# Yiou Intelligence

## AI Industry Synthesis Report

## April,2017

# Introduction

Machines can not only extend humans' hands and feet, replacing humans on some manual labor, but also extend humans' brains, replacing some humans' thinking activities. It has already been an obvious fact since the advent of computers. Following this direction, a new technology of artificial intelligence (which we use AI as abbreviation in following) will be formed gradually in the future, with the development of computer technique.

AI includes but is not limited in simulating the central nervous system in the human's brain to build neural network models to deal with complex and changing problems in the reality. It could instruct the computer to play chess, prove theorems, draft strategies and make decisions, use machines to recognize the words, sound, and images, contact with computers directly through the natural language (human language), and develop machines with the capability of recognition, analysis, synthesis and execution, and so on.

From the time human first created the computer which needs guiding and controlling to run, to the time when the computers could learn by themselves, there is a qualitative leap for the academic community and it brings economic benefits of the tangible productivity to the industry.

We believe that 2016 is an important turning point for the development of AI. It is faster and stronger computing power and the explosively growing database that push AI to the spotlight. It is not too much to say that AI has been at the forefront of popular culture and political discourse. However, we also speculate that it is also possible that AI will be at the cusp in the next intersection.

The purpose of this report is to review the route of the development of AI, to examine the nature of AI technology, to unearth the opportunities and challenges for technology landing in the specific market with a researching attitude, and help with the continuous development of AI before the come of the time "giving people promises and disappointing them".

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Tracing the generation and development of AI

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### 1.2 Development of neural network

From neural module to deep learning

### 1.3 The opportunities and challenges of deep learning

## Reviewing the history of AI development

### ·What is AI?

In general, AI is to create a machine which can think like humans. It not only exists in science fiction films, but also is the ultimate dream of science geeks, and the synonymous of the impractical, whimsical fantasy of the technology fans.

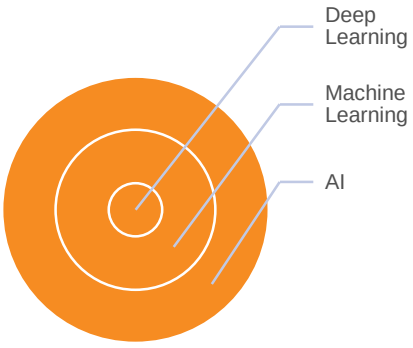
For the narrow sense of AI, Professor Nielson from Stanford University's AI Research Center in U.S.A. defined it as: "AI is the subject about knowledge, is the science about how to express knowledge and how to acquire and use knowledge. Defining AI by the functions it achieved, it is the functions performed by intelligent machines which is usually human intelligence-related, such as judging, proving, identification learning and problem solving and other thinking activities. These reflect the basic ideas and basic aspects of the AI discipline that AI is to study the rule of human intelligence activity. In a practical view, AI is a knowledge engineering: to have knowledge as the object, study the acquisition of knowledge, the method of performing knowledge and the use of knowledge. "

### ·Tracing the generation and development AI

The earliest artificial neural model was proposed in 1943. A group of scientists discussed at the Dartmouth Conference in 1956. They finally proposed the concept of AI and the year then became the first year of AI. In the Fifth International AI Conference in 1977, computer scientist Professor Fergenbaum from Stanford University formally put forward the concept of knowledge engineering. Various expert systems were then developed, and many commercialized expert systems were introduced to the market. Unfortunately, the development did not last long due to the lack of learning ability of the computer system, or in other words, the learning ability was very limited and failed to satisfy the new needs of technology and production. Therefore, following the expert systems, machine learning has become another important area of AI.

### ·The relationship between AI, machine learning and deep learning

The relationship between AI, machine learning and deep learning is that the latter belongs to the former. The on-trend deep learning is a branch under machine learning, and the multi-layer neural network it constructed is actually evolved from the earliest neuron model.



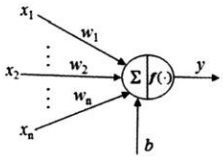
## Reviewing the history of AI development

### ·The history of neural network development ;

M-P neuron model ;

Single-layered perceptron ;

Multilayer perceptron ;




Deep Neural Network , DNN;

Convolutional Neural Network , CNN;

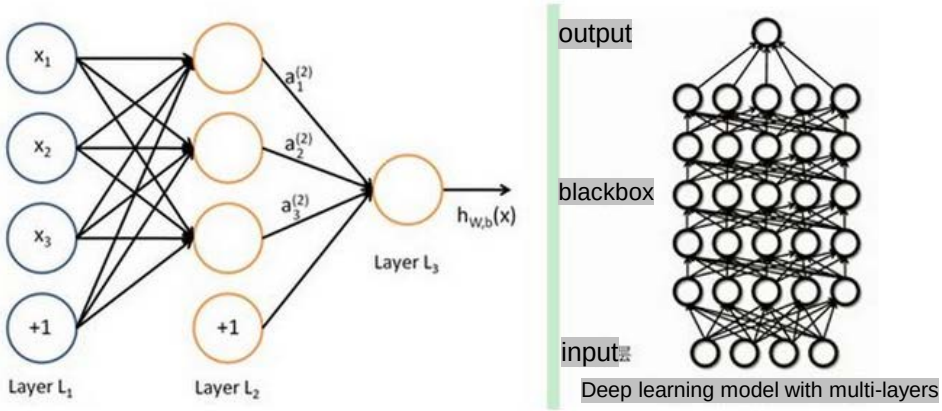
Recurrent Neural Network , RNN ;

……

Early in 1943, the first M-P neuron model was established before computer was invented. In this model, neurons receive the input signals which conveyed through weighted links transmitted from infinite neurons. The neurons compare the total input values received with the threshold of the neuron, then produce neuronal output through activation function.

The single-layered perceptron proposed in 1958 was developed from M-P neuron model. It was constructed with two layers of neurons of input and output, and was able to solve simple linear problems of logical conjunction, logical disjunction and negation. However, it was doubted in a book written by Minsky, one of the AI's founders in 1969.

A single-layered perceptron indeed cannot solve exclusive disjunction problems, but a multilayer perceptron (MLP) built with piled single-layered perceptron, the multi-layered neural network in our words, is able to solve them. It splits tasks which it cannot solve in one step into many steps, learns the statistical laws from a large amount of training samples with calculations in the same time, and thereby predicts the unknown events.



Deep learning model with multi-layers

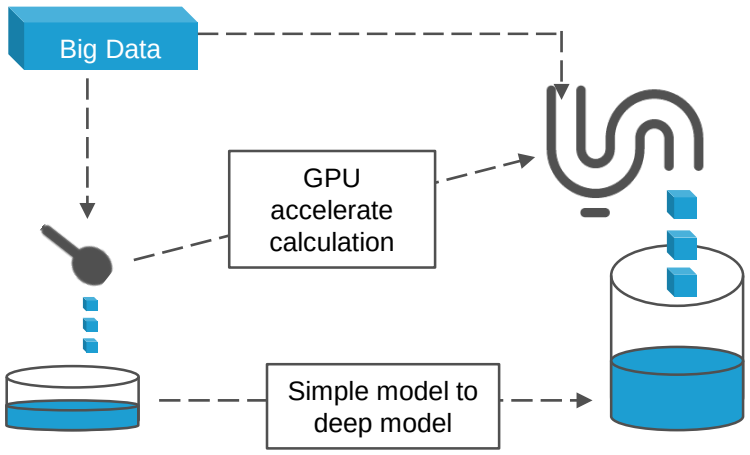
The so-called deep learning, which in a narrow sense refers to layers of neural networks, in a number of tests and competitions, especially in those related to the application of complex objects such as voice and image, has achieved superior performance.

## Reviewing the history of AI development

In the past, if one wants machine learning to achieve good performance in the application, the requirement of the user's skill would be higher correspondingly. However, as the deep learning technology is based on complex model, the users often only need pay effort on adjusting and tuning parameters to get good performance. The threshold to users was greatly reduced.

### ·The opportunities of deep learning

Deep learning is a kind of machine learning. Its nature is to calculate data and generalize the model from the data. In fact, neural networks have been existing for a long time. In the case with the same number of parameters, multi-layered model of deep learning has stronger expression ability than the shallow model.




Draw an analogy that big data is water, and the computing power is the tool for conveying water, it is the GPU and others, which replace the spoon with the water pipe, that increase the irrigation quantity (to improve the operation speed) more efficiently. It is the container of depth model trained by the deep learning algorithm which increases the loading capacity of water that greatly improves the efficiency. After this engineering approach, the deep neural network built by deep learning has become a practical weapon for the industry, and has brought milestone-like changes in a number of areas.

### ·The challenges of deep learning

Deep learning is the technology with the highest exposure rate in these 20 years, but it is not all of the innovations of AI. Its innovation occurred in the late 1980s, when there was a boom of multi-layer neural network technology for AI, but it was not successful, and even experienced more than 10 years of winter. The reason behind is that there was no large amount of data and high-performance computing power to do a lot of computation in past.

## Reviewing the history of AI development

Furthermore, there are also some defects on deep learning. Ruling Lu, a researcher from Institute of Mathematics in Academy of Mathematics and Systems Science, Chinese Academy of Sciences and professor in Fudan University, mentioned when writing the preface for the book Machine Learning that one of the defects is the theoretical innovation of depth study is not obvious enough, and the second defect is that the operation of depth study is only applicable to neural networks.

