

Review on the Status and Development Trend of AI Industry

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Abstract—The status and development of artificial intelligence attract scholars from different countries. This paper focuses on status of AI and majors to conduct in-depth research in AI industry. The paper draws the outline of general status based on AI from quantitative to qualitative scientific practice, the development level of AI is inferred. We investigated the differential AI status of all of the verified cases distributed from 1990 to 2017. Choosing the artificial intelligence industry as data source, AI research output was inspected and some key elements of AI were analyzed. We found that AI papers increased to more than 400%, AI venture capital surged 6 times, AI start-ups surged 14 times, New AI application skills become the core skills of job searching, image labeling accuracy rate was up more than 26%, robot imports increased to 2.5 times. And then its future development trend is predicted. A large study reveals that ‘AI+ Industry’ is the future development direction, computer vision research highlights image and video applications, sales of Robot increase year by year, increased types of work and high efficiency of human-machine complement, and interactive interface makes people go head with empty hands.

Keywords—AI; industry; status; trend; image labeling accuracy; venture capital; sales of robot; interactive interface

I. INTRODUCTION

AI, artificial intelligence, which takes digital computers or digitally controlled machines to simulate, extend and expand human intelligence. It is a system of theory, methods, techniques, and applications, which could get the best results by sensing the environment, acquiring knowledge, and using knowledge. At present, AI mainstream research still focuses on weak artificial intelligence, and it has made significant progress, such as speech recognition, image processing and object segmentation, machine translation and so on. Besides, strong artificial intelligence refers to a smart machine that equipped with real thinking. That is to say, the machine can be thought that it is self-conscious [1]. This paper predicts the development trend based on the artificial intelligence industry. Also, it puts forward proposals for development prospects and investment directions. Artificial intelligence technology has gradually matured, and relevant policies have been introduced to promote the continuous development of industrial applications [2-3]. With the integration of high-tech such as artificial intelligence, sensing technology, and big data, various medical services have gradually become intelligent and accelerate the development of the smart medical industry [4]. Artificial intelligence related technologies have been gradually explored or applied in the fields of auxiliary diagnosis, genetic testing and personalized

treatment, patient and elderly intelligent care, intelligent drug research and development and many other fields [5]. With the popularity of the Internet, the ubiquity of sensors, the emergence of big data, the development of e-commerce, as well as the rise of information communities, data and knowledge are intertwined and interacted between human society, physical space and information space [6].

II. ANALYSIS OF THE CURRENT SITUATION OF INDUSTRIAL DEVELOPMENT

The industry covered by artificial intelligence is relatively broad, mainly including the base layer, technology layer and application layer, covering a variety of different technologies and application scenarios [7]. Pricewaterhouse Coopers pointed out that by 2030, AI will bring 14% growth to global GDP, which is equal to \$15.7 trillion. Here, \$6.6 trillion comes from productivity gains and \$9.1 trillion comes from related consumer/commercial markets. In order to study and judge the development of the artificial intelligence industry as well as the impact of artificial intelligence on humans, Stanford University, the top US university, continued to investigate AI activities. Based on verifiable data, they reveal the current status of AI development.

A. Number of AI Papers Increased to more than 400%

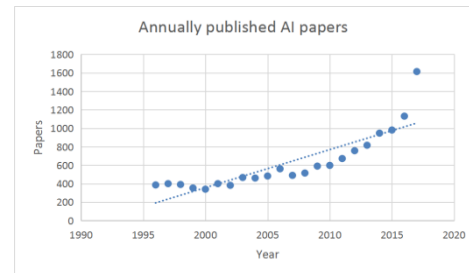


Figure 1. Increase in the number of AI research papers chart

Since 1996, in the following 20 years, the number of AI papers has increased significantly, increasing to more than 400%. The rapid increase in the number of academic research papers indicates that the number of new intellectual property rights and patents has also advanced by leaps and bounds. In the Web of Science platform, the entire database contains 13735 papers from 1996 to 2017 in the field of computer science with the keyword ‘Artificial Intelligence’. It can be seen that the number of research papers on AI has grown rapidly, and the momentum of publication has shown a good trend.

