MAFS6010U Artificial Intelligence in Finance

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Abstract

SenseTime is a world's leading artificial intelligence company with roots in China and has achieved one of the highest total financing and valuation in the industry. Our project starts from the analysis on policy environment and overall industry development, followed by emphasis on the products, partners and investors of SenseTime, with comparative study on products, financing, key words reflecting development focus and trends between SenseTime and their primary competitors YITU, MEGVII and CloudWalk, using web crawler technology for information collection and processing. This report consists of four parts: work summary and learning from our project, two article reviews on artificial intelligence and finance, our suggestions for further study and individual contribution to this project.

1 Work summary

Through the whole semester, we conducted a complete and thorough analysis on one of the worldwide well-known artificial intelligence companies with roots in China, that is SenseTime, founded in Hong Kong in 2014 by Tang Xiaohu, a professor at the information engineering department at CUHK (the Chinese University of Hong Kong) and a computer scientist named Xu Li, which nowadays leads AI innovation and holds one of the highest total financing and highest valuation in the industry. We summarized our analysis into two aspects---the industry macro environment and the company itself. We looked at the overall development of industry including the characteristics of industry chain and tendency of the industry and technology applications, and relevant policies promulgated by Chinese government and their impacts on the industry. Also, we analyzed the company from two sides---products and people associated with SenseTime including partners, investors, counterparties and competitors, combined with qualitative and quantitative approaches through the whole process.

We first started with an overview on the whole industry and policy environment, since we believe they have a profound impact on the companies in the industry. We focus on the composition of the industry chain---how the three layers that make up the industry chain work with each other, and development of technology applications---how the application layer realizes the integration development with traditional industries. We got access to the market size of the overall industry as well, and chose the following areas for key analysis, such as AI with security, finance, auto, home, medical and robot. In accordance with McKinsey report, by 2025, AI industry will generate more than $10 trillion in market size, implying bright future and good prospects of the industry. In addition, we summarized relevant policies from 2015 to 2019 and researched their meaning and significance delivered by the government, so that we could easily be aware of the industry focus of government attention and industry trends under policy guidance, which would be helpful for the next stage of the company's development.

Then we moved to specific analysis on the company. For the products, we simultaneously studied the products issued by SenseTime and its competitors. SenseTime constructed its own deep learning platform which has been leveraged to launch products and propel the upgrade of the

industry. We found that SenseTime is most famous for computer vision technologies that have quickly captured the market share with face recognition, image recognition, text recognition, video image analysis, image and video editing, autonomous driving, remote sensing, and medical image recognition included. On the other hand, we incorporate the information of similar products from competitors in order to derive the pros and cons of each side. To illustrate, the product direction of SenseTime roughly includes Intelligent Video Analytics, Identity Verification, Driver Monitor System etc. For each product direction, we found more than three market competitive products to compare their essential features, so that we could articulately explain the competitors' characteristics. Take SenseTime Intelligent Video Analytics product for example, one main competitor is IBM Intelligent Video Analytics aimed at security and safety, whose key strengths could be accurately detecting changes to patterns. Obviously, after the explicit comparison between SenseTime and its competitors, we could adopt a cautious attitude towards the assessment of its progress and value.

Furthermore, we researched at people associated with SenseTime to achieve more discovery and information, such as market size, market position, business scope and investors' appetite, etc. First of all, as SenseTime's core technologies are typically applied to six domains, which are AI with chip, smart city, automobile driving, smart phone, finance and AI laboratory establishment to promote industry development, business partners from each line of business are studied among their business pattern, development and achievements. For example, Qualcomm, an American multinational semiconductor and telecommunications equipment company as well as global communication giant, chose SenseTime as strategic partner to promote on-device artificial intelligence and invested a large amount on SenseTime, which shows the recognition of SenseTime's strong technical strengths and important market position in the industry. Additionally, we conducted a comparative analysis between the competitors and SenseTime from their team background, core technology, technology applications and customers. The primary competitors of SenseTime in Chinese market include YITU ('依图科技'), CloudWalk ('云从科技') and MEGVII ('旷视科技'). Their team members are basically PhD and graduates from distinguished universities around the world like MIT, Stanford and Tsinghua University, or practitioners and professionals from target companies like Huawei, Google, Microsoft and Apple. However, they specialize in different areas and have their own advantages on each field. CloudWalk pays much attention on face recognition while SenseTime and YITU have a wider range of business. Besides, we also collect recent financing information of SenseTime and competitors to find those that invest and support them, which kind of imply investor's appetite and attitude towards the company and the industry. For instance, lots of distinguished investment agencies and PE/VC funds like Softbank, Fidelity International, IDG, and Tiger Fund, etc., have invested billions of dollars in the industry since 2013, the beginning of the surge of AI industry. Moreover, Alibaba not only participated in both B+ and C round financing of SenseTime, but also got involved in the D round financing of MEGVII, another AI company in China focusing on the domain of image identification and deep learning. These all demonstrate investors' preference and optimism about the artificial intelligence industry. Meanwhile, we could obtain their latest valuation and compare their operating conditions from their financing. Among its primary competitors, SenseTime so far has achieved the highest valuation and total financing, and we could see that the whole industry needs funding and support to promote their development and technological innovation.