An additional defect is the unexplainable feature of deep learning. The process that deep learning extracts the characteristics of the original input information and output information is a black box, lacking interpretability.

There are industry insiders who believe that "how to let deep learning process merge with the large number of highly structured knowledge that human beings have accumulated, to develop logical reasoning, even self-consciousness and other human advanced cognitive function, is the core theoretical issue for the deep learning in next generation. "

In contrast, some people think that "AI is not human intelligence. Machines exceed the human brain without need to imitate the human brain. Just like people do not eliminate large beasts with stronger or sharper claws. The greatest role of AI is not to imitate human, but to mechanize those human intellectual labor which can be replaced by machines.

The strength of machine is its extremely low cost of individual education and extremely fast speed of communication. The speed of information exchanges between people is only a few bits per second, but the machine’s is quicker than this for almost a few million times. The machine does not need to compare with human on their calculating ability. As long as its rate of evolution is faster than human, there will inevitably be a killer machine in the natural selection.

# CHAPTER 2

## Thinking about the nature of AI

### 2.1 Overview of all kinds of AI technologies

### 2.2 Computer Vision Technology of Computer

What is computer vision ?

Classification of computer vision technology

Identification process of computer vision technology

Structure graph of computer vision technology

### 2.3 Speech Recognition Technology

What is speech recognition ?

Speech recognizing process

Structure graph of speech recognition technology

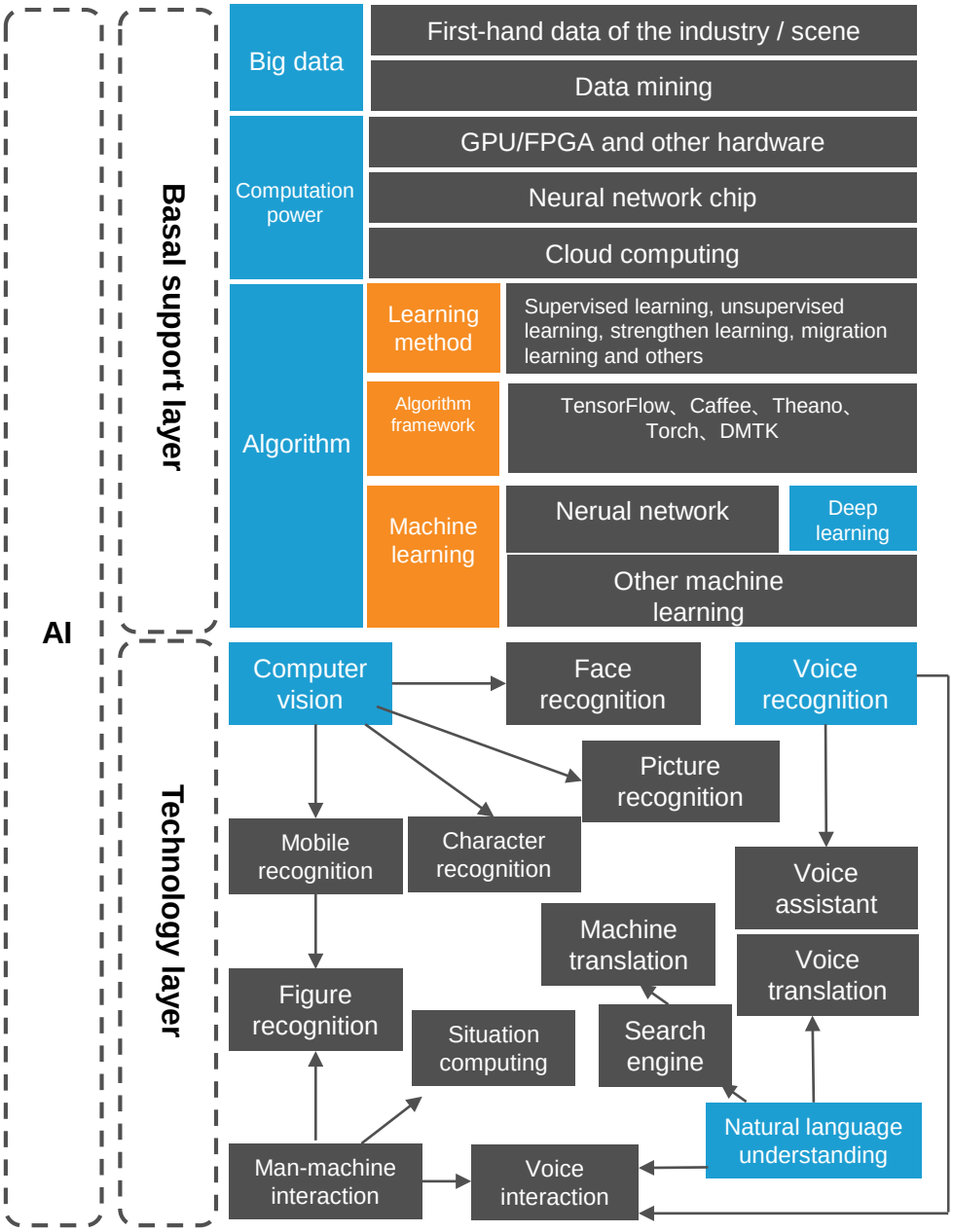
### 2.4 Natural Language Understanding Technology

What is natural language understanding ?

The application of natural language understanding: search engine and machine translation

## Thinking about the nature of AI

### ·Overview of all kinds of AI technologies




As mentioned earlier, the innovation of algorithm on the basal support layer happened in the late 80s of last century. It is the big data and computing power that push AI to the spotlight. Furthermore, it is the foundation for technologies such as computer vision, speech recognition and natural language understanding. The machine tries to understand the human world through looking, hearing, communicating with human by human languages, and to study on the rules of human intelligence activities.

**Thinking about the nature of AI**

# ·Computer Vision

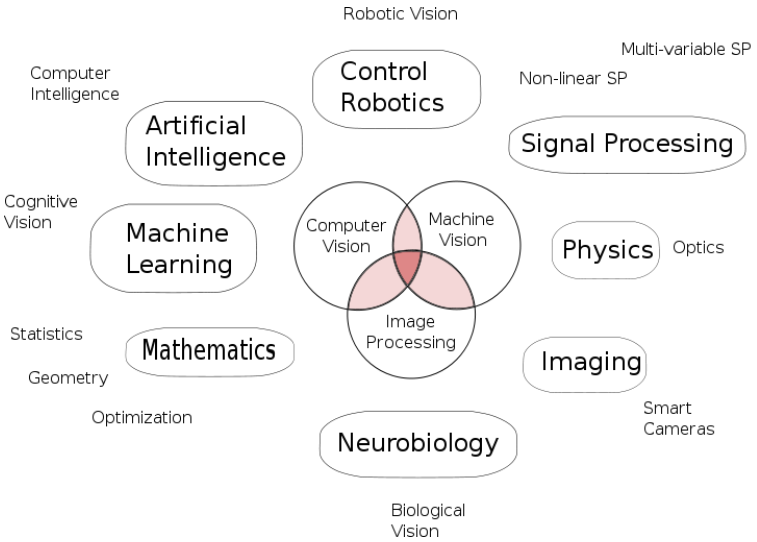
## ·What is computer vision ?

About 70% of the brain's cortical activity is dealing with visually related information, which is equivalent to the gates of the human brain, others such as hearing, touch, and taste are narrower channels. Visual is like a high way with eight traffic lanes, and the other feeling are like sidewalks on both sides. If you cannot deal with visual information, the whole AI system is an empty shelf. It can only do symbolic reasoning, such as playing chess and proving theorem, but cannot enter the real world. Computer vision is like a door-opening spell for AI. The door is inside, and if you fail to open it, there is no way to study AI in the real world.

—— Songchun Zhu, Professor of statistics and computer science of University of California, Los Angeles

According to China science communication's definition of computer vision, this is a science studying how to let the machine "see". Furthermore, it refers to the machine vision that use computers to replace human eyes to do target recognizing, tracking and measuring, and to do further graphics processing, so that the computer processing will be more suitable for human eye observation or transmission of images for the instrument to detect.

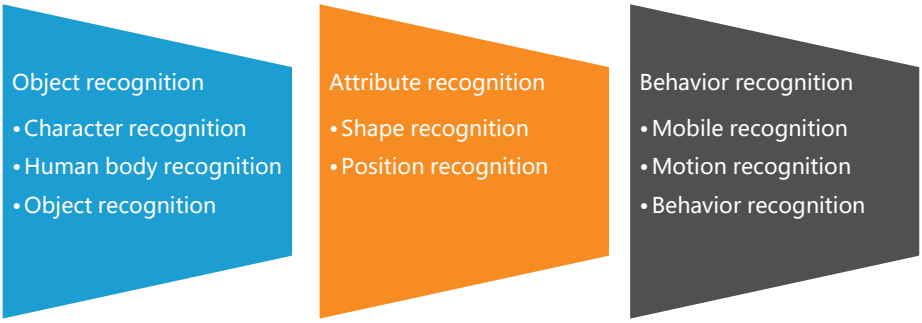
## ·Computer Vision VS Machine Vision




Computer vision is more concerned with the study of the image signal itself, as well as image-related cross-field (map, medical image); machine vision emphasizes on computer vision technology engineering, and is more concerned about the application of the image signal (laser and camera) in the broad sense and automation control (production line) aspects.

