Exploration of the Application of Computer Science and Technology in the Context of Big Data

Zijun Wang

School of Computer Science, Hubei Second Normal University, Wuhan, Hubei 430205, China

Abstract: *Since the emergence of computer science and technology, there has been a fundamental change in the way people manage and analyze data, which has driven the informatization and digital transformation of human society.Big data is a product of highly developed information technology, and computer science and technology are the necessary foundation for realizing the value and development of big data.At present, in the process of developing big data resources, the application of computer science and technology still faces some difficulties. Therefore, practitioners in related fields need to strengthen the development and innovation of technology, so as to promote the development and progress of human society.*

Keywords: Big data;Computer;Science And technology.

1. INTRODUCTION

With the continuous advancement of technology in today's society, the development of computer science is also getting faster and faster. The application of computers can be found in daily life, and their role in science and engineering is becoming increasingly evident.At the same time, the deep integration of big data technology and computer software technology provides greater space for the future development of big data technology, but there are still many problems that need to be solved urgently. In intelligent transportation systems, Tu [1] developed a reliable vehicle platooning system utilizing redundant 5G link aggregation for enhanced smart road connectivity. Industrial applications have seen substantial improvements, with Zhao et al. [2] optimizing steel production scheduling through deep learning algorithms. Financial analytics has similarly benefited from AI integration, as Yang et al. [3] proposed a convolutional neural network-based approach for stock market sentiment analysis and prediction, while Gong et al. [7] applied machine learning to predict extreme financial market volatility using unstructured data. Computer vision has made notable progress through Ding et al.'s [4] work on clothing-changing person re-identification, which introduced a novel decoupling feature-driven attention mechanism. Mechanical engineering applications include Wang et al.'s [5] multiscale shakedown analysis for auxetic tubular structures and their subsequent work [6] on machine learning-based fatigue life evaluation of pump spindle assemblies. Privacy-preserving technologies have advanced with Wang et al.'s [8] federated learning-based recommender system, addressing critical data security concerns in personalized services. The intersection of AI and social sciences is exemplified by Zeng et al.'s [9] investigation of how education investment and social security affect household financial participation. Educational applications have progressed through Wang et al.'s [10] AI-powered system for early identification of learning difficulties. Computer vision continues to evolve with Wang et al.'s [11] YOLOv8-based vehicle detection system and Chen et al.'s [12] EmotionQueen benchmark for evaluating LLM empathy. Multimodal learning frameworks have expanded, as demonstrated by Moukheiber et al.'s [13] fusion of satellite imagery with public health data, while Restrepo et al. [14] contributed to medical AI through their multilingual benchmark for ophthalmological question answering systems.

2. CONCEPT AND CHARACTERISTICS OF BIG DATA TECHNOLOGY

Big data technology refers to a series of techniques and tools used for processing, storing, analyzing, and visualizing large-scale datasets.It can help organizations and businesses extract valuable information and insights from massive amounts of data to support decision-making, business optimization, and innovation.The following are several main characteristics of big data technology:

2.1 Large amount of data

Big data technology mainly deals with massive amounts of data, which are usually measured in TB, PB, or even EB units.Traditional data processing techniques often have low efficiency when dealing with such a large amount of data.

2.2 Diversity

Big data includes not only structured data, but also unstructured data (such as text, images, audio, etc.), as well as semi-structured data (such as log files and sensor data, etc.).Big data technology needs to be able to handle various types of data.

2.3 Real time performance

Many big data applications require real-time processing and analysis of data, and timely response.For example, the financial industry needs to respond quickly to market fluctuations, while the Internet of Things requires real-time monitoring and control of devices.

2.4 Data Value

The goal of big data technology is to extract valuable information and insights from large amounts of data and provide decision support for organizations and businesses.These values can be realized through technologies such as data mining, machine learning, and artificial intelligence.

2.5 Distributed processing

Due to the large amount of data, traditional centralized computing architectures cannot meet the needs of big data processing.Big data technology adopts distributed computing and storage technology, distributing data and computing tasks to multiple nodes for parallel processing.

2.6 Scalability

Big data technology needs to be able to scale horizontally according to demand to cope with the increase in data volume and computing tasks.This means that the system needs to be able to easily add new nodes and automatically balance the load.

2.7 Security and Privacy Protection

Big data involves a large amount of sensitive information, such as personal data, trade secrets, etc.Big data technology needs to provide a series of security measures to protect the security and privacy of data.

