

Discussion on the Integration and Application of Artificial Intelligence, Big Data and Cloud Computing

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Abstract: *With the development of the Internet and technology, a revolution in information technology is taking place. Artificial intelligence, big data and cloud computing have been applied in various fields, promoted social progress and brought new growth points for economic development. Artificial intelligence, big data, and cloud computing are independent, mutually reinforcing, and complementary to each other. They are also gradually merging from a single development direction to a three-dimensional integration, forming the "ABC Golden Triangle." In the future, the integrated development of the three is an inevitable development trend, and the integrated application of the three will also be reflected in all walks of life. Based on it, this article discusses the integration, application fields and future development trends of artificial intelligence, big data, and cloud computing.*

Keywords: *Artificial Intelligence, Big Data, Cloud Computing, Integration, Application*

1. Introduction

With the rise and popularization of computer science, information technology with the Internet as its core is constantly reforming and iterating. The initial simple tool system is gradually transitioning to an adaptive system and a complex giant system. Various high technologies have emerged accordingly, such as artificial intelligence, big data, and cloud computing. Their continuous upgrades and breakthroughs have accelerated social development and created lots of economic growth points.

In terms of concept and performance, artificial intelligence, big data, and cloud computing are independent of each other, with different characteristics and fields of focus. From the application form and development direction, the three are complementary and closely related. Among them, artificial intelligence first appeared in 1956 and experienced three ups and downs. The emergence of big data solved the bottleneck encountered by artificial intelligence in terms of computing power and training data volume. The joint application of artificial intelligence and distributed technology of big data promotes the upgrade of artificial intelligence and generates huge production value. Due to the promotion and development of big data, more and more data are gathered on the platform. Enterprise big data and technology platforms need the support and response of branches. The emergence of cloud computing information processing technology realizes the further collaboration between artificial intelligence and big data in the future. At the same time, the integration of cloud computing and big data has laid a solid basis for the progress of artificial intelligence, and provided a boost for innovation and breakthroughs.

Driven by the Internet, the applications of these three can be seen everywhere, such as various information platforms, shopping platforms, public management platforms and other fields. The application of information technology has brought convenience to people both in their lives and work. The application of artificial intelligence and cloud computing also plays a significant role in promoting human's digital and intelligent work and life. It can be seen that the integrated development of the three is the future trend, but at the current stage, the integrated development and application of the three are still in the preliminary stage of exploration. In real applications, there are still many problems to be solved. This article discusses the future integration and application of artificial intelligence, big data, and cloud computing, as well as the future development direction.

2. Overview of Artificial Intelligence, Big Data, and Cloud Computing

Artificial Intelligence, referred to as AI, is an important part of computer science. It was first proposed by Dartmouth College in the United States in 1956, and has experienced three ups and downs [1]. Artificial intelligence is an important link in the development of intelligent society. It is a subject that studies how the computer simulates, extends, and extends the theory, technology and application system of human intelligence. The science involved in artificial intelligence is very extensive, algorithm is the core of artificial intelligence, data and calculation is the foundation. The direction of artificial intelligence mainly includes robot, image and language recognition, natural language processing, expert system and so on [2]. Artificial intelligence is essentially an information processing system that simulates human thinking and actions, and can endure machines with information processing capabilities equal to or even beyond human beings. It has formed a border subject that crosses natural sciences, social sciences, and technical sciences. It is also a product of technological innovation and social development [3]. From the perspective of human thinking, it covers logical thinking, image thinking and inspirational thinking. In the process of transforming artificial intelligence with big data as the core to artificial intelligence with machine learning as the core, the popularization and application of artificial intelligence subversive changes the elements and structure of productive forces and liberates people from alienated labor and unreasonable economic relations [4].

