, including the influence of artificial intelligence on various spheres of activity and especially on education. The modern world of innovative industries and globalization leads to the creation of digital enterprises, and high-tech development of industries contributes to the patenting of inventions in areas such as artificial intelligence, including those related to education. Intellectual property (IP), and patents, are a tool for "technological progress" that encourages digital enterprises to invest in the creation of new technological developments, which lead to digital competitiveness over other business entities. IP is a factor of company competitiveness. [1]

The essence of AI patents is identified, and examples of digital enterprises are given.

The subject matter of this paper are artificial intelligence patents in digital enterprises.

2. Artificial Intelligence

2.1. Essence of Artificial Intelligence

Artificial intelligence simulates human behavior or thinking and can be trained to solve specific problems. AI is a combination of machine learning and deep learning techniques. Using machine learning, computers find information without being told where to look. Instead, they use algorithms that learn from data in an interactive process. Machine learning is a general term for a set of techniques and tools which help computers learn and adapt on their own. Machine learning algorithms support the AI to learn without being explicitly programmed to perform the desired action. One of the well-known machine learning applications is the way e-mail providers help deal with spam. Spam filters use an algorithm to identify and move new types of spam to the spam folder. Deep learning can be seen as a subset of machine learning. This is an area that is based on learning and self-improvement through the study of computer algorithms. While machine learning uses simpler concepts, deep learning works with artificial neural networks that are designed to mimic how people think and learn. Large and complex neural networks allow computers to observe, learn, and respond to complicated situations faster than humans. Deep learning helps image classification, language translation, speech recognition. [2]

2.2. Areas of Application

Before considering the areas of application of artificial intelligence in education, it should be noted that artificial intelligence is used in almost every area of modern human life. It would be difficult to comprehensively define each of its applications, but some of the most commonly used areas are e-commerce, navigation, robotics, healthcare, agriculture, social media, autonomous vehicles, space, banking, creativity and more.



Regarding education, some of the areas of activity of digital enterprises are the following.

2.2.1. Artificial intelligence can be a teaching assistant

AI can always be next to the student, which is impossible in other conditions. Examples of this type of application are “Brainly” (a social network where students interact by discussing school tasks), “Thinkster Math” (a math application that combines a standard curriculum and individual teaching style) and “Netex learning” (helps teachers to engage interactively audio and video content). [3]

2.2.2. Artificial intelligence can automate the assessment of knowledge

Testing exams are time consuming for the teachers. By automating assessment, for example, the teacher will not waste so much time and effort, and assessment by AI will be also objective.

2.2.3. Artificial intelligence can analyze students’ behavior

AI-related cameras can not only automatically monitor attendance, but also analyze students’ behavior. [4]

2.2.4. Artificial intelligence can improve the education system

AI can help address the problems of low-quality education, as well as improve the existing education system.

3. Digital Enterprises

3.1. Nature of Digital Enterprises

There are different definitions of the term digital enterprise and there is no unambiguous terminology. The digital enterprise has completed a digital transformation, digital competitiveness and has included all-digital tools and technologies in its field of activity - from the idea itself through implementation to use. In a broad sense, digitalization transforms the original business model of the enterprise and creates new business opportunities by using globally distributed digitalized assets and organizational resources. [5]

3.2. Examples of Digital Enterprises

There are various examples of digital enterprises, both at the international level and on the territory of Bulgaria. Globally, good examples are Ford and Microsoft, as well as those operating in the information and communication technology sector. The development of digital enterprises is one of the best opportunities for countries to increase their export potential and competitiveness and to retain their young and talented staff.

According to a study conducted on the territory of Bulgaria by “Economic Development via Innovation and Technology” in the period between 2008 and 2016 the number of employees in the field of information technology has increased from 18 to 38 thousand people, and foreign direct investment has increased from 104 to 232 million euros. 95% of digital companies in Bulgaria have at least one founder with higher education, and in 23% of cases it is a bachelor's degree, in 63% - a master's degree, and in 9% - a doctoral degree or higher. Only 5% of digital enterprises are founded by entrepreneurs whose highest education is secondary or lower. [6] Examples of digital enterprises in Bulgaria are “Unicredit Bulbank” and “Musala Soft”.

4. Patents

Legal protection of a patentable invention is granted by a patent. Patentable is the invention which meets the criteria for patentability - novelty, inventive step, and industrial applicability. Patents provide number of benefits to their owners and a high return on investment made in the development of technological products. By using patentable inventions, an enterprise can gain a significant profit if it succeeds in imposing the patent monopoly properly and enjoys the advantages which it has as the holder of an exclusive right over the invention. The validity of the patent has a time limit - the term of protection is 20 years from the date of filing the patent application and is only for the territory of the countries which patent protection is granted for, namely the countries specified in the granted patent.