B. AI Venture Capital Has Surged 6 Times since 2000

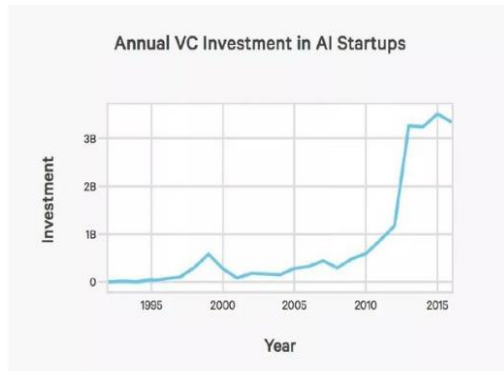


Figure 2. AI venture capital growth chart
Source: Crunchbase, VentureSource and Sand Hill Econometrics

Venture Capital (English: Venture Capital, abbreviated as VC), also known as venture capital investment, which is a form of private equity investment. According to research data from Stanford University, the top US University, since the year 2000, venture capitalist (VC) have invested six times more in investment of AI start-ups each year. Figure 2 in detail reflects the total annual investment of VC in AI start-ups at all financing stages in the United States. Generally speaking, venture capital is invested in start-ups with high technology. The rapid increase in the amount of investment indicates that venture capitalist (VC) have a firm confidence in the development of AI start-ups and are extremely optimistic about their development prospects. For Crunchbase, VentureSource and Sand Hill Econometrics, which are used to determine the amount of VC annual investment in start-ups, these start-ups play an important role in certain key areas.

C. AI Start-ups Surge 14 Times

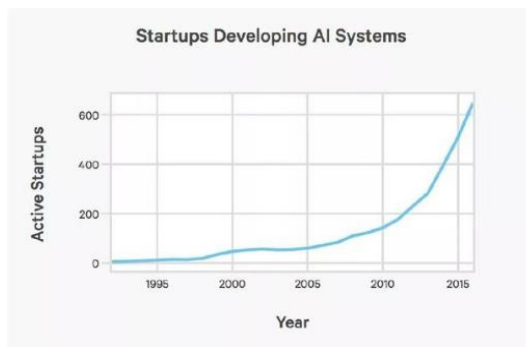


Figure 3. AI start-up growth chart
Source: Crunchbase, VentureSource and Sand Hill Econometrics

Figure 3 reveals the growth situation of AI start-ups in the United States in recent years. Since 2000, the number of AI start-ups with capital support in the United States has increased by nearly 14 times. Crunchbase, an enterprise service database company that covers the ecology of start-ups and investment institutions. VentureSource, VentureSource is the most accurate, comprehensive global database on companies backed by venture capital and private

equity. Sand Hill Econometrics, provides for VentureSource estimated values for rounds of funding for private companies. All three have quantitatively analyzed the number of AI start-up companies.

Currently, Amazon, Google, Facebook and IBM are leading the way in artificial intelligence. These giant companies collect more usable data and lay out in the field of artificial intelligence.

Amazon has invested in artificial intelligence for more than 20 years, grabbing more than 5 PB of web page data, more than 500,000 JPEG images and corresponding JSON meta-data. More than 250 million data is captured every day in the world of radio, magazines and online news. Nearly 100M images and videos are captured every day. Amazon Echo series speakers have occupied more than 70% of the voice assistant market.

Google has the world's largest database, focusing on applications and product development. Google Brain has a team of more than 1,300 researchers and has a 23.8% share of the voice assistant market. The size of the Google Earth database is estimated to be 3017 TB or approximately 3 PB, and Google Street View has approximately 20 PB of Street View photos. In addition, Google has a deep learning artificial intelligence research project, Google Brain, which covers machine learning, natural language understanding, and robotics.

Facebook processes 2.5 PB of content and more than 500 terabytes of data per day. Facebook Artificial Intelligence Researchers produce 30 million photos a day and scan about 105 terabytes of data every 30 minutes. It has a 62,000 square foot data center that can hold up to 500 racks. Translate 2 billion user posts in more than 40 languages every day, and 80 million users need to use these translations every day.

IBM plans to create a MIT-IBM Watson Artificial Intelligence Lab with a 10-year, \$240 million investment. IBM has more than 2,000 AI employees worldwide, and Watson users span five continents and more than 25 countries. IBM invested \$1 billion in the Watson project, including \$100 million in venture capital.