Michael Cox and David Ellsworth were the first to use the term "Big Data", which refers to the use of a larger amount of scientific data for visualization. At present, there are many definitions of big data [5]. The most famous version may come from IBM [6]. It believes that big data can be described by any or all of the three "V" characters to investigate situations, events, etc.: volume, variety, and velocity. In the "Science" magazine published in 2008, "Big Data" is defined as "represents the progress of the human cognitive process, usually including data sets beyond the current technology, methods and theoretical capabilities, these data sets cannot capture, manage and process data within a tolerable time" [7]. Gartner's definition of big data is: "Big data is high-capacity, high-speed and/or high-diversity information assets that require new forms of processing to enhance decision-making, insight and discovery, and process optimization" [8]. In simple terms, big data refers to massive information processing, optimization, and classification. In a broad sense, it is not only to master huge amounts of data information, but also to carry out professional and systematic processing of these data containing various meanings. In a narrow sense, big data and cloud computing are inseparable. Big data is also information that cannot be processed by a single computer and must be processed by a distributed architecture. Big data itself is the emerging distributed mining of massive data. The processing technology of big data must rely on the distributed data and processing of cloud computing and the virtualization processing technology of cloud computing.

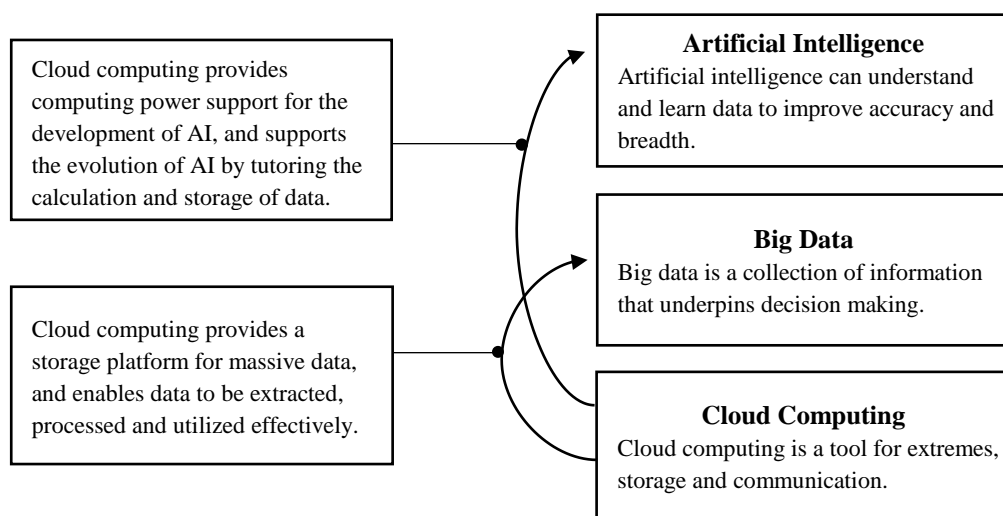


Figure 1: Functions of Artificial intelligence, Big data and Cloud computing

Cloud computing was created at the end of 2007. Because it can provide a flexible and dynamic IT infrastructure, a QoS-guaranteed computing environment and configurable software services, it has

become a hot topic at present. Cloud computing is also developed on the basis of the progress of Internet computer technology. Cloud computing realizes the virtualized information and data resources through the relevant service information, usage and delivery mode of Internet computers, coupled with the dynamic and easily extensible technologies on the Internet. The National Institute of Standards and Technology (NIST) defines cloud computing as "a model that allows ubiquitous, convenient, and on-demand network access to a shared pool of configurable computing resources (for example, network, server, storage), which can be quickly supplied and released" [9]. Cloud Computing is an information use and delivery model based on Internet technology. It is a virtualized resource computing that provides dynamic information through the Internet. Cloud computing can provide convenient, fast, and effective network information [10]. The computing power of cloud computing can reach 10 trillion calculations per second, which can even simulate a nuclear explosion in the real world, and the flow of bank transfers can be calculated instantly.

3. Integration and Application of Artificial Intelligence, Big Data, and Cloud Computing

3.1. Integration and Application of Artificial Intelligence, Big Data, and Cloud Computing

At present, artificial intelligence, big data, and cloud computing are developing actively, and have been applied to many industries and fields. Among them, big data and cloud computing have injected new impetus into the reform of artificial intelligence. Besides, the use of artificial intelligence and big data has also created a broader space for cloud computing, allowing the level of cloud computing to develop in a deeper direction. With the current level of science and technology in China, China's artificial intelligence, big data and cloud computing are still in the process of continuous research, and through this research process to create a better environment for the development of these three technologies [11]. Among them, artificial intelligence is closely related to people and is used most frequently in daily life. For example, the smart home and the intelligent voice function in mobile phones have fully proved that artificial intelligence, big data and cloud computing has been fully developed.