In short, big data technology provides valuable information in real-time by processing massive and diverse data, providing decision-making support and business competitive advantages for organizations and enterprises.

3. THE ROLE OF COMPUTER SCIENCE AND TECHNOLOGY IN MODERN APPLICATIONS

3.1 Beneficial for ensuring data information security

Although the application of computer science and technology can enrich people's lives, there are still various forms of security risks in activities such as online shopping and chatting, which seriously threaten the personal information security of users.The modern application of computer science and technology enables the development of computer protection systems based on the application status of computer networks, avoiding virus risks, hacker intrusions, and other issues, thereby ensuring the security of data information in computer networks.In addition, the security of computer network information also requires the use of different technologies for maintenance. The modern application of computer science and technology meets the requirements of computer applications in the new era, ensuring the standardization and scientificity of users' use of computers, thereby reducing the possibility of security risks such as data loss and information leakage.

3.2 Outstanding Popularization of Computer Science and Technology

Computer science and technology have the characteristics of popularization and development.At present, computer science is widely applied and seen in multiple industries.For example, in the fields of online payments and smart homes, the continuous popularization of computer science and technology has made it more convenient and efficient for people to process work and life information, making social development more stable and harmonious.

3.3 Conducive to strengthening network supervision and management

Due to the relatively chaotic computer network environment at present, which involves different security risks, the modern application of computer science and technology can strengthen the supervision and management of computer networks, in order to create a secure and stable computer network environment.Under the modern application of computer science and technology, relevant departments can attach importance to network supervision and management, strictly crack down on infringement and fraud in the computer network environment, and establish corresponding regulatory mechanisms in the process of network supervision and management to ensure the security of the computer network environment.

4. ISSUES IN THE MODERN APPLICATION OF COMPUTER SCIENCE AND TECHNOLOGY

4.1 Lack of a comprehensive computer science and technology system

With the update and development of the Internet and related information technology, the application form and content of computer science and technology are constantly enriched, which also makes the competition in the computer network industry increasingly fierce, which is not conducive to the modern application of computer science and technology.In terms of the current development of computer science and technology in China, there is a significant difference in the level of modern application compared to foreign computer science and technology. China's computer science and technology are showing a clear state of chaos, which has reduced the quality and efficiency of modern applications.In addition, computer science and technology also face the problem of vicious competition, coupled with the lack of sufficiently advanced information technology as assistance and support, which seriously affects the scientificity and stability of its modern applications, and also hinders the development and innovation of computer science and technology in China.Due to the lack of a comprehensive system of computer science and technology, it is impossible to achieve modern applications of computer science and technology according to the direction of social development and user needs in the new era, which is not conducive to the optimization and improvement of computer technology in China.

4.2 The comprehensive computer technology ability of the staff is relatively poor

Lack of proficiency in basic operations: For example, unfamiliarity with basic computer operations such as using operating systems, file management, and folder structures, leading to low operational efficiency.Lack of familiarity with software applications: Lack of familiarity with common office software, unable to quickly and accurately complete various tasks such as processing documents, creating presentations, and spreadsheets.Poor information retrieval ability: unable to effectively use the Internet and search engines to find and obtain the required information, lacking information retrieval skills and strategies.Insufficient data processing capability: Lack of understanding and application of data processing tools and techniques, inability to effectively process and analyze data, and inability to extract valuable information from data.

4.3 Computer Network Risk Threats and Data Information Security

Computer networks have always been in an open state. Although this openness has improved the convenience for users to obtain and disseminate information, it can also be attacked by illegal users and threaten the security of data information, leading to problems such as data loss and information leakage.At present, relevant departments have not established a sound supervision and management system for computer science and technology, so there are still various forms of problems in computer network applications, which increase the possibility of cybercrime and also affect the security of data and information in computer networks.For example, some enterprises have not established targeted management systems based on the nature of computer networks and the management status of the enterprise in the process of applying computer science and technology, which can lead to virus intrusion problems in information exchange and data transmission, thereby reducing the integrity and security of enterprise

data information.In addition, computers have high technological capabilities. If there are vulnerabilities in them, it will attract the attention of hackers and other criminals. In the process of exploiting vulnerabilities, criminals will not only threaten the security of data information, but also bring economic losses to enterprises.

