

Emerging Technologies of Software Engineering

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Abstract: Since we have been the age of Big Data, AI and Big Data are playing more and more important roles in our developing life. This article comes up with the situations and the crucial technologies of Big Data and AI first, then expects development prospects and the meanings of our life by researching Big Data and AI.

1. Introduction

Since Internet is popularized more and more in our life, and with the development of the Internet of Things, the new technologies, Big Data and AI has been regarded as an important factor by many countries for their competition between each other. In many European countries, Big Data and AI not only get into a high elevation in the only one field, but also has been used in many different fields, such as scientific research, education, environment conservation, Biomedical, sports financial etc.

AI(artificial intelligence)is a branch of computer science. It's essence is to produce a new intelligent machine which has the same reaction as human. This field includes robot, voice recognition, graph recognition, natural language processing etc. From the birth of AI, the theory and the technology become more and more mature, and the application fields have expanded as well, we can give an imagination that the technical products from AI in the future will be a“vessel” of human intelligence. AI can simulate human consciousness and human thought, it is not like human intelligence but can think about things like a human, even surpass human intelligence.

Big Data is not a specific technology but includes data mining, predictive parsing, statistic analysis, machine learning, natural language processing, parallel computing, data storage, stream computing and some other technical applications. Because Big Data has its feature, all old methods and items that we used for processing and analyzing may not work well. So, to capture the opportunity of big data time, there still have more technical difficulties to figure out.

2. Research status

Before 2017, UK opened the databases about transportation, weather, heath, and invested 10 million English pounds in building up the first “Open Data Institute” in 5 years. The government will work with the publishing industry and others to make free access to publicly funded research as early as possible. The royal society is also considering ways to improve the sharing and disclosure of research data among research communities and other users. In May 2016, for example, the White House set up the machine learning and artificial intelligence (MLAI), specifically for inter-departmental coordination of AI research and development, and based on AI problems, gave technical and policy suggestions, also supervise the research institutes and development of artificial intelligence technology.

However, in my country, Big Data is still developing, and with the population of Internet and the development of IoT, the market size and the requirements will continue to expand continuously.

3. The key technology of software engineering in the age of Big Data

3.1 Software service engineering in the context of big data

Understand and locate users. Many companies are bound up in social media data, browser log, text mining, etc. And set up predicted model by the Big Data, to completely know about users, and also what they like.

Understand and optimize business processes. Big Data is increasingly used to optimize business processes, such as supply chain or optimization of the distribution path. By using location and identification systems, we can track or transport vehicles and optimize routes based on real-time traffic data.

Provide personalized services. Big Data is adaptive not only in companies and government, but also to each and every one of us, for instance, we can get benefit from smartwatches and smart bracelets or other devices that have data collected.

Amend health care and public health. The ability to analyze Big Data can decode entire DNA sequences in a few minutes, which helps us find new treatments and understand, predict disease patterns better.

Improve sports skills. Today, most of the top sports events has adopted Big Data analysis technique, such as the NFL has developed specific application platform, to help all the team according to the grass on the field conditions, weather conditions, and the player's individual performance to make the best decisions during study, in order to reduce those of unnecessary injuries.

3.2 Applications of big data in life

Finance. The main role of Big Data in the financial industry is financial transactions. High-frequency trading is a field where big data is more widely applied. Among them, a Big Data algorithm is applied to trade decisions. A lot of equity trading is now done using Big Data algorithms that help people calculate information about their business transactions. In this way, many enterprises can grasp the actual situation of their own business, as they can have a reference for their developments of the future.

Big cities' changes. Big data is also applied to improve our daily life in cities. For example, our cities have real-time traffic information, use social networks, and weather data to optimize the latest traffic situation. But now, many cities are carrying out Big Data analysis and pilot. In the future, Big Data will be more and more popular in China.

Everyone in our lives. And many of us now wear smartwatches or bracelets, which can generate the latest data, allowing us to track our calorie burning and sleep patterns, which makes our life more beautiful.

They are improving computing power in medical and research applications. Big Data analysis allows us to learn about DNA in a minute, and allow us to come up with the newest treatments. Colleagues can better understand and predict disease. Big data can help patients better treat their condition. Big data can also be used to record and analyze a baby's heartbeat, so as to monitor the baby's physical condition, to ensure the baby's health.