The continuous development of big data has been put into various industries, and in the process of application, enterprises have carried out in-depth excavation of their business value. For big data to have a more permanent development, it will have to rely on cloud computing technology. The storage and computing functions in cloud computing can promote the development and popularization of the Internet of Things and artificial intelligence. Consequently, the progress of cloud computing will also have a broader space. In addition, as the scale and types of data continue to increase, cloud computing is needed to process and calculate massive data and types. This also indicates that the value of cloud computing and cloud services has been fully brought into play and become the basis for the advance of artificial intelligence life. Internet technology generates a lot of economic value in the process of updating, and cloud computing provides the basic technology for this process. The evolution of cloud computing has had a huge impact on various industries. Therefore, as cloud computing becomes more and more mature, it will be more and more widely used and will become an important standard for judging industry standards in the future process.

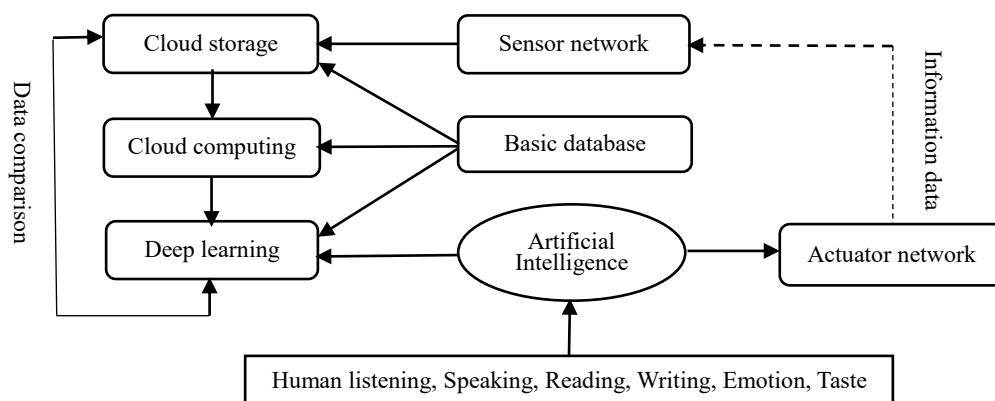


Figure 2: The connection between Artificial intelligence, Big data and Cloud computing

Artificial intelligence has limitations in the upgrading and reform. To solve these problems, we

must rely on big data and cloud computing. However, the application of traditional big data and cloud computing cannot completely solve the problems of the flexibility and practicality of artificial intelligence. The development of artificial intelligence is inseparable from big data. This data must be analyzed and processed through cloud computing technology to achieve the diversification of AI development. For example, smart logistics in hospitals uses cloud computing technology to scientifically classify and manage all kinds of drugs. In the progress of artificial intelligence, it also needs the support of big data, which is inseparable from big data science. The advance of big data science has made artificial intelligence technology reach a new height. Therefore, the relationship among artificial intelligence, big data and cloud computing is complementary to each other (see Figure 2).

3.2. Application of Trinity

Firstly, the development direction of the integration of the three is multi-faceted and very wide. It not only covers digital recognition, analysis, and processing, including the recognition, analysis, and processing of different symbols such as sound, image, behavior, and even animal language. After the integration of the three, the technology breaks the boundaries and breaks through its shortcomings by identifying, analyzing, and processing, so as to provide users with high-quality and accurate information. Secondly, the integration will inevitably bring many problems: such as the security of cloud computing, the sharing and privacy of big data, and the cost of artificial intelligence. Examples of practical applications of trinity integration are as follows.

3.2.1. Medical Internet of Things

Smart medical care is based on the interconnection of artificial intelligence, cloud computing and big data to break the data island and establish medical full connectivity. The use of big data is more likely to become the breakthrough point of smart medical care. The standard and large volume of image data provide the most important prerequisite for the application of AI in this field. Through more mature algorithms and big data applications, machine reading can be more "objective, accurate, and efficient", and it also makes it possible for machines to be comparable to humans in medical imaging, and even to replace humans. However, in the past, a lot of medical data was isolated. A device generated an isolated island of data, and a hospital generated an isolated island of data. When all these "isolated islands" are connected together, it is really big data. In the meantime, the combination of artificial intelligence, cloud computing, and big data technology is also an inevitable trend, which can create value around every link of data. Nowadays in medical image analysis, the combination of "cloud technology + big data + AI" is gradually breaking the isolated island of medical data: through the interconnection of cloud computing and big data technology, all medical institutions can establish a borderless medical full connection.