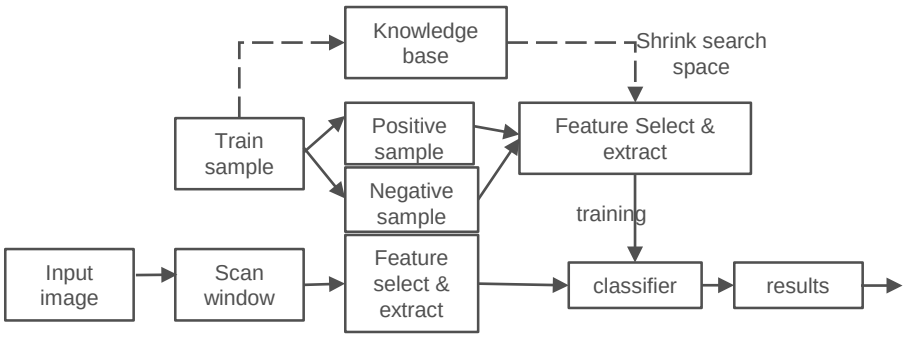
## Thinking about the nature of AI

### ·Classification of computer vision recognition technology




Object recognition is divided into "1 VS N", classifying different objects, and "1 VS 1", distinguishing and identifying the same type of object. Object properties recognition, combines with the map model so that the object can get the memory reconstruction in the visual three-dimensional space, and then analyzes and judges the situation. Object behavior identification is divided into three advanced steps. Mobile identification determines whether the object has done displacement. Action identification determines what the object has done. Behavior recognition is combined with the visual subject and scene interaction to make the analysis and judgment of the behavior.

### ·Computer vision recognition process



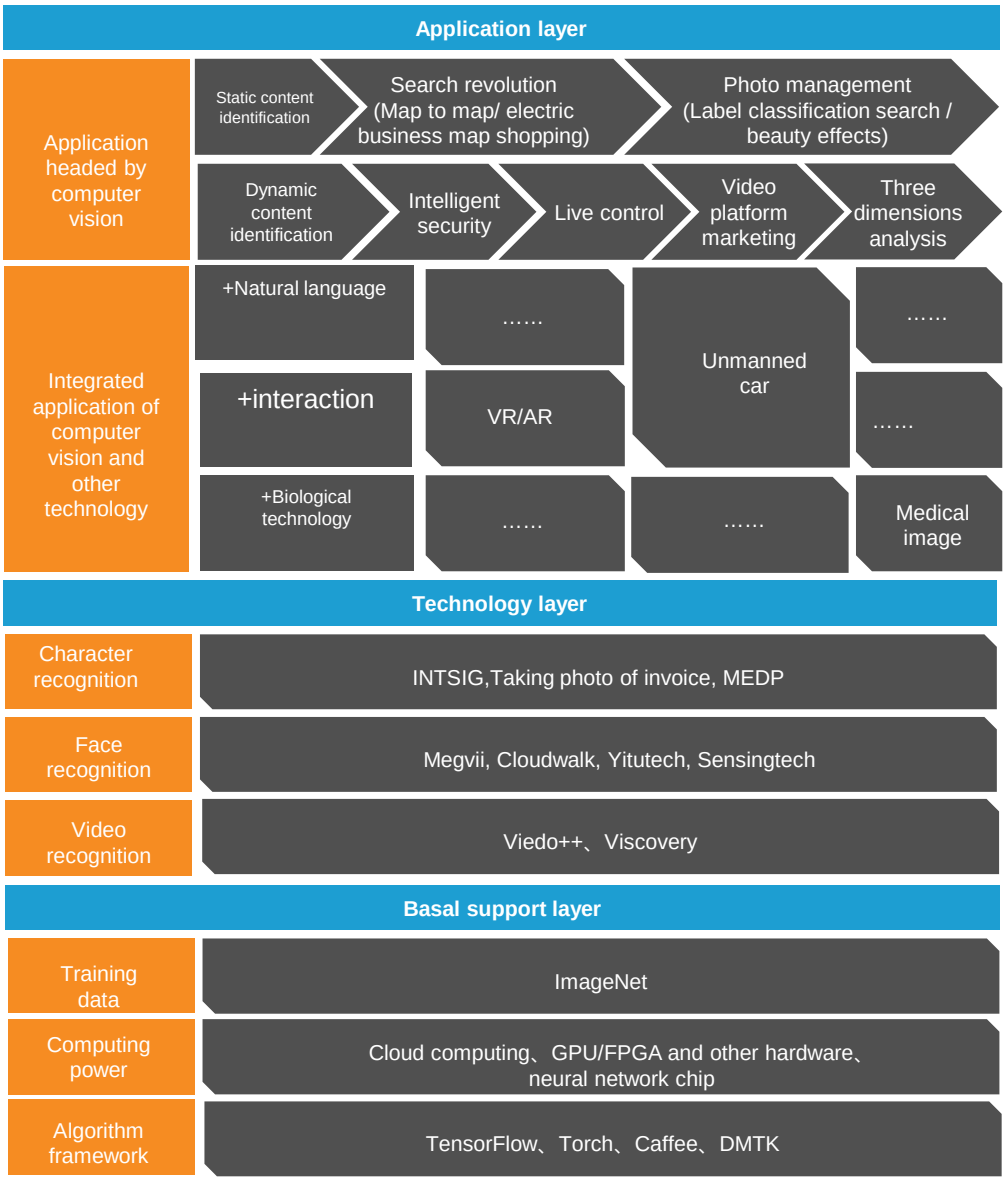

The computer vision recognition process is divided into two routes: training model and identifying images

**Training model:** The sample data includes positive samples (samples containing the target to be tested) and negative samples (samples that do not contain the target). The visual system uses the algorithm to select and extract the characteristics of the original samples, getting the classifier (model). There are thousands of sample data, and the number of extracted features is doubled. In order to shorten the training process, people might add knowledge base to tell the computer some rules in advance, or introduce some restrictions to narrow down the search space.

## Thinking about the nature of AI

**Identifying image:** Signal conversion, noise reduction and other pre-processing will be done to the images, and then use the classifier to do target detection for input image. The general detection process is sliding a subsidiary scan window on the image which need to be detected continuously. Sub-window will calculate the characteristics of the region in every position. And then use the training classifier filter the characteristics of the region and determine whether the region is a goal.

### ·Structure graph of computer vision technology




ImageNet provided by Stanford University AI Laboratory is the world's largest image recognition database. Collecting the appropriate training data is also necessary for subdivided field such as medical and others; technology tycoons such as Google and Microsoft will provide open source algorithm framework to the market and primary algorithm for the initial visual recognition company.

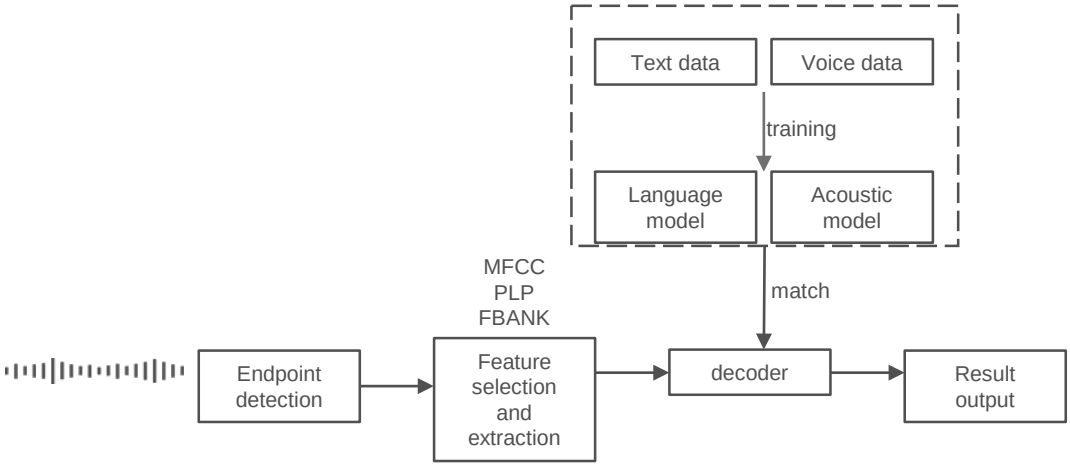
# ·Speech Recognition

## ·What is Automatic Speech Recognition ?

Speech recognition is a technology that uses voice as the object of study. It is a technology to convert the speech signal into the corresponding text or command after the machine automatically recognizes and understands the language spoken by the human beings through the signal processing and recognition technology.

Voice interaction which composes of speech recognition, speech synthesis, natural language understanding and semantic network technology is gradually becoming the main way of multi-channel, multimedia intelligent human-computer interaction currently.