5. APPLICATION OF COMPUTER SCIENCE AND TECHNOLOGY IN THE CONTEXT OF BIG DATA

The existing articles still need further in-depth research on the above issues. In response to these problems, the author will present some of their own insights in the following text in order to provide reference.

5.1 Emphasize the development of software system functions

5.1.1 Understand user needs:

Fully communicate, understand, and document user needs to ensure that the development process does not deviate from user expectations.
5.1.2 Develop detailed functional specifications:

Before developing features, develop clear and detailed functional specification documents that specify the purpose, input, output, and required behavior of each feature.

5.1.3 Using appropriate development methods:

Based on project requirements and the actual situation of the team, choose appropriate development methods such as waterfall model, agile development, etc. to ensure high-quality delivery of system functions.

5.1.4 Reasonably divide functional modules:

Divide the system's functions into modules, determine the priority order, and gradually develop and test each module to ensure that the basic functions of the system can be quickly available.

5.1.5 Perform continuous integration and testing:

In the process of feature development, work closely with developers and testers to continuously integrate and test, and promptly identify and fix issues in feature development.

5.1.6 Regularly conduct functional reviews and optimizations:

At different stages of feature development, regularly conduct feature reviews and optimizations, evaluate the practicality, reliability, and performance of developed features with users and relevant teams, and make timely improvements and corrections.

5.1.7 Value user experience:

In addition to feature development itself, it is also important to focus on user experience, design user-friendly interfaces, simplify operation processes, and provide good feedback mechanisms to enhance user satisfaction.

5.1.8 Continuous learning and improvement:

Software system function development is a continuous process of learning and improvement, which requires paying attention to new technologies and trends in the industry, actively participating in training and exchange activities, and constantly improving one's development ability and technical level.

5.2 Strengthen information security management

Under the advantages of 5G technology, the security and privacy protection capabilities of 5G technology can be fully utilized, security encryption algorithms can be improved, and data transmission security can be enhanced;Fully integrate 5G technology with artificial intelligence, machine learning, and other technologies for

threat detection and attack identification, and provide real-time feedback and response;Apply 5G technology, establish closed channels such as virtual private networks, isolate the connection between public Internet and private networks, and increase network security.To further strengthen information security management, it is necessary to first establish a comprehensive information security management system.By formulating and implementing relevant information security policies, standards, and norms, clarifying the security responsibilities and duties of personnel at all levels, establishing an information security management organization, implementing security measures, and promoting the establishment of information security management mechanisms.At the same time, relevant departments should actively carry out information security publicity, education, and training for different groups of people, improve employees' security awareness and skill level, enhance their awareness of information security prevention, and reduce the probability of security vulnerabilities.Secondly, multi-level security measures should be taken.Prevent different types of attacks and threats through technological means such as network isolation, authentication, encryption technology, intrusion detection, etc.On this basis, establish a comprehensive emergency plan and security incident handling process to promptly handle and track security incidents.Finally, strengthen security auditing and monitoring.By means of security auditing and monitoring, regular testing and analysis of systems and networks are conducted to identify and eliminate potential security risks and hazards, thereby improving the overall security level of information resources.

5.3 Cultivate high-end information technology talents

In addition to the above aspects, in order to promote the development and application of computer science and technology, we also need to attach great importance to the cultivation of high-end information technology talents.On the one hand, as one of the most important national first level majors today, computer science and technology should be strengthened in talent education, especially focusing on the cultivation of practical and hands-on abilities, in order to cultivate a group of comprehensive talents.On the other hand, enterprises should pay attention to strengthening the professional skills of their technical personnel, while also enhancing the cultivation of innovative consciousness. Only in this way can big data resources be developed more scientifically and efficiently, laying a solid talent foundation for the development of enterprises.

5.4 Improve the system of computer science and technology

5.4.1 Education and Training:

Strengthen education and training in computer science and technology, including offering relevant courses and majors in schools, providing practical opportunities and internship projects, and cultivating students' technical abilities and innovative thinking.At the same time, provide continuing education and training opportunities for employees to maintain their ability to keep pace with technological development.

5.4.2 Research and Innovation:

Allocate more resources and funds to support research and innovation in computer science and technology.Encourage collaboration between academia and industry, promote the exchange and sharing of knowledge and technology, and advance the development and application of cutting-edge technologies.