In order to illustrate the comparative analysis more vividly and concretely, and precisely grasp industry and company trends, we apply web crawler technology to our research. During the research, we found it necessary to analyze Sense Time's development tendency in the future, such as their focused technology and products emphasis. However, it is nearly impossible to directly get accessible to those critical results, so we are supposed to obtain that information by crawling open source data, such as public words in social media or published articles in news website, through web crawler technology. Since we were not familiar with the technology, we appointed three team members to be responsible for studying it and then shared with others. To start with the web crawler technology, we searched for many articles as well as posts on professional forums as our study materials. Then we applied those algorithms into our situation, including adapting to different working environment and adjusting parameters. Specifically, we obtained our results from two directions. On the one hand, we could get access to one particular user in Weibo, and then obtained all information chronologically, including published time, text content and favorites number. We first dealt with content, dividing the time period of each company into 2016 (and before), 2017, 2018, and 2019, processing word segmentation by jieba package in python, and

counting words with higher word frequency in different time periods. Moreover, based on the text content, we additionally applied natural language processing to analyze the statistics of those frequently mentioned words, which indicates the current development focus and tendency of the company. Then we listed the Weibo contents with top 10 number of ups, retweets and top four number of comments (the remaining number of comments was even no more than 20). Such content usually contains information with high attention, which is worthy of analysis. On the other hand, we were able to attain part of the data across the whole Weibo platform, regarding one particular key word, specifically generating a word cloud related to the key words, which explicitly displays the most frequent words related to our selected key word, and where the logo of each company was used as the background version of the word cloud.

For the results, we found that artificial intelligence is the most frequently mentioned words by all four companies among three years. It is reasonable since the four companies all aimed at AI technology. However, differences also exist in different years. In year 2017, face recognition and vision to be the emphasis of SenseTime. Similarly, MEGVII, YITU and CloudWalk also mentioned words like "FacePlusPlus" and "Facial Recognition" for many times, indicating a market trend towards face recognition in 2017, but SenseTime may focus on developing technology and application in the future, while YITU aimed at medical industry and CloudWalk bank system. In year 2018, SenseTime may have a product emphasis on augmented reality. In terms of company strategy, SenseTime changed from a national-based strategy to a global aimed one. It underlined the importance of technology innovation and product cooperation, endeavoring to leading artificial intelligence to the future. Meanwhile, its competitor may have the same goal while differentiating to multiple areas, including public security, finance and detection. In year 2019, SenseTime stressed the importance of self-driving cars, which could be interpreted as a product emphasis transformation. Moreover, they stressed the significance of mobile terminate. At the same time, YITU may focus its goal on medical industry and CloudWalk underlined the cooperation of companies, attempting to pursue development within industry.

Graph 1: Word cloud of SenseTime

Graph 2: Key words in 2019—SenseTime
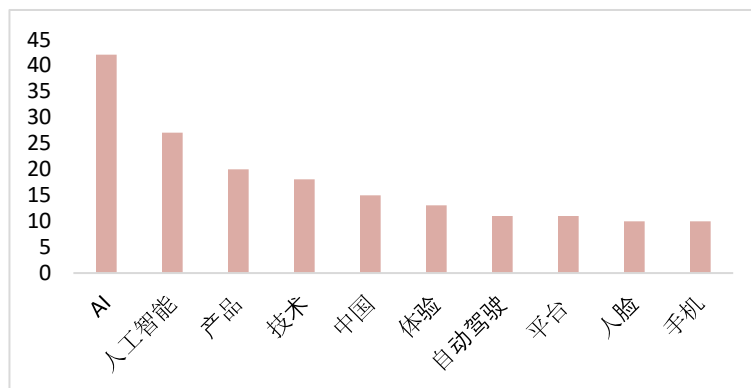
2   Article review on artificial intelligence