3.2.2. Security System

For the past few years, the advance of the industry represented by video surveillance as its core is moving towards ultra-high-definition, intelligent and integrated applications. The data collection volume of existing video surveillance systems in systematic projects is showing linear growth, especially the beginning of the Internet of Things construction. In the case of huge amounts of data, the requirements for efficient, timely storage and processing are constantly increasing, and it is impacting the traditional storage system. Unfortunately, the original storage systems cannot meet the new requirements of the big data era, and new storage technology support is urgently needed. The existing business model also expands new space for AI technology in security. From security IT to Internet Plus, from artificial intelligence-enabled security to ICT enterprises into security, with the digital transformation of all industries in the country to the depth of development, in the support of big data, cloud computing, artificial intelligence security is heading for a new change and transformation. Driven by digital transformation, traditional security systems have begun to move from closed to open. Analogue cameras have been replaced by network cameras, and matrixes have been gradually replaced by DVR and other systems. Networking and integration have gradually become the dominant security system. Meanwhile, big data and cloud technology began to be more and more applied in the construction of video surveillance system, and cloud-based and clustered big data platforms become the key to the security system.

3.2.3. AI Education

Under the evolution of AI technology, the education industry is gradually moving towards Internet technology teaching. In this context, the Internet company giant Baidu launched the "Baidu Education

Brain". The smart education model is not the only innovation of the traditional education model, but is also based on the three major technologies of AI technology, big data, and cloud computing, which integrates the industry's massive high-quality resources, huge industry data, and accurate user data to provide enterprise-level services for the entire education industry. At present, in the education information industry, the more mature products of artificial intelligence education are mainly intelligent correction, intelligent question bank, adaptive learning and graded reading, which assume the role of teaching aid. In the meantime, with the addition of big data, education big data provides the basis for artificial intelligence data analysis, and artificial intelligence will give new functions to education management. Cloud computing can also provide landing application scenarios for a variety of technologies, effectively allocate and manage information resources, and realize dynamic information, data, resources real-time sharing. In the future, under the integration of the three, a data-driven education management information system is expected to be built.

3.2.4. Smart Transportation

Smart transportation will rely on the Internet of Things, cloud computing, big data, artificial intelligence and other information technologies to achieve intelligent management of urban rail transit, public transportation systems and highways. Cooperative intelligent transportation and autonomous driving may become the focus of smart transportation. Intelligent transportation is based on intelligent transportation, adhering to the concept of "low carbon, efficient, safe, sustainable, people-oriented". In addition to the intelligent control of information technology, intelligent transportation also includes the intelligent joining of people and vehicles, people-oriented, sustainable development and other connotation, paying more attention to personal experience. The key technology of smart transportation mainly includes Internet of things technology, artificial intelligence, big data technology, cloud computing technology and mobile Internet technology. These technologies provide effective technical support for the development of the smart transportation industry. Artificial Intelligence: By using various sensors to collect enough data on all traffic main lines in the city, according to which can create a real-time intelligent digital model of traffic flow, so as to optimize the city traffic. Big data: Fully excavate and utilize the value of information data, activate existing data, apply and evaluate, and serve the management and decision-making of the transportation department. Cloud computing: Provides a new model for the storage of various types of traffic data. The establishment of a "traffic cloud" breaks the "information island" and thoroughly realizes the sharing of information resources and system interconnection.

4. Discussion on the Future Development of the Trinity

4.1. Pattern Recognition

Pattern recognition refers to functions such as processing and automatic interpretation through mathematical calculations. The research on complex psychological processing is the key development direction in the future, and the realization of pattern recognition can help human beings to study their own intelligence. In current life, the recognition of acoustic information, optical information, and fingerprint information are all important contents of intelligent recognition. The future integration of the trinity could promote a more accurate and efficient recognition process.