3.3 Big Data processing difficulties

3.3.1 Cloud computing

Cloud computing is a kind of distributed computing, which refers to the decomposition of huge data processing programs into numerous small programs through the network "cloud", and then the processing and analysis of these small programs are through the system composed of multiple servers to get the results and return them to the users. In the early days of cloud computing, it was simple distributed computing, solving the distribution of tasks and combining the results. Therefore, cloud computing is also known as grid computing. With this technology, tens of thousands of data can be processed in a very short time (a few seconds) to achieve powerful network services.

3.3.2 Big Data and Cloud Computing

Technically, big data and cloud computing are just like two sides of a coin. It is inevitable that big data cannot be processed by a single computer, so a distributed architecture must be adopted. Its feature is to carry out distributed data mining for massive data, but it must rely on the distributed processing, distributed database, cloud storage, and virtualization technology of cloud computing.

3.3.3 Application difficulties of Big Data

Big Data is constantly showing the huge opportunities of which bring to academia, industry, and government. At the same time, Big Data also poses great challenges to all parties involved. First of all, Big Data technology faces three important problems:

How to process unstructured and semi-structured data by means of information technology?

In Big Data, structured data only accounts for about 15%, while the other 85% is unstructured data, which largely exists in social networks, Internet, e-commerce, and other fields. On the other hand, perhaps 90 percent of the data comes from open-source data, and the rest is stored in databases. The uncertainty of big data is manifested in high dimension, changeability, and strong randomness.

2. Influence of the relationship between data heterogeneity and decision heterogeneity on Big Data knowledge discovery and management decision.

Due to the complexity of big data itself, this problem is undoubtedly an important scientific research topic, which poses a new challenge to the traditional data mining theory and technology. In the context of Big Data, management decision faces two problems: "data heterogeneity" and "decision heterogeneity". The traditional management decision model depends on the learning of business knowledge and accumulated practical experience, while the management decision is based on data analysis.

How to explore the complexity of big data, the description method of uncertain characteristics and the system modeling of big data

The breakthrough of this problem is the premise and key to realizing big data knowledge discovery. The complex form of big data leads to many research problems related to the measurement and evaluation of "rough knowledge". Known utility theories of optimization, data envelop analysis, expectancy theory, and management science can be applied to the study of how to integrate knowledge into the process of "secondary mining" of rough knowledge generated by data mining. Human-computer interaction will play a crucial role here.

4. The key technology of artificial intelligence engineering

4.1 Research field of AI

The main goal of artificial intelligence research is to use machines, usually electronic instruments, computers, etc., to simulate human mental activities as much as possible, and to strive to improve and exceed human capabilities in these areas eventually. Its research fields and applications are very wide, such as automatic theory proving, reasoning, pattern recognition, expert knowledge systems, intelligent robots, learning, gambling, natural language understanding, and so on.

Pattern recognition is probably the most basic and important part of artificial intelligence. Pattern recognition is to enable computers to recognize things around them, making communication between people and computers more natural and convenient. It includes text recognition (reading), speech recognition (listening), speech synthesis (speaking), natural language understanding, and computer graphics recognition. If pattern recognition technology can be fully developed and applied to computers, then people will be able to communicate with computers naturally and can directly give orders to computers without having to remember those commands. It also provides the necessary conditions for the research of intelligent robots, which can communicate with the outside world like a person.

The most interesting application of artificial intelligence is probably robots. In fact, the range of robots is very wide, including not only various types of intelligent robots, but also some used in

industrial production and used to replace human labor robots. The present robot technology has made some achievements in manufacturing robots with only a certain function, but to develop a multifunctional, humanized intelligent robot, it still needs a lot of time. By then, people would see the contradiction between humans and robots in science fiction movies and wonder if it would come true.

Expert system has certain commercial characteristics. It first inputs the main knowledge of a certain industry (such as medicine, law, and so on) into the computer system knowledge database, and then by the designer according to the unique relationship between this knowledge and professional experience, designs a system. This system can not only provide users with the industry knowledge query, suggestions and other services, but more importantly, as an artificial intelligence system, it has the ability of automatic reasoning and learning. Expert systems are often used for a variety of business purposes, such as customer information systems within enterprises, decision support systems, and software such as medical consultants and legal advisers that are visible to the public.

In addition, artificial intelligence can be found in many places in people's lives. Many home appliances, for example, have smart chips, navigation systems for cars and airplanes, artificial intelligence programs for video games, and some custom-made electronics to help people.