D. New AI Application Skills Become the Core Skills of Job Search

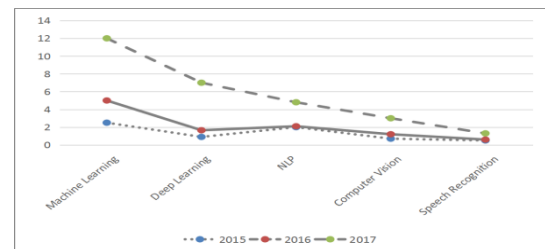


Figure 4. Core of job search AI application skills map

Figure 4 reflects the core skills that are most needed for the current job. According to statistics on the online job search platform Monster.com: deep learning, machine learning and natural language processing (NLP) have become the three most important skills for job hunting.

Especially for NLP, NLP has long been predicted to become the most needed skills for new AI applications, and application developers must master the NLP skills. In addition, the most popular skills include machine learning technology, Python, Java, C++, Spark, MATLAB and Hadoop. According to Monster.com's salary statistics, US data scientists, artificial intelligence consultants, and machine learning supervisors could earn \$127,000. Many signs indicate that modern international companies require job seekers to master certain AI skills.

E. Image Labeling Accuracy Rate Was up more than 26%

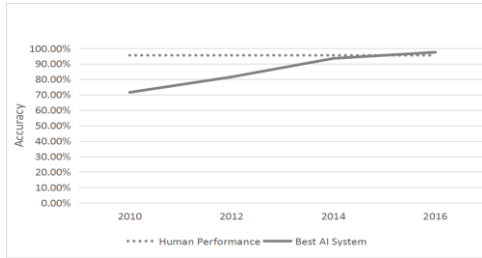


Figure 5. Image labeling accuracy rate floating graph

Figure 5 reflects the accuracy of image labeling from 2010 to 2016. It can be seen that the accuracy of marking increases from 71.5% to over 97.5%, and the accuracy rate increases by more than 26%. Yong Rui, deputy dean of Microsoft Research Asia, proposed that before the introduction of deep learning in 2012, the error rate of image labeling was as high as 28.2%. Later, the deep learning network analysis model was introduced, and the error rate of machine-labeled images began to decline. From 16% in 2012 (already lower than 2012) to 3.5% in 2015. According to the analysis of the competition data of the LSVRC competition rankings on the ImageNet website, and in the object detection task of the 2014 Large-Scale Visual Recognition Challenge (LSVRC), AI performed exceptionally. In this particular task, AI is more precise than humans.

F. The Number of Robot Imports Has Increased to 2.5 Times

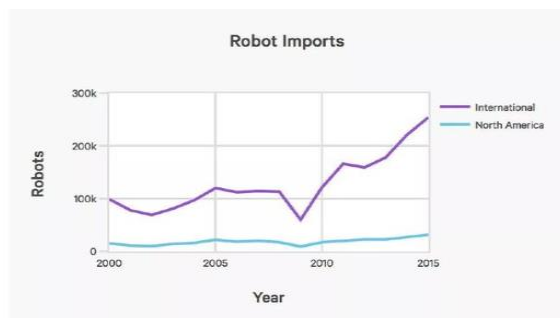


Figure 6. Robot import quantity growth chart

Source: International Federation of Robotics, World Robotics Project

Figure 6 reflects the number of industrial robots imported into North America and the world in recent years. From 2000 to 2015, in this time zone, the import volume of robots has increased from 100,000 units to 250,000 units, and robot

imports have increased to 2.5 times. Especially after 2009, the import volume of robots has increased rapidly [8]. From a global perspective, International Data Corporation (IDC) predicts that robot consumption will continue to accelerate in five years, reaching \$230.7 billion by 2021, with a compound annual growth rate (CAGR) of 22.8%.

III. DEVELOPMENT TREND OF ARTIFICIAL INTELLIGENCE INDUSTRY

A. 'AI+ Industry' Is the Future Development Direction of Artificial Intelligence

Nowadays, artificial intelligence has begun to enter various fields such as medical care, transportation, environment [9], and justice, and is playing its due role for the benefit of mankind. On the base of a large number generated cases and health data, artificial intelligence technology is bound to play a huge role in medical fields such as disease prediction, precision drug application, and cancer research[10-15]. Studies have shown that intelligent traffic management of AI can shorten people's waiting time, save energy and reduce emissions. In the area of human environmental protection and monitoring, unmanned boats equipped with complex sensing devices are applied to marine patrols to collect data on the oceans and to be aware of changes in the marine ecosystem. In the future, this technology may be applied to weather warning, climate monitoring, and illegal hunting monitoring and so on [16-17].