4.2. Expert system

The expert system reserves a large amount of industry and professional knowledge, which is an important direction for the future iteration of artificial intelligence. At present, the realization of the expert system still needs support from two aspects: one is the need to determine an expert problem-solving mechanism similar to the field; the other is the need to improve the knowledge construction of the expert database. The integration of the Trinity can provide support in both areas.

4.3. Symbolic Calculation

Generally speaking, scientific computing is divided into two categories: symbolic computing and pure numerical computing. In the actual calculation process, symbols are not only limited to numbers, but also functions, sets, geometric images, etc. Symbolic computing will continue to be a development trend in the future, and a variety of software functions are also its key research objects. The human-machine interface can meet people's needs for dynamic applications. By outputting instructions,

artificial intelligence can complete the corresponding operations. At present, computers can only execute commands entered by humans, which has caused certain limitations to computers. The future integration of the Trinity application can break through this limitation.

4.4. Artificial Neural Network and Machine Emotion

Judging from the current analysis, many fields have been applied to the idea of artificial intelligence, and shortly soon, artificial neural networks can play an important development field of artificial intelligence. Judging from current research and analysis, emotion is also an important part of intelligence. Therefore, the development of artificial intelligence is inseparable from endowing computers with human emotions. This ability will become an important breakthrough in the development of artificial intelligence.

5. Conclusions

In the era of economic globalization and technological modernization, information technology has made great strides in industry, agriculture and human civilization. The integration and application of artificial intelligence, big data and cloud computing are reflected in every aspect of life. Artificial intelligence, big data and cloud computing complement each other and interact with each other. The integrated development and application is the result of scientific and technological progress. At present, the integration and application of the three are still in the primary stage of exploration, and there are still many problems in reality, such as the lack of a large number of high-level professionals, the security and reliability of cloud computing also have certain limitations, the big data sharing and data behind people's privacy cannot be effectively protected, as well as the cost of the artificial intelligence and so on. In the future, as technology matures, the three will become closer together, What's more, their boundaries will become more and more blurred. The effective integration and application of the three will create a new pattern of the scientific era, bring more intelligence and convenience to life, and promote the progress of human civilization.

References

- [1] Castells M. *Toward a sociology of the network society*. *Contemporary sociology*. 2000; 29(5):693-9.
- [2] Oliveira AL, de Araújo OC, Cardoso Jr G, de Moraes AP, Mariotto L. *A mixed integer programming model for optimal fault section estimation in power systems*. *International Journal of Electrical Power & Energy Systems*. 2016; 77:372-84.
- [3] Peng M, Qin Y, Tang C, Deng X. *An e-commerce customer service robot based on intention recognition model*. *Journal of Electronic Commerce in Organizations (JECO)*. 2016;14(1):34-44.
- [4] Warren Jr JD, Moffitt KC, Byrnes P. *How big data will change accounting*. *Accounting Horizons*. 2015; 29(2):397-407
- [5] Botorabi, F., Haapasalo, J., Smith, E., Haapasalo, H. and Parkkila, S. (2011) *Carbonic Anhydrase VII—A Potential Prognostic Marker in Gliomas*. *Health*, 3, 6-12.
- [6] Graham-Rowe D, Goldston D, Doctorow C, Waldrop M, Lynch C, Frankel F, et al. *Big data: science in the petabyte era*. *Nature*. 2008;455(7209):8-9.
- [7] Katal A, Wazid M, Goudar RH, editors. *Big data: issues, challenges, tools and good practices*. 2013 *Sixth international conference on contemporary computing (IC3)*; 2013: IEEE.
- [8] Cox M, Ellsworth D, editors. *Managing big data for scientific visualization*. *ACM siggraph*; 1997.
- [9] Peters DP, Havstad KM, Cushing J, Tweedie C, Fuentes O, Villanueva-Rosales N. *Harnessing the power of big data: infusing the scientific method with machine learning to transform ecology*. *Ecosphere*. 2014;5(6):1-15.
- [10] Bughin J, Chui M, Manyika J. *Clouds, big data, and smart assets: Ten tech-enabled business trends to watch*. *McKinsey quarterly*. 2010;56(1):75-86.
- [11] Marston S, Li Z, Bandyopadhyay S, Zhang J, Ghalsasi A. *Cloud computing—The business perspective*. *Decision support systems*. 2011;51(1):176-89.