5. Examples of Patented Inventions in Artificial Intelligence and Education

There is a significant trend in the world to invest in artificial intelligence technologies (it is estimated that by 2025 they will reach \$ 50 billion), the number of patents for these technologies is increasing (in



2016). IBM and Microsoft are leaders in AI patenting in various fields related to artificial intelligence. IBM has the largest portfolio of AI patent applications with 8290 inventions, followed by Microsoft with 5,930. In some areas, the largest number of patent applications come from companies with a high degree of specialization and experience in this field such as Baidu, Toyota, Bosch, Siemens, Philips and Samsung. [7]

One of the patented inventions in the field of artificial intelligence and education are the following:

5.1. Method And Apparatus For Providing Education Service Using Satellite Imagery Based On Artificial Intelligence

Patent № KR 102244678 B1. The patent is granted for the territory of South Korea. The name of the patent owner is Contec Co Ltd.

5.2. System For Providing Artificial Intelligent Home Education Big Data Platform By Using Sampling Method Based On Mobile Device And The Operating Method Of The Same

5.3. Patent № US 10997621 B1. The patent is granted for the territory of USA and the patent owner is Kwon Yonghyun.

6. Patent Searches at Online Patent Database

The patent research was carried out according to a pre-established specialized methodology for conducting patent research. [8]

6.1. Determining the parameters of a patent search

The purpose and subject matter of this patent search is to identify the patent applications and patents granted in artificial intelligence and education. The territories covered by the study are China, South Korea, and USA. These are the countries that have the largest number of applications and patents granted in the relevant field. The patent study covers the period from May 2001 to May 2021, or a total of 20 (twenty) years. The patent search is carried out at Lens Online Database.

6.2. Systematization of patent documentation

The systematization of the information was done by countries, companies, years, as well as by the number of applications for inventions and patents granted.

6.3. Results of the study and analysis of the information

Patent research was conducted by subject "Artificial intelligence and education".

The patent applications filed during the period May 2001 to May 2021 are 81 and the patents granted are 5. [9]

Figure 1 Patent applications and granted patent for the period May 2001 to May 2021

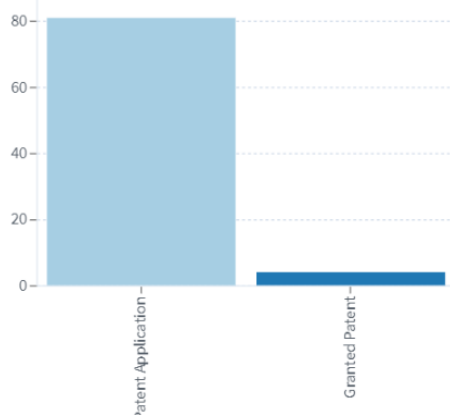


Figure 2 Figure 2 shows the number of patent documents published over the years - in 2003 there was one result found, in 2018 - 13, in 2019 - 32, in 2020 - 31 documents, and in 2020 - 8 documents.



Publication Year

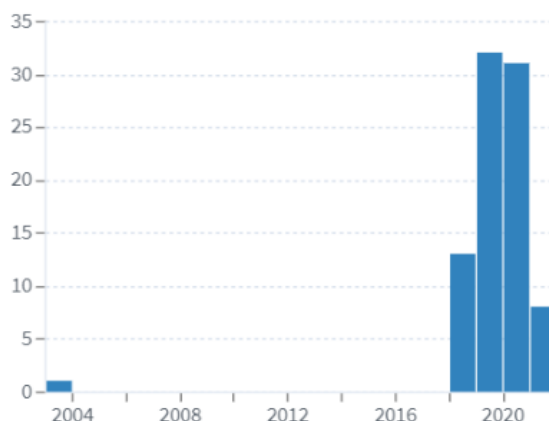


Table 1 lists the applicants with the highest number of applications filed in the field of artificial intelligence and education.

Company	Number of patents applications and granted patents
Gansu Pugongying Information Tech Co Ltd	8
Daguo Innovation Intelligent Tech Dongguan Co Ltd	4
Anhui Mingsi Tech Co Ltd	3
Shanghai Yixue Education Tech Co Ltd	3
Gansu Pugongying Information Tech Co	3
Shenzhen Hongtu Education Network Tech Co Ltd	2
Guangyuan Liangzhahui Tech Co Ltd	2
Zhejiang Chuangke Network Tech Co Ltd	2

6.4. Conclusion of the search

Based on the results of the study, it can be concluded that in the initial years the applicant activity is zero and it increases in recent years - in 2018, 2019 and 2020. Applicants for patents in the field of artificial intelligence and education are mainly Chinese individuals and legal entities.

7. Conclusion

Digital businesses need to make significant changes to their patent policy. For a digital enterprise to be successful, it must invest in the creation of technological developments in the field of artificial intelligence, which will receive patent protection. Regarding the Bulgarian business environment, it should be noted that digital enterprises do not create innovative products in the field of artificial intelligence to be protected by a patent for an invention.

References

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