Artificial intelligence is a field of study that includes a large number of theories, methods and technologies, which not only combines large amounts of fast processing data and intelligent algorithms, but programs to learn automatically from data models or features as well. With the development of big data technology, artificial intelligence is capable of handling with millions of information and data, through which we can make great achievement in the area that we can never imagine before. Almost all industries have applied artificial intelligence to improve its solving methods and working efficiency, including manufacture, military, medical, finance, Internet and etc. It is the technology that subvert both social and technological structure that has long been dominated by manual resources, and moreover, will redefines the imminent era and shapes the future.

In terms of the mechanism of artificial intelligence, a large number of processes are related. To illustrate, automatic learning that builds the analytical model through automation process, including neural networks and statistics, is designed to help find hidden information in the data. Besides, deep learning which reacts by external inputs to process information, help to use complex models to analyze large amounts of data. Additionally, cognitive computation which involves a human-machine interaction, is used to simulate human processes through interpreting images and speech. Moreover, computer vision based on model recognition and deep learning, is supposed to capture images and videos in real time. Last but not least, natural language processing, possessing the ability to understand human language, allowing people to communicate with computers using normal and plain language to perform their tasks. Reasonably, the development of computer science technology facilitates the application of artificial intelligence to various of areas and industries.

The positive impact of artificial intelligence on society lies in many aspects, from economics and law to technical subjects such as verification, validity, security and control. On the on hand, artificial intelligence truly makes our daily life more effective. To illustrate, plenty of our routine experiences and interactions are involved with machines or devices related to artificial intelligence. Take Hirevue, an online interview platform, for example, which is highly adopted by a large number of big companies, applies artificial intelligence to recognize facial expression and word articulation, facilitating the expense saving process in recruitment. Besides, Siri, a voice interface implemented in the iPhone device system and the Mac OS operating system, is one of the most acknowledgeable artificial intelligence in daily life, which could possibly free our hands on operating the device. Additionally, the face recognition technology we use to unlock our mobile devices, the voice detection methods to encrypt our secret files, the voice-to-text technology we encountered under certain situations to help make our life more convenient, and also the chatting robots provided by online shopping websites to facilitate the purchasing processes. In fact, the above examples are simply a miniature of the enhancing function of artificial intelligence towards our daily life.

On the other hand, artificial intelligence is highly emphasized in various industries. For example, it can be used in enhancing human memory, which could remember any people is ever met, including names, family details, favorite sports and last conversation with them. Once at Facebook's annul development conference, Mark Zuckerberg proposed it possible to build non-invasive sensors to read human's brain activity and translate thought into speech. Besides, artificial intelligence is also applicable in terms of space exploration. The motivation of the exploration partly came from some NASA researchers' concerns about our planet's grim future, including the threat of nuclear war, the overcrowding, or the lack of action in the face of climate change. Robotic "bees" was designed to discover the secrets of the neighboring planet, especially mechanized devices called 'Marsbees' is aimed at Mars that can easily and quickly explore or bring samples back to the base.

Furthermore, advanced and swift development in the robot learning process promotes the invention of automated process to proceed with sophisticated tasks through constant learning. For example, the implementation of artificial intelligence on building autonomous driving systems are indeed accelerating its step. Companies including Google, Apple, Nissan and Toyota are endeavoring to facilitate the process to ensure both accuracy and security. Similarly, in finance industry, bank robots are invented to help automating money-making decisions, acting as a personal digital assistant to customers, while other aspects such as payment applications and the

digitalization of the credit process are also involved with robot consultants, where there does not exist decision-making necessity. Sectors applying automated robots also include financial robots that help to detect credit fraud, marketing robots that aimed at delivering customized messages to customers, and medical robots that facilitate analyzing the relationship between prevention and treatment techniques plus patient analyses. Obviously, artificial intelligence is absolutely an enormous leap of current technology, enhancing the development of various of industries to a large extent.