## ·Speech recognition process

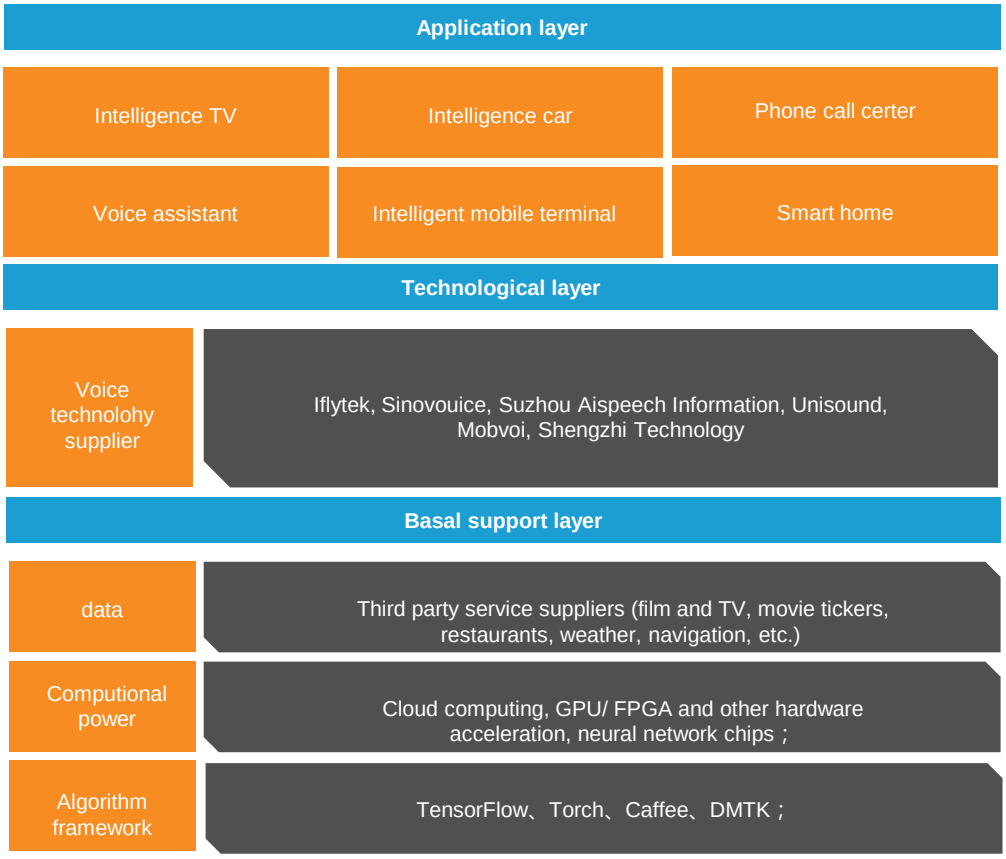



The speech recognition process is divided into training and identifying.

After front-end signal processing, endpoint detection and other pre-processing, voice signals will be extracted frame-by-frame to extract voice features. The traditional feature types include MFCC, PLP, FBANK and other characteristics. The extracted features will be sent to the decoder. The most matching sequence will be found and output as the result of the recognition under the well-trained acoustic model and language model.

## Thinking about the nature of AI

### ·Speech Recognition Technology Patterns and Correspondence Graphs




**Basal layer**: Contains big data, computing power and algorithm. The big data is accessed to the third-party service providers of the corresponding areas. Machines access the human voice command and provides the corresponding service such as film and television, movie tickets, food and so on;

**Technical layer**: voice technology providers; headed by Ifytek;

**Application layer**: Manufacturers have given the devices in the traditional home environment such as TV and speaker the voice recognition function as the new way interaction. Smart cars with voice interaction improve the safety factors by reminding the drivers keeping their hands on the steering wheel; and there is also voice assistant produced by search firms base on searching.

# ·Natural Language Understanding

## ·What is Natural Language Understanding ?

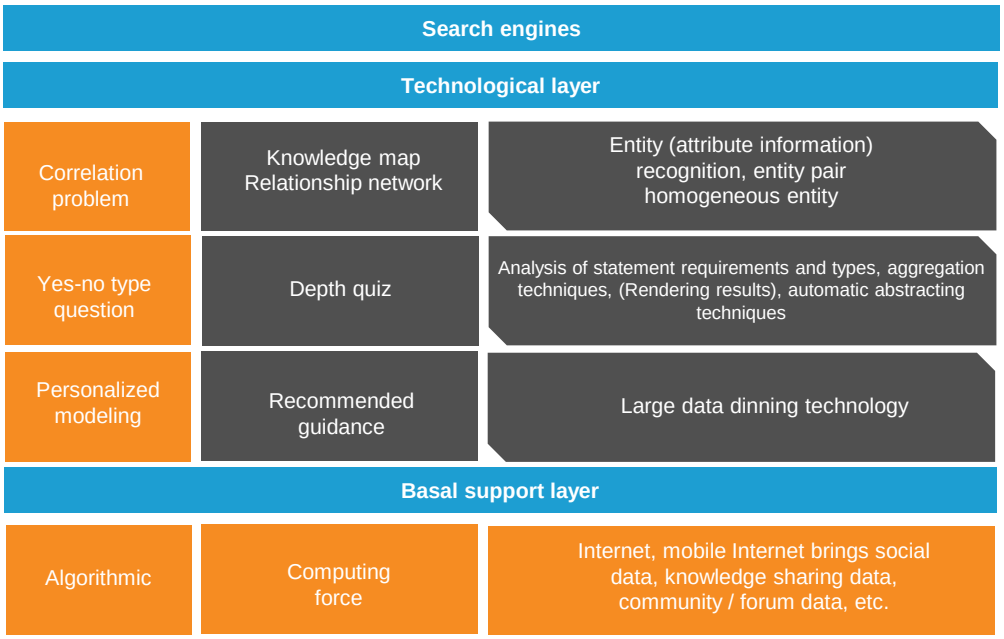
Natural language understanding is the text comprehension, and is essentially different with the pattern recognition technology of voice and image. Language, as the carrier of knowledge, carries an amount of complex information and is highly abstract. The understanding of language belongs to cognitive level, and it cannot be done with only pattern matching.

## ·The application of natural language understanding: Search engine + Machine translation

The two most typical applications of natural language understanding are search engines and machine translation.

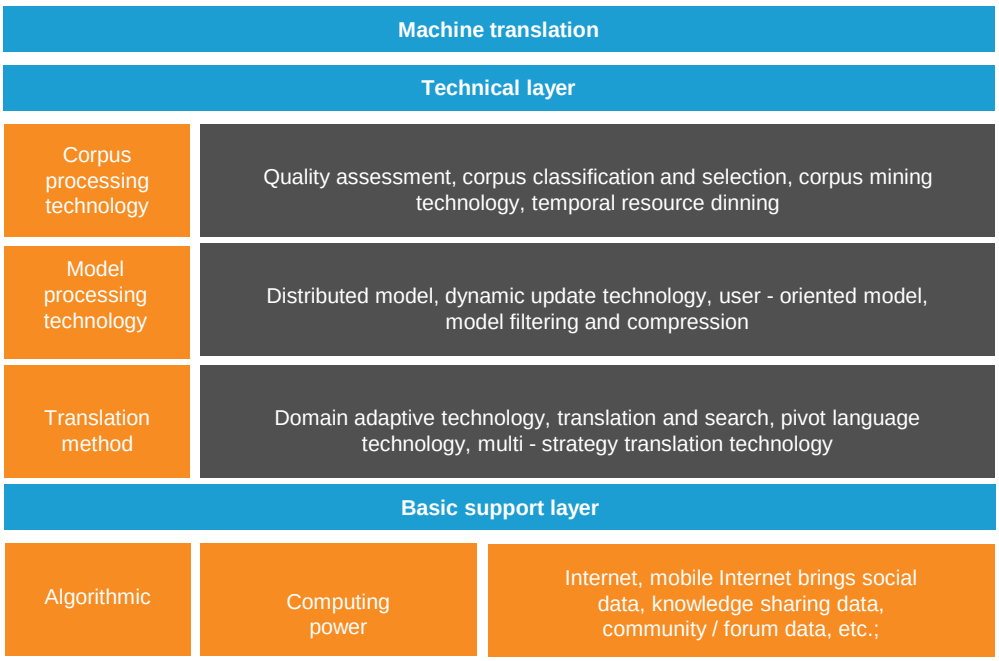
The search engine can understand the natural language of human beings in a certain extent. It extracts the key content from the natural language and uses it for retrieval. Finally, it reaches the good connection between the search engine and the natural language user and establishes a more efficient, deeper information transformation between the two.

### ·The application of natural language understanding technology in the search engine



## Thinking about the nature of AI

### ·The application of natural language understanding technology in the search engine




In fact, the search engine and machine translation are not separated. Internet and mobile internet brings a qualitative change to the development of the corpus modal while enriching it. In addition, to make the original off line of information (original corpus) online, Internet and mobile Internet also derived the new UGC model: knowledge sharing data, artificially calibrated entries such as Wikipedia and Baidu Encyclopedia, receives fewer dissents; Social data, such as Weibo and WeChat which show the user in a personalized, subjective and timeliness way, can be used to provide personalized recommendations, emotional tendencies analysis, detect and track on hot public opinions; Community and forum data, like the Guokr, Zhihu, provides the search engine data sources of Q & A knowledge, Q & A resources and others.

On the other hand, since the hierarchical structure that deep learning used is unexplainable under the large-scale data based spontaneous studying black box mode, and language-mediated communication between people should be based on mutual understanding, the utility of deep learning is less significant on search engine and machine translation, compared with voice and image recognition field.