5.4.3 Legal and policy:

Establish relevant legal and policy frameworks to promote the development of computer science and technology.Legislation and regulation, including intellectual property protection, data privacy and security, e-commerce, etc., provide a compliant and trustworthy environment for the application of technology.

5.4.4 Industrial cooperation:

Encourage collaboration between academia, industry, and government to form a healthy ecosystem for computer science and technology.Promote cooperation between technology enterprises and academic institutions, and support the incubation and transformation of innovative projects.At the same time, it connects with other industries to promote the application and development of technology in various industries.

5.4.5 International Cooperation and Exchange:

Strengthen international cooperation and exchange, share the latest research achievements and application cases of computer science and technology, learn from foreign experiences and practices, and promote the global development of computer science and technology.

Through the efforts in the above aspects, we can continuously improve the computer science and technology system, enhance our technological level and application capabilities, and promote the widespread application and development of technology in social, economic, and scientific fields.

6. CONCLUSION

With the continuous development of big data technology, the related applications of computer technology have shown a good trend and are deeply integrated with various industries.Computer technology has obvious advantages in processing data information, which can better meet the requirements of social development for data processing in a short period of time and provide strong technological strength for social progress.To accurately classify the data services that need to be processed in the context of big data, based on the actual value of data information, personalized processing of data services should be carried out to demonstrate the various application attributes represented by data information, build a stable data chain, and promote the development of computer application technology.

REFERENCES

[1] Tu, Tongwei. "Reliable Vehicle Platooning via Redundant 5G Link Aggregation in Smart Roads." (2025).

[2] Zhao, H., Chen, Y., Dang, B., & Jian, X. (2024). Research on Steel Production Scheduling Optimization Based on Deep Learning.

[3] Yang, W., Lin, Y., Xue, H., & Wang, J. (2025). Research on Stock Market Sentiment Analysis and Prediction Method Based on Convolutional Neural Network.

[4] Ding, Y., Wang, X., Yuan, H., Qu, M., & Jian, X. (2025). Decoupling feature-driven and multimodal fusion attention for clothing-changing person re-identification. Artificial Intelligence Review, 58(8), 1-26.

[5] Wang, Lizhe, et al. "Loading capacity prediction of the auxetic tubular lattice structures by multiscale shakedown analysis." Composite Structures 314 (2023): 116938.

[6] Wang, Lizhe, et al. "Machine Learning-Based Fatigue Life Evaluation of the Pump Spindle Assembly With Parametrized Geometry." ASME International Mechanical Engineering Congress and Exposition. Vol. 87684. American Society of Mechanical Engineers, 2023.

[7] Gong, Chenwei, et al. "Application of Machine Learning in Predicting Extreme Volatility in Financial Markets: Based on Unstructured Data." The 1st International scientific and practical conference "Technologies for improving old methods, theories and hypotheses"(January 07–10, 2025) Sofia, Bulgaria. International Science Group. 2025. 405 p.. 2025.

[8] Wang, Yikan, et al. "Design of Privacy-Preserving Personalized Recommender System Based on Federated Learning." (2024).

[9] Zeng, Yuan, et al. "Education investment, social security, and household financial market participation." Finance Research Letters 77 (2025): 107124.

[10] Wang, Chun, Jianke Zou, and Ziyang Xie. "AI-Powered Educational Data Analysis for Early Identification of Learning Difficulties." The 31st International scientific and practical conference "Methodological aspects of education: achievements and prospects"(August 06–09, 2024) Rotterdam, Netherlands. International Science Group. 2024. 252 p.. 2024.

[11] Wang, Hao, Zhengyu Li, and Jianwei Li. "Road car image target detection and recognition based on YOLOv8 deep learning algorithm." unpublished. Available from: http://dx. doi. org/10.54254/2755-2721/69/20241489 (2024).

[12] Chen, Yuyan, et al. "Emotionqueen: A benchmark for evaluating empathy of large language models." arXiv preprint arXiv:2409.13359 (2024).

[13] Moukheiber, Dana, et al. "A multimodal framework for extraction and fusion of satellite images and public health data." Scientific Data 11.1 (2024): 634.

[14] Restrepo, David, et al. "Multi-OphthaLingua: A Multilingual Benchmark for Assessing and Debiasing LLM Ophthalmological QA in LMICs." Proceedings of the AAAI Conference on Artificial Intelligence. Vol. 39. No. 27. 2025.