When evaluating the benefits we obtained from artificial intelligence, however, we are supposed to recognize the potential weaknesses and threats coming from AI, since the existence of artificial intelligence definitely induces some problems including unemployment and threats. To illustrate, when it comes to the bank robots, AI threatens the existence of bank branches, defending a multitude of non-physical banks and posing threat to traditional institutions. In addition, the threats of artificial intelligence on human intelligence in the long term, as was raised up by Stephen Hawking, or Bill Gates, is a huge controversial problem to debate on. It is possible that a performative AI will succeed in the long term, and a system with such AI outperforms human on all cognitive tasks, which could suffer a recurrent self-improvement, triggering an explosion of intelligence. Concern exists; however, human still need the new revolutionary technologies to eradicate war, disease and poverty. Regarding the threat issue, from our perspective, could be solved through more advanced theories and technology.

Currently, countries around the world are facilitating its process on developing artificial intelligence technology. Germany, Sweden and the United Kingdom facilitated their automated driving systems by reviewing their legislation and have allowed testing cars without a driver. While the US is generally considered to be the leader in the field, other countries are coming up strongly, such as the People's Republic of China. When it comes to China, the world's second largest economy, it has become a major global rival in using artificial intelligence as the engine of economic progress, who also has the resources and plans to create an artificial intelligence economy in the upcoming future. Identifying artificial intelligence as the next major innovation area, the Chinese government and companies assert the potential of what artificial intelligence will bring us and value it will creates in the future.

It is commonly acknowledged that technology is an integral part of our lives. Since the first industrial revolution, technology has been increasingly developing in an exponentially explosive speed, contributing to huge transformations from century to century. From the steamer engine in 1760s, to electricity in 1870s, until the internet in 1950s, we intensively developed our technology in less than 300 years, among the long history of millions of years. Specifically, we develop our mobile terminate within 10 years and the big data technology in almost 5 years. Now we have brand new innovation called artificial intelligence and block chain technology, all attempting to achieve a much more efficient society and advanced life convenience. Currently, human have never relied on technology more before. And it is reasonable to expect what we can achieve in the next decade, while it is hard to imagine what life will be like in 10 years, since the development of technology is too fast to predict.

What's more, the germination of artificial intelligence technology gives human the opportunity to emancipate hands to a large extent. From the perspective of evolution, human's development generally follows a pattern, which started from hands and ended with tools. Tools here are what we have long been attempting to achieve and improve. At first, we could only use what is natural, including iron, woods and water. Then we were capable of some simple inventions such as fire. Next, we gradually used tools to take place of our hands. Then manipulated machines were invented to enhance the effectiveness and efficiency of our productivity. At last, automated machines were generated to help us liberate our hands. Brain is what makes it different between human and other species, while we are now creating artificial brains, which may contribute to the germination of another artificial specie.

To summarize, advanced technology, explosive information and sophisticated relationship combined to lead to a more complicated society and life for us. Probably in the upcoming future, robots and computers may surpass human intelligence that has evolved for millions of years, thus generating a new artificial specie, which make us encounter moral and social problems. Nonetheless, the benefits the technology brings us cannot be neglected, not only in the sense of enhance productivity, more on the social impact and evolutionary points of view. Hence, the primary reflection of the processing of further development of artificial intelligence lies in the

balance between desiring development and potential threats. As a graduate student majored relating to finance and mathematics, we should clarify the importance of the artificial intelligence and embrace the new technology cautiously, to help deliver more advanced process and achievements, both in academy or industry, while still attained autonomy and independence.

3   Article review on finance

A new wave of information technology innovation, represented by e-commerce, big data, cloud computing, mobile internet, etc., has rapidly promoted the rise of new Internet finance forces. This year's 'Double Eleven' online shopping spree, Alibaba's transaction volume reached an astonishing 91.2 billion. Less than half an hour after the 'Double Eleven' was unveiled, Ali's sales have exceeded 16 billion, which is equivalent to the total amount of transactions on the 'Black Friday' line of the traditional American promotion day. Whether it is Jingdong, Suning Tesco, or Gome Online, this year's "Double Eleven" sales have exploded compared to last year.