B. Computer Vision Research Highlights Image and Video Applications

Computer vision is an artificial intelligence technique that mimics human vision, using machines to 'see' images and 'understand' images. As known in Figure 7,

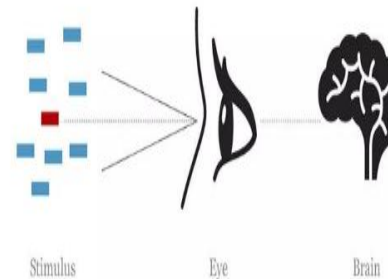


Figure 7. 'see' and 'understand' images chart

In recent years, humans have tried to reveal the essence of biological vision and nervous system from multiple levels. Emotion is a dimension of artificial intelligence research. Scientists summarize emotions, and current analysis software can accurately identify 26 emotional expressions. Moreover, through the subtle expression curves of the corners of the eyes, the nose, the corners of the mouth, the analysis software can respond accordingly, and even

recognize the true and false expressions. The software responds to human emotions, that is, humans and artificial intelligence share various emotional knowledge and various new applications.

Computer scene recognition and vision applications have now penetrated into various research areas.[18-20] Along with the rapid development of graphics processing chip GPU manufacturing, machine learning, especially the rapid development of deep learning algorithms, computer vision technology is showing a good development trend.

C. Sales of Robot Increase Year by Year

In a research report entitled 'Personal and Professional Services Robot Market: Global Forecast and Assessment 2012-2017', market research firm MarketsandMarkets pointed out that global service robot sales in 2017 were \$46.1 billion. According to statistics, the global average industrial robot density in 2015 was 69, and the average industrial robot density in industrial powers in developed countries such as Korea, Japan and the United States exceeded 150. Among them, South Korea has the highest density of robots in the world, and it is 531. The robot density in the United States is 176, and the density of Chinese robots is lower than the global average, only 49. It is estimated that between 2016 and 2020, China's annual growth rate of robot sales will reach one-fifth. In 2020, China's robot density will exceed 170 [21]. According to the IFR (International Federation of Robotics), the world's industrial robot inventory will reach 300,000 by 2020. However, in 2016, the inventory was 182,800 units, which means that the robot market will maintain a growth rate of 14% in recent years [22-23].

D. Increased Types of Work and High Efficiency of Human-machine Complement

Kevin Kelly, the founding editor of Wired Magazine, known as the 'Prophecy', believes that future artificial intelligence or robots will bring new jobs and types of work. With the development of artificial intelligence and robots, many new jobs will be born in the future [24-25]. As far as current technology is concerned, robots are more suitable for solving efficiency problems. People are more suitable than robots for work that does not require efficiency or dexterity. Some work on inventions and relationships is less likely to be replaced by robots [26]. People and robots work together, and human-machine teams or human-machine hybrids can complement with each other, maximizing the intelligence of all parties [27]. And finally it can work more efficiently.

E. Development of Interactive Interface Makes People go Head with Empty Hands

In the theory of American futurist Raymond Kuzwell, 'singularity' refers to the fusion of humans and other species (objects), that is to say, the wonderful moment when computer intelligence is compatible with human brain intelligence. Kuzwell predicts that by 2045, 'singularity' will appear. The interface between artificial intelligence and human interaction is presumed to be information about a certain part of the human body in the future. For example,

fingerprints, sounds, faces, and eyelids become interactive interface, and it is also possible to be interface of body posture, posture, and expression. In different situations, you can also use voice navigation, enter text on the screen, play games with virtual reality, or the ultimate interface will be virtual reality. There are many ways for humans to interact with artificial intelligence or robots in the future[28-29]. For example, in the future, the key to the door may be the holographic image of the human body; Apple's concept watch would make use of gestures to operate various functions; In a natural environment, a gesture or idea can be transformed into a mobile phone or computer or pay wallet even without anything.

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