# CHAPTER 3

## The opportunities and challenges of the application of AI in some specific areas

### 3.1 Why we believe the application of AI will firstly happen on health care, finance and transportation?

### 3.2 AI+ health care

The problems in the health care field

AI gives health care a cost reduction tool

But the road of medical intelligence is still rugged

### 3.3 AI+ finance

The demand for investment advisers

Robo-adviser

The dream of robo-adviser is challenged by reality

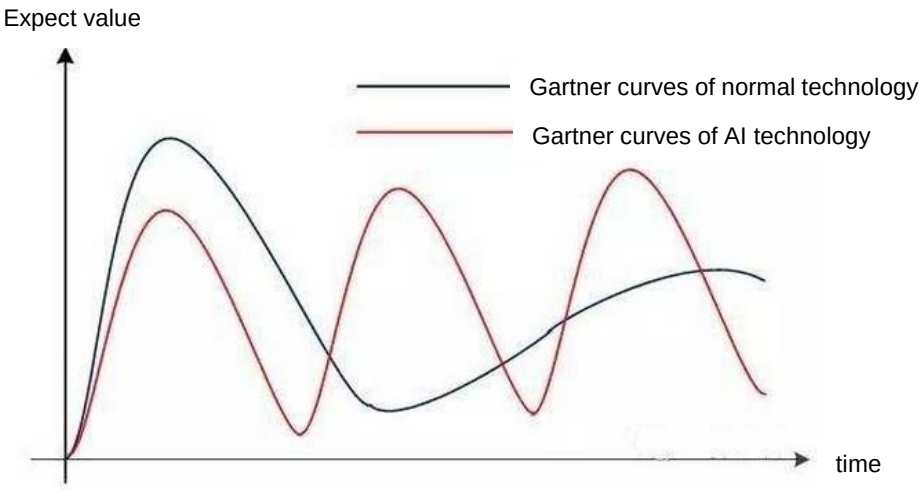
### 3.4 AI+ transportation

What is an unmanned car

Automation is one of the future mobile travel trends

Problems on unmanned regulatory system

## The opportunities and challenges of the application of AI in some specific areas




From Zhihu@北冥乘海生

Following the Gartner's hype cycle, the development of a new technology will experience the expansion of expectation from the public, and those expectations will then be shattered and stable, but AI is a different case. The expectation it received is erratic. For now, it may be a hot topic, but at it next intersection it may also lost the public's interest. Different with the unstable environment of public opinion, AI cannot produce a product that suddenly changes the quality of life. On the contrary, it will keep on improving and developing in a continuous and progressive way, and new technology is being applied step by step.

### ·Why give priority of application of AI to health care, finance and travel ?

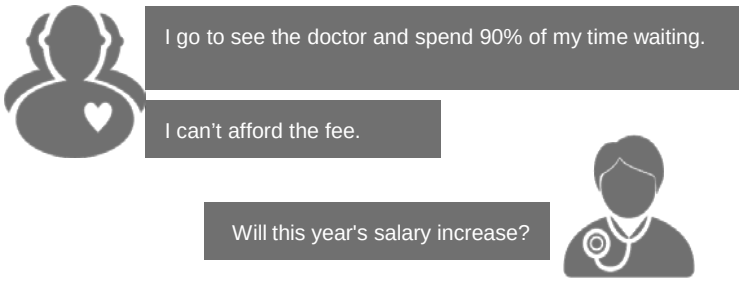
Tracing back its nature, AI is one of the tools for cost reduction and efficiency improvement. However, AI is being concerned at different levels in different industries, some of them are giving excessive pursuit, and some of them are making no response.

Overall, Yiou Intelligence has seen the possibility of cost reduction and efficiency improvement in the field of medical, finance and travel, the close relationship between the changes in these fields and people's life and the potential butterfly effect behind these changes.

## The opportunities and challenges of the application of AI in some specific areas

### ·The butterfly effects

**·For the health care have the most pressing needs of change**




health care is a field about people's livelihood, and "health care reformation" has been being the hot topic for years, but it has also been disappointing the public for years. Until now, Internet + medical implementation does not seem to have any apparent effect. Whether one can make a difference with the help of AI + medical, has become the new stadium for the industry elites to compete.

**·For the financial industry is a kind of service industry, it acts as a lubricant for other industries**

Data from Bureau of Statistics shows that in 2015 China's financial industry added value accounted GDP for 8.5%, and it rose to 9.2% in the first half of 2016. As GDP is the sum of all the added value of the industries of the national economy, the meaning of the risen account of the financial industry's added value in GDP is very simple. This is indicating how much resources and how much the return of the whole society is flowing to the financial industry. The financial industry is the one of the service industries, and for other industries it acts as a lubricant. Lack of lubricating oil will lead to poor operation, wear and tear, but too much oil will cause slipping and idling.

**·For mobility are the lifeblood of the city and the basic need of urban life**

The data shows traffic jams cause losses to Los Angeles each year as high as $ 23 billion. On this basis, the trend of urbanization and population growth will also drive increasing the city's average population density by at least 30%. Therefore, we can expect that the demand for mobile will be doubled. It will lead to greater traffic congestion, and decrease the efficiency of mobile travel. It is a problem of individual rights, economic circulation, and environmental protection.

# CHAPTER 3.2

## The opportunities and challenges of AI technology in the health care market

### 3.2 AI reduces cost and improves efficiency for health care, but the road is still rugged

The problems in the health care field

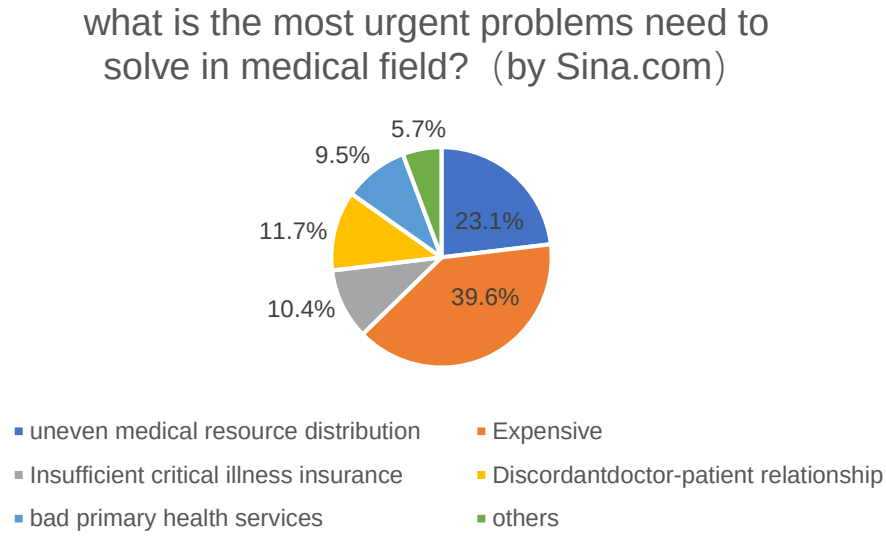
AI gives health care a cost reduction and efficiency improvement tool

But the road of medical intelligence is still rugged

## The opportunities and challenges of the application of AI in some specific areas

### ·Problems of health care field

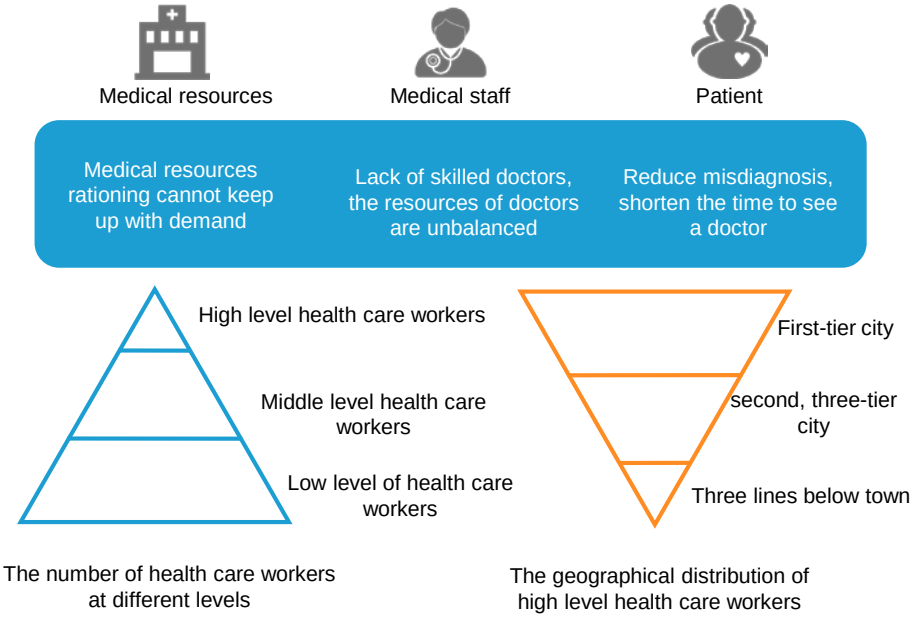
What is the most urgent problem to solve in the current medical field? Sina Weibo launched a survey on this issue, and got the final result of 3933 people participated in the single vote. To a certain extent, it reflects the people's opinion of the most urgent problem needed to solve in the current medical field.




As shown above, 39.3% of the 3933 voting results complained that the medical expense is too high, followed by "medical resources imbalance", "doctors and patients with disharmony" and "poor primary health services". The basic participants in the medical industry are hospitals (medical resources), health care workers and patients. The former will not be focused on the discussion in this article, the latter two cares nothing more than simple demands such as "Is it troublesome or expensive to see the doctor", "Can I go home on time today" or "Will this year's salary increase".

## The opportunities and challenges of the application of AI in some specific areas

Digging deeper behind those demands and these problems in the current medical industry will be found.




**·From the supplier's side, allocation of medical resources is inadequate, and health care workers are limited, and doctors with high qualification are distributed unevenly**

For the health care workers, the problem is not only that the skilled doctors are rare, but also that they are all concentrated in the first-tier cities. In addition to the lack of talents, rationing also cannot keep up with demand. Li Bin, director of the National Health and Family Planning Commission said when attending the PRESS Conference of the 12th National People's Congress (NPC): "Currently there are still major problems of inadequate total amount and imbalance allocation of high quality medical resource", "To promote the resources to sink and the focus to go down, the first step is to establish a hierarchical treatment system through the reformation".

**·From the demander's side, "difficult to see a doctor", "expensive to see a doctor "**

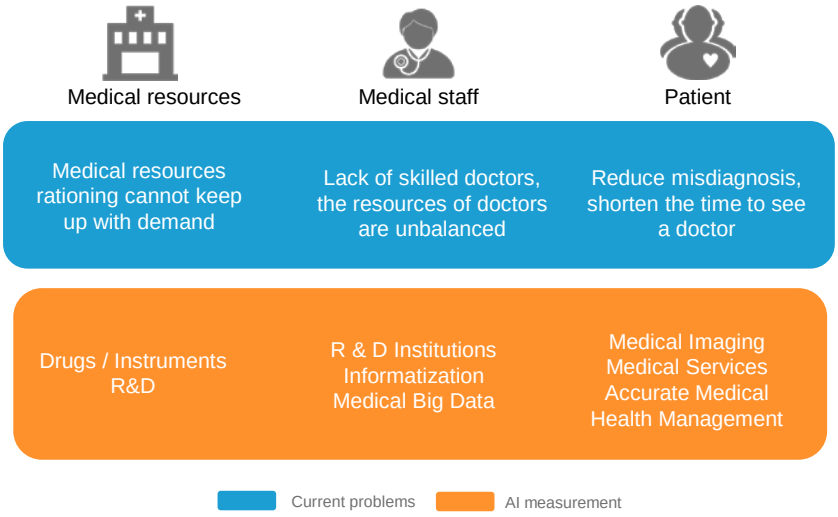
The main appeal of the public is to shorten the time to see the doctor and reduce misdiagnosis. Excluding some of the private hospitals with good service, it is very possible that every citizen has experienced the feeling when they go to see the doctor but end up with spending 90% of their time queuing.

## The opportunities and challenges of the application of AI in some specific areas

### ·AI gives health care a cost reduction and efficiency improvement tool

AI has been developing for some years in the medical field. The deep learning brings people a new expectation to AI. Whether it is looking for the arrival of AI to replace the doctor, to diagnose some fatal diseases, or even to choose the best treatment or predictive results based on the big data.

**·Seven categories of medical + AI enterprises:**




Aiming the problems in the medical field, the market has emerged a number of "medical + AI" companies. Yiou Intelligence classified them into these types: medical imaging, gene sequencing, medical data, medical services, health management, pharmaceutical / equipment research and development, institutional information, as shown above.

**The delimitation of the classification boundary：**

**Institutional information:** These companies mainly help medical institutions to improve operational efficiency and diagnosis effect, and reduce the cost of expenditure through data monitor and analysis way.

**Medical big data categories**: This classification is relatively vague, because several other types are inseparable from the medical big data. However, such companies are more concerned with the research and analysis of the data itself, such as the famous Flatiron which build a large platform for tumor data, cumulate the data of cancer patients, and serve clinical sectors, scientific research, new drugs and patient treatment through data research and development and analysis.

## The opportunities and challenges of the application of AI in some specific areas

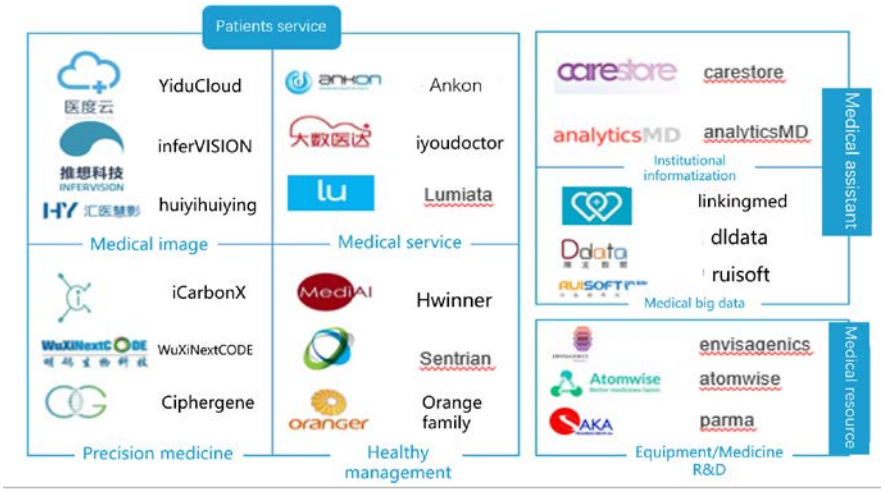
**Drugs / Devices R & D**: Based on big data and AI technology, these companies use the calculation of the data to simulate drug / equipment research and development process to help pharmaceutical companies / equipment manufacturers to shorten the development cycle, reducing research and development costs.

**Medical imaging**: Based on AI and deep learning techniques to help doctors read the patient's image data in a faster and more adequate way and make a better judgment. Current computers are able to read the ECG fully automatically, read the cervical scraping picture semi-automatically, and independently finish many experimental diagnostic test programs.

**Medical services**: These companies are commonly understood as clinical diagnostic assistance systems, including early screening, diagnosis, rehabilitation, surgical risk monitoring, medication safety and so on, and are divided into different areas, such as blood, sleep, nerves, psychological and others.

**Precision medical categories**: Based on the digitization of the human body, these companies provide accurate treatment through the analysis of these data. Gene sequencing data is different with general medical data. However, the future of AI and precision medical might be linked by gene sequencing.

**Health management class**: They focus on producing the individual's health management and the equipment. Such companies mainly use the user's personal health data to predict the risk of having disease and provide health management programs. This to C kind of company is rare in the medical + AI business.




The picture above shows the corresponding classification of the relevant "medical + AI" business.

## The opportunities and challenges of the application of AI in some specific areas

**·Medical image is a plate of "medical + AI" which is the closest to commercialization**

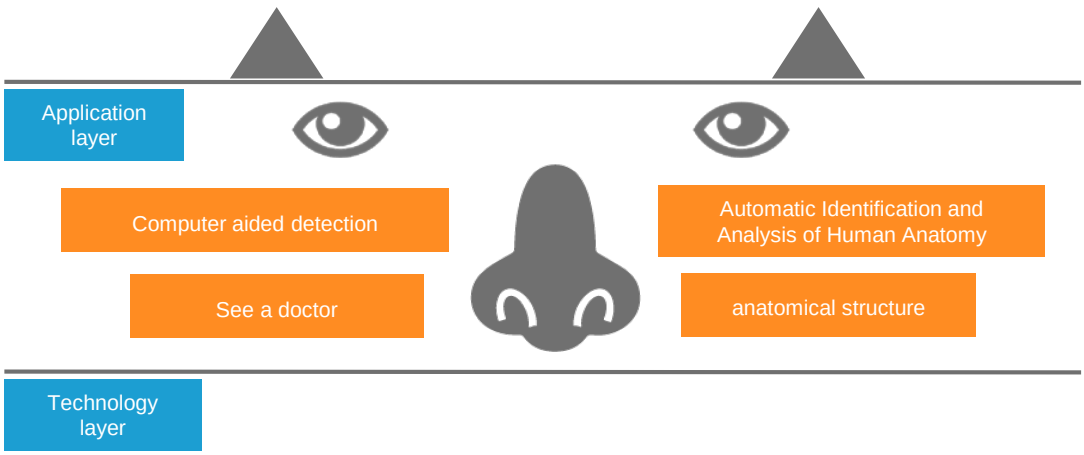
Among the above seven major categories, Medical Imaging is the closest plate to commercialization on the insiders' view.

Yiou Intelligence: insiders' view to medical images

| Insiders | views |
|---|---|
| MicroCloud's CEO Zhiyong Peng | " Datamation of images is the best example of the medical data standardization, it may will be first filed that AI can land |
| inferVISION's CEO Kuan Chen | "medical images is the foundation of critical illness detection, radiology department needs lots of people, and deep learning is good at analyze image data. Thus medical images technology will be the first one landing the market. |

On the one hand, image data is part of medical data with the highest standardization. On the other hand Medical Images are highly concerned by the public. Pushed by modern medicine, bio-engineering and computer information technology, Medical Imaging has become one of the three major treatments, paralleling with external and internal surgery. Many fatal diseases, such as cancer and certain heart diseases, can be found early in the lesion through high-end medical imaging equipment. It not only increases the chance of cure, but also controls medical expenses. High-precision multi-modal medical imaging technology has long been what the world's major scientific research institutions and multinational companies desire for. Medical imaging market has already been a market with the scale of a 100 billion.

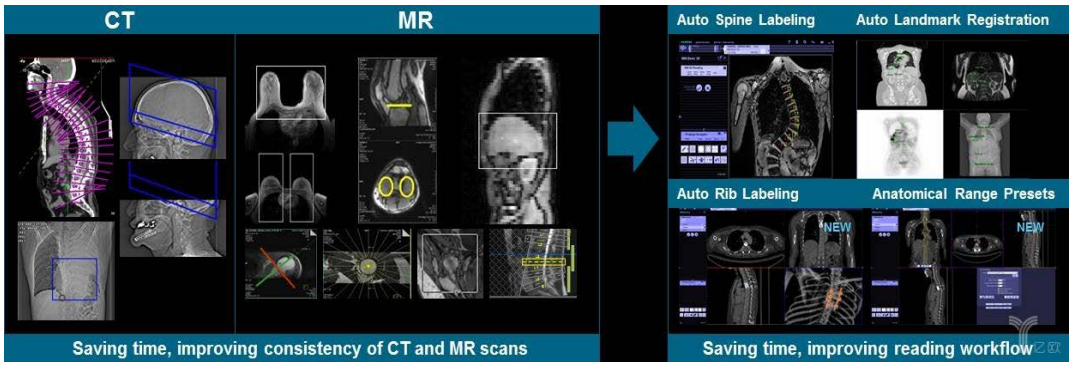
**·The specific application of AI in the medical image**




Speech Recognition, Image Recognition, Natural Language understanding, Knowledge Map, Data Mining Technology, Machine Learning

## The opportunities and challenges of the application of AI in some specific areas

From Dr. Zhou Xiang's article "AI Medical Applications: Random Thoughts of Commercialization and Industrialization", Yiou Intelligence summed up that (as above): AI endues medical imaging equipment two eyes: one focused on watching Disease, which is the traditional CAD (Computer Aided Detection) field; the other will focus on looking at anatomical structures, ALPHA (Automatic Landmarking and Parsing of Human Anatomy).




ALPHA: Automatic detection of human anatomical structures based on machine learning has been widely used in medical imaging. CT and MRI machines can automatically find various anatomical structures from the pre-sweep map. Then it can very accurately image the target structure (such as the brain), while reducing unnecessary damage to adjacent sensitive organs (such as the cornea), track the movement of organs, and provide a variety of measurements, as shown above.

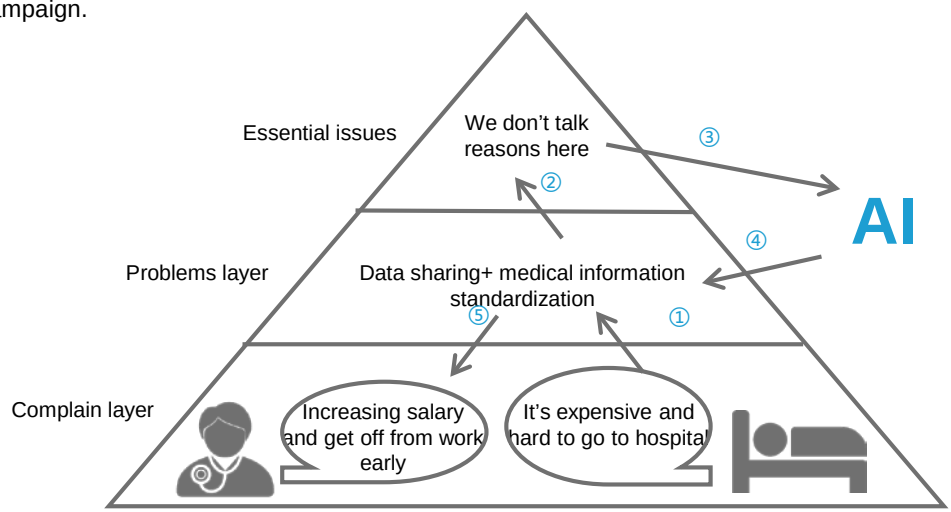
ALPHA tools help greatly improve the quality, speed, consistency and reproducibility of imaging: Consistency refers to the fact that different technicians should get the same result while imaging the same patient. An example of reproducibility is that the MRI image of a knee should have exactly the same anatomical plane as the picture six months ago so that it can clearly show the true effect of the six months of treatment, and help radiologists to deal with images and write reports faster and better.

CAD: Things like changes of the subject of the responsibility of accidents in L2 to L3 in autopilot also happens in medical image. However, most of the time CAD computer-aided detection algorithm plays the role of "second reader". The algorithm only provides help / assistance, and the doctor still needs to take full responsibility for the collection and analysis of the image. When AI becomes the "first reader" and even "the only reader" at the L3-level, it is mainly responsible for the accident. According to Dr. Zhou Xiang in his article, AI has long been carrying the primary responsibility of the task of automatic analysis of the current ECG monitoring, cervical smears and some pathological images. Doctors only need to review the suspicious lesions found by those algorithms. The computer will analyze all chest X-ray images, and report directly to the clinician that some people may have lesions, and send those people who look normally healthy back to home directly.

## The opportunities and challenges of the application of AI in some specific areas

### ·Since big data cannot be shared and medical information cannot be standardized, the road of medical intelligence is still rugged

Although AI can really help to change the medical, solving the medical problem is a long-term campaign.




The demands and complains of the grassroots are "increase wages, get off work quickly ", and "expensive and difficult to see a doctor". In the long term, the reasons that those demands cannot be figured out are "big data cannot be shared" and "medical information failed to be standardized", as shown on Figure 9 (above).

Due to the closure of the hospital system and the sensitivity of the data, the hospitals do not admit each other's result, whish results the lack of big data. Coupled with the lack of standardized medical information, it can be said for a long period of time, if the two problems of big data sharing and medical information standardization cannot be solved, the road of medical intelligence will still be rugged.

**·Big data sharing**

Entrepreneurs need a mass of data, but hospitals and patients want to protect the data.

**Hospital**: Entrepreneurs need large amounts of shared data, but in order to get more benefits, hospitals and suppliers need to adhere the barriers to prevent sharing. Over the years, a huge chain of interests brings data sharing the deadlock which is difficult to break. How to break the confliction of interests of all parties and protect data security will be an important issue for medical intelligence.

## The opportunities and challenges of the application of AI in some specific areas

**Patient**: In addition, even if the data opened, for patients, the protection of data security is another problem. No patients want their data to be leaked.

**·Medical information standardization**

As for medical information standardization, most of the hospitals' data are not standardized. Even if there are electronic medical records, the contents are also only the subjective input of the doctor, rather than the systematic standard language. If the medical field cannot standardize varieties of information, precision health care just engages in idle theorizing.

Just like playing game, the expectations of the demand layer must be met. There are still many different difficulties before big data sharing and standardization of medical information could be achieved. On the road of medical intelligence, although AI can play a real cost reduction role while solving the fundamental problems of medical care, the complex network of interests behind and other difficult issues will be involved. The road of intelligence medical is still rugged.

# CHAPTER 3.3

## The opportunities and challenges of robo-adviser

### 3.3 The reality of robo-adviser: AI valued but far from the task

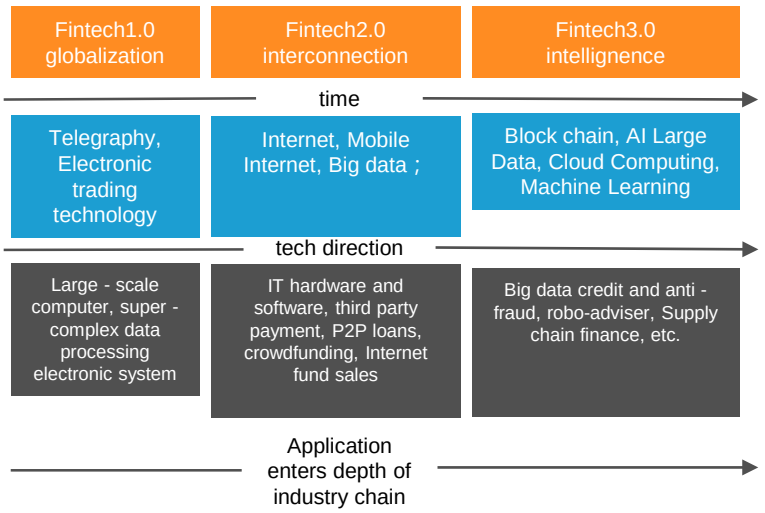
The demand for investment advisors

Robo-adviser

The dream of robo-adviser is challenged by reality

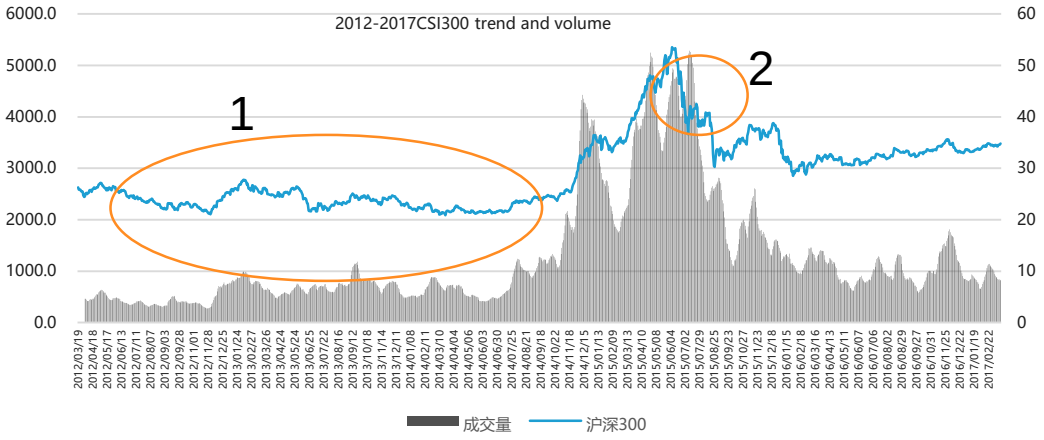
## The opportunities and challenges of the application of AI in some specific areas

Fintech, as a technological solution for the financial industry, is quietly changing all aspects of finance.




From globalization to interconnection, then to intelligence, Fintech3.0 is no longer just a technology, but a power of technique clusters. robo-adviser, as one of the representatives of this era, changes the traditional financial information collection source, risk pricing model and investment decision-making process mainly through big data, cloud computing, AI and block chain.

### ·The investors' demand for investment advisors is mainly reflected in "emotion management" and "investment strategy / advice"




As shown above is the "comparison between 2012 - 2017 CSI 300 index trend and trading volume ". The area circled with "1" shows that the trading volume is stable when the index trend is gentle; the area circled with "2" shows that the trading volume apparently shrank when the Index slightly decreased, and when the index went up slightly, customers would buy a large number of securities and the trading volume would increase sharply.

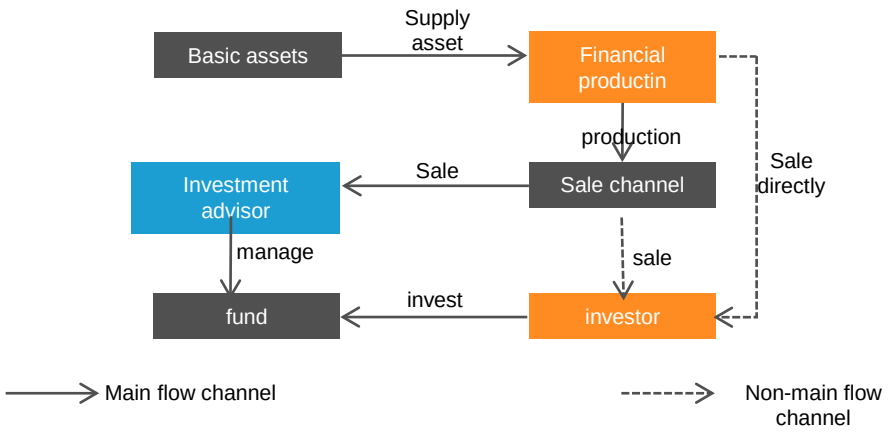
## The opportunities and challenges of the application of AI in some specific areas

We can see the fluctuations caused by the greed and panic of the investors in investment from this picture. On the other hand, comparing investors with investment adviser, the latter can relatively gather information more efficiently than the former, and understand financial markets clearer, which can help investors make more reasonable choices. Hence, investors' demand for investment advisers are mainly reflected in emotion management and investment strategies / recommendations, as shown in the following table (asset allocation is part of the investment strategy / proposal).

Yiou Intelligence: insiders' view to the demand of investors

| Insiders | views |
|---|---|
| MIT<br>Director of finance Engineering<br>WenQuan Luo | "investment is a process full with emotion, investors usually feel panic when face up with fluctuation, this kind of unreasonable decision can be avoid by algorithms" |
| "father of world assets allocation"<br>Gary Brinson | Doing investment decision, the best way is based on market, be sure of the kind of the assets, from long-run, 90% percent of success can attribute to the asset portfolio. |

As shown in the following figure, we consider the asset distribution process from two parts: buyers' and sellers'. "basic assets - financial products - selling channels" is the sellers' chain, and "investors - fund - investment adviser" is the buyers' chain.



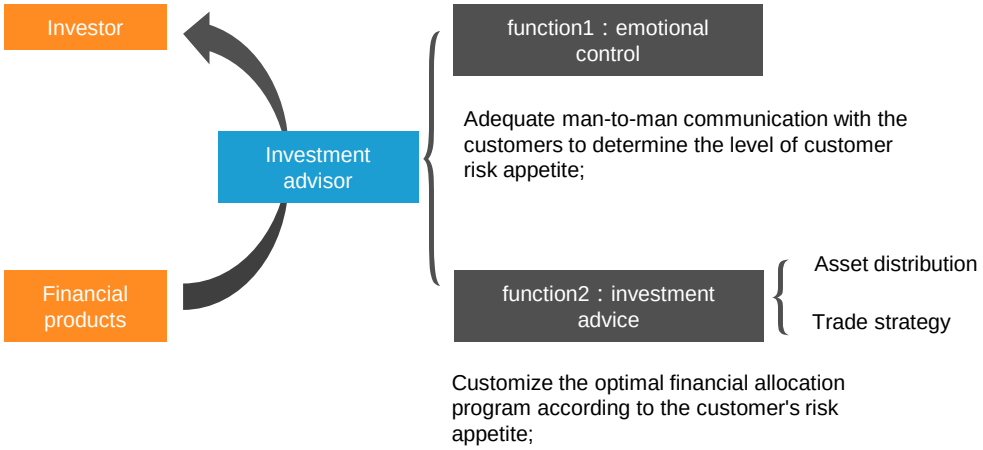

**Basic assets**: refers to bonds, stocks and other basic products, or their derivatives, which is on the industry's bottom;

**Financial products**: designed, managed and sold by the asset management agencies, which is the core of the industry;

**Selling channels**: banks, third-party wealth companies and other institutions with resources and professional capacity of undertaking sales;

**From the buyer's point of view**, investors invest in funds and the fund hires an investment adviser as a fund manager.

## The opportunities and challenges of the application of AI in some specific areas




As shown above, investment advisors (and of course selling channels) set up a bridge for investors to buy financial products. Investment advisors, as fund managers and financial advisers serving investors, mainly play two major functions: emotion management and investment strategy / advice.

**·emotion management**

Determine the level of customer risk appetite through adequate man-to-man communication with the customers. Generally, risk appetite is expressed as fear or greed, and is not fixed. Most people's risk appetite will fluctuate with the ups and downs of the market, and with the change of income levels and other factors.

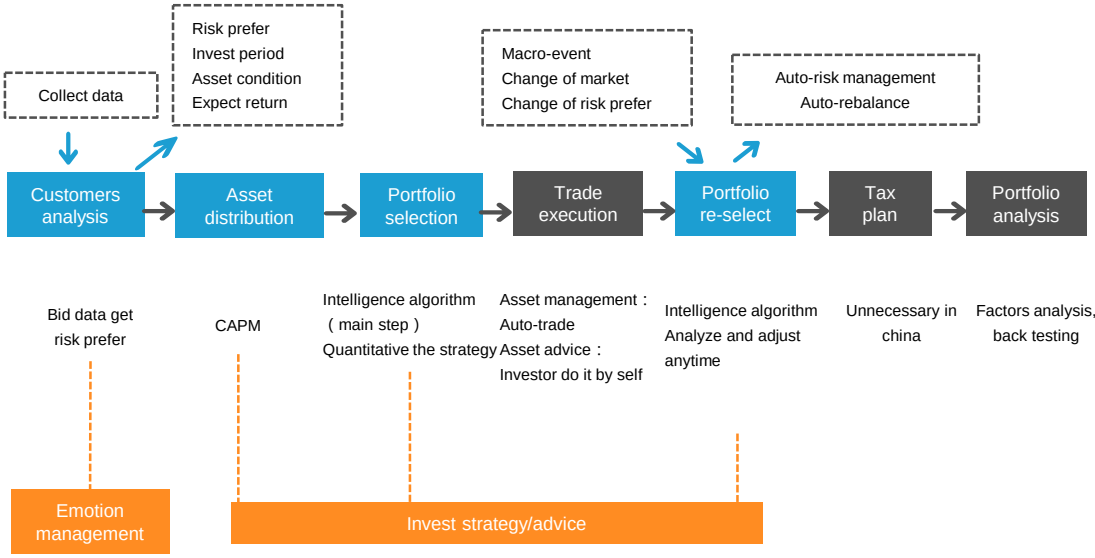
**·Investment strategy / advice**

For investment, risk should be considered more serious than return. Asset allocation is that according to investors' risk appetite, investment advisers build portfolio with the highest return at certain risk level for investors.

**·AI investment advisor provides functions of "emotion management" and "investment strategy / recommendation"**

robo-adviser is a combination of AI and investment advisor, or it can be known as RoboAdvisor. It provides wealth management and online investment advice services based on modern portfolio Theory, combined with individual investor risk appetite and financial goals, using algorithms and friendly Internet interface. In general, its cost is much lower than the human investment adviser, because its service can achieve totally or mostly through automated operation and management, and is therefore called robo-adviser.

## The opportunities and challenges of the application of AI in some specific areas




As shown in the above chart, according to the standards the of US Financial Regulatory Authority (FINRA) proposed in March 2016, robo-adviser services include: customers analysis, assets allocation, portfolio selection, transaction execution, portfolio re-selection, tax planning and portfolio analysis.

AI is mainly used on customers analysis, assets allocation, portfolio selection and re-selection of the portfolio, to assist the investment adviser to help customers do a better job in emotion management and give them investment strategy / suggestion.

**·emotion management**

**customer analysis:** Obtaining the user's personalized risk appetite and its changing law through the big data, AI algorithm can help investors to assess their long-term investment goals and the real risk appetite more effectively, make more rational judgments for them when they are affected by their emotions and communicate with them. On the one hand, in some degree, it is cheaper and more efficient comparing with traditional man-to-man communication of the investment advisors. On the other hand, assisted with AI, we can achieve real-time dynamic data collection and calculation, and reduce the hysteresis to a certain extent.

**·Investment strategy / suggestion**

**Big class asset allocation**: robo-adviser advisors build customized asset allocation program according to the user's personal risk preference combined with the investment model, and meanwhile use the Internet to achieve real-time tracking and rebalance the portfolio in time.