From the perspective of the whole book, this book comprehensively analyzes the development status, regulatory rules and future trends of various Internet formats, including the mode, risk and supervision of online banking, and the management of online lending risk and Supervision, development and supervision of third-party payment institutions, Internet insurance development overview, opportunities and challenges, Internet financial guarantees, Internet finance integrated operations, Internet finance development trends, Internet financial regulations analysis, Internet financial tax system thinking, almost covers all the current internet finance situations and predictions that may arise in the future. This book not only details the development of various aspects of the new finance, but also analyze the problems and risks encountered in its development. Compared with the development of Internet finance in Europe and the United States, China's development will be even later, and the problems encountered are not totally same. While borrowing from foreign experience, it is also necessary to combine our own development. The lack of law and the lack of supervision system are the places where China's new finance needs to face and need improvement. As a new type of financial innovation, like P2P, as the increase of its platform, the problems will also increase. According to statistics, until December 2014, China has accumulated 370 problem platforms, while only 18 in 2012 and 75 in 2013, the number has increased exponentially. This unhealthy development situation harms the interests of both parties. The platforms try their best to prevent them, such as face recognition and fingerprint recognition, but they cannot eliminate this phenomenon. Therefore, people need to improve their own discriminating ability. The primary source of improvement in ability is to have a certain understanding of the industry. After reading this book, I believe that the concept of ordinary vagueness is gradually clear.

The development of Internet finance relies heavily on the analytical capabilities of big data. If the report on this year's 'Double Eleven' online shopping carnival only provides statistics on the sales amount of major e-commerce companies, then from the book--Economist Prospective Network, the article '2015 double eleven Domestic Consumer Behavior Research Report' has the analysis of the number of people in the shopping period, the analysis of the proportion of shopping times, the comparative analysis of the attention of shopping websites, the analysis of the proportion of shopping types, the analysis of the proportion of sales methods, and the comparative analysis of online shopping satisfaction. Through the model construction and various data analysis, the domestic consumption behavior is studied more comprehensively and deeply. This valuable report will undoubtedly provide a reference for the future development of e-commerce. Drucker, the father of modern management, said the best way to predict the future is to create the future. In fact, after the 'Double Eleven', every e-commerce companies have a key task, which is to analyze big data based on the massive transaction information accumulated by various platforms, which will guide investment, create opportunities, and realize personalized customization in finance.

The big data strategy is obviously crucial to the future development of Internet finance. Whoever ignores big data will be abandoned by the times. As a department that implements macro-control and Internet financial supervision, the People's Bank of China Financial Research Institute brings together the research results of the past two years and assembles into the 'New Financial Era'. Through authoritative interpretation, it analyzes the development status, regulatory rules and future of various Internet formats. trend. As the Vice President of the Central Bank, Pan Gongsheng, summed up in the preface to the book, the current academic circles and the industry have discussed three aspects of Internet finance. They have formed three views:

First, they must see the tremendous changes caused by Internet finance, and they must see that they have not changed the essence of finance. Second, it is necessary to see the competitive substitution of the emerging financial industry for the traditional financial model, and to see the broad cooperation space between these two parts. The last one is that It is necessary to pay close attention to the financial risks brought about by Internet financial innovation, however cannot inhibit the vitality and motivation of the market.

While the 'New Financial Era' generally affirms the advantages of Internet finance, it also points out that these advantages are not the same as replacing traditional finance, but more as a supplement and development direction of traditional finance. Another trend of Internet finance is from offline to online. It may be called financial internet, that is, the financial industry is going to the Internet. The breakthroughs in the work of ICBC, the Minsheng Direct Bank, and the Ping An Orange Bank in recent years are all make effort in this direction. The 'New Financial Era' especially pointed out the possible problems of Internet finance from the perspective of supervision, such as regulatory arbitrage, data forgery, technical loopholes, and irrational behavior. To accelerate the integration of Internet finance and traditional finance, online and offline must be deeply integrated, and the use of big data analysis to shape a more rational financial order and regulatory model, which is an inevitable requirement of China's economic development.

The 'New Financial Era' first compares the similarities and differences between online banking and traditional banking. Internet banking is a new thing, and it still faces various bottlenecks. Compared with traditional banks, the biggest advantage of online banking is database. Based on data mining, online banking can grasp the borrower's large amount of information in real time and use the data model to grant credit to the lender, which can proactively judge potential risks. Take the credit risk management of ant small loans as an example. The main products of ant small loans include: Taobao (Tmall) order loans, Taobao (Tmall) credit loans, Ali credit loans and consumer loans.

Information is the core of finance, and risk management is the top priority of the financial industry. It is difficult for the traditional financial industry to quickly and efficiently obtain huge amounts of data from customers and potential customers. If one-to-one online operations are performed, the cost will be unbearable. The ant small loan better solves these problems, and the big data analysis can be used for screening and screening first, which not only has low cost, but also has convenient procedures and can enhance the customer experience.

Of course, on the one hand, online banking reduces the operational risks caused by traditional artificial factors, and on the other hand, it also generates new operational risks, mainly reflected in the technical security risks arising from the high dependence on the network information platform and the real-name authentication using remote channels, which will cause the certification risk. These risks need to be solved by scientific means such as face recognition technology. The supervisory layer should further strengthen the supervision and breadth of the supervision.

One famous person said: "The essence of the Internet is sharing. Only sharing can bring resources together. Only when resources are brought together can the cost of communication and transactions be reduced." The world is crushed into a flat shape in this sense. The big pie, and the industry chain that used to rely on information asymmetry in the past will be completely broken. This is the natural advantage of Internet finance. Internet finance has lowered the threshold for investors, and everyone can become a 'financial party' and can be transformed into a 'lender' when needed, which allows fragmented funds to be used more efficiently.

4 Suggestions for further study

It is the first time for team members to learn and use the web crawler technology, and we only crawl the text content, comments, likes and forwarding amount of official Weibo account to extract key words to analyze the trends and focuses of these AI companies. The web crawler technology is quite useful and might be proceeded for crawling the information on the website or the paper published by the scientists of the company in the future. Also, due to the limited time, we do not have extra time to learn more technologies such as natural language processing, which can be utilized for processing and sorting out more information we need. On the other hand, since those companies have not listed yet, public information cannot be obtained easily, making it difficult for us to collect valid and objective data and study the company from various aspects. If

they are going to be publicly traded in the coming future, we are able to analyze them more concretely and deliver a more reasonable result.

5 Individual contribution

Table 1: Individual contribution

Research Component	Li Ye	Gao Jianyu	Tian Lei	Chen Shuying	Xu Liyuan
Products			√	√	
Investors&Partners		√			√
Competitors	√				
Industry Analysis			√		
Policy Analysis		√			
Web Crawler	√			√	√
Article Review			√	√	
Data Collection&Process	√				
Report		√			
PPT					√

Reference

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Appendix

Presentation link: https://youtu.be/YX6w84rOWXk

Codes: Please refer to the code files.
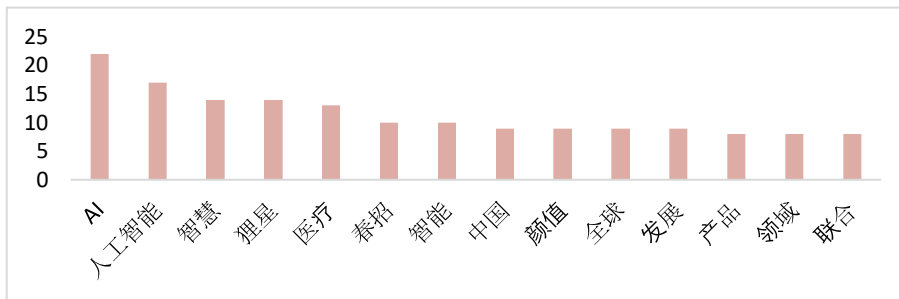
Graph 3. Word cloud of Yitu
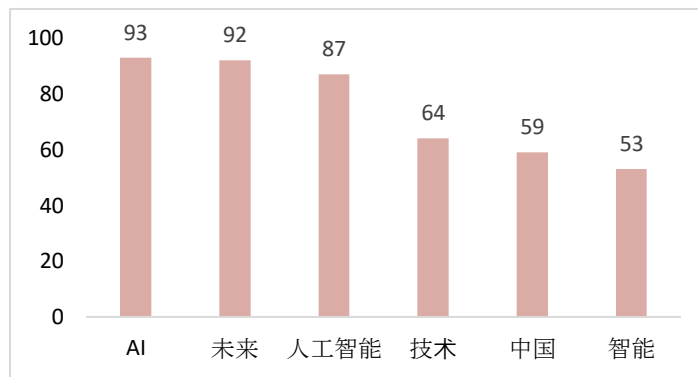

Graph 4. Word cloud of MEGVII

Graph 5. Word cloud of CloudWalk

Graph 6. Key words in 2019—Yitu

Graph 7. Key words in 2019—MEGVII

Graph 8. Key words in 2019—CloudWalk