4.2 Current application of AI

AI has many applications, but they broadly have five categories: natural language processing, speech recognition, computer vision, expert systems, and intelligent robots.

Natural language processing is an important direction in computer science and artificial intelligence. It studies various theories and methods that enable efficient communication in natural language between humans and computers. Natural language processing is a science combining linguistics, computer science, and mathematics. Therefore, the research in this field will involve natural language, the language that people use everyday, so it is closely related to the study of linguistics, but has important differences.

--Multilingual translation, virtual personal assistant, intelligent online customer service, article editing.

Speech recognition technology, also known as automatic speech recognition (ASR), is designed to convert words in human speech into computer-readable input, such as buttons, binaries, or character sequences. This is different from speaker recognition and speaker confirmation, which attempts to identify or confirm the speaker rather than the vocabulary contained therein.

--Smart doctor, voice evaluation, smart speaker.

Computer vision is the science of making machines "visible". In addition, it refers to the use of cameras and computers instead of human eyes to identify, track and measure machine vision. After that, graphics processing makes computer processing more suitable for human observation or transmission to the instrument for detection of the image. As a scientific discipline, theories, and techniques related to computer vision research attempt to build artificial intelligence systems that can extract "information" from images or multidimensional data.

--Security monitoring, criminal tracking.

The expert system is a programming system that solves problems at the expert level in a particular field. It can effectively utilize the effective experience, and professional knowledge accumulated by experts for many years, and solve the problems that experts need to solve by simulating the thinking process of experts.

--Self-driving cars, smart city systems, product/service recommendations, financial investment advisers.

Intelligent robots can understand human language, talk to human language, and form detailed patterns of the external environment, enabling them to "survive" in their own "consciousness". It can analyze the situation, adjust its behavior, meet all the requirements of the operator, formulate the ideal action, in the case of insufficient information, rapid changes in the environment, complete the action.

--Industrial robots, service robots.

4.3 Outlooks of AI

Outlook 1: AI has great potential for vertical applications in various industries.

The AI market has huge potential in verticals across industries such as retail, transportation and automation, manufacturing, and agriculture. The main factor driving the market is the increasing number of applications of AI technology in various terminal vertical fields of users, especially to improve services to terminal consumers.

Outlook 2: AI imports the health-care industry to maintain high growth

Due to the extensive use of Big Data and artificial intelligence in the health-care industry, disease diagnosis can be precisely improved, the imbalance between medical personnel and patients can be reduced, and cross-industry cooperation can be promoted. In addition, AI is widely used in clinical trials, large medical plans, and medical consultation.

Outlook 3: AI replaces screens as the new UI/UX interface

In the past, from the PC to the mobile phone era, user interface is through the screen or keyboard to interact with each other. As smart speakers, virtual/augmented reality (VR/AR), and self-driving car systems enter human environments, those developments allow people to communicate with computing systems without the need for screens.

Outlook 4: in the future, there will be a built-in AI computing core in mobile phone chips

At present, the mainstream ARM architecture processor is not fast enough. If it needs to carry out a lot of image computation, it is still insufficient. Therefore, the future mobile phone chip will definitely have an AI computing core built-in.

Outlook 5: AI chips are key to the successful integration of hardware and software

The core of AI chips is semiconductors and algorithms. AI hardware mainly requires a faster instruction cycle and low power consumption, including GPU, DSP, ASIC, FPGA, and neuron chip, and must be combined with a deep learning algorithm. The key to the successful combination is advanced packaging technology.

Outlook 6: AI autonomous learning is the ultimate goal

AI brains get smarter in stages, from machine learning to deep learning, then to autonomous learning.

Outlook 7: the perfect architecture is a combination of CPU and GPU

In the future, there will be many specialized areas of the super performance of the processor, but the CPU is universal and various devices, any scenario can be applicable.

Outlook 8: AR becomes the eye of AI, the two are complement and indispensable

AI needs AR in the future, and AR also needs AI in the future. AR can be compared to the research of AI. The virtual world created for robot learning is itself a virtual world.

5. Conclusion

AI and Big Data are both related and different, and can work together. AI needs to learn through trial and error. It needs big data to teach and train AI. AI needs to rely on big data to build its intelligence. While big data plays a role in artificial intelligence, artificial intelligence developers must not forget to collect and use big data reasonably and pay attention to the protection of personal privacy. AI, which intelligently analyzes data, is only part of AI, not all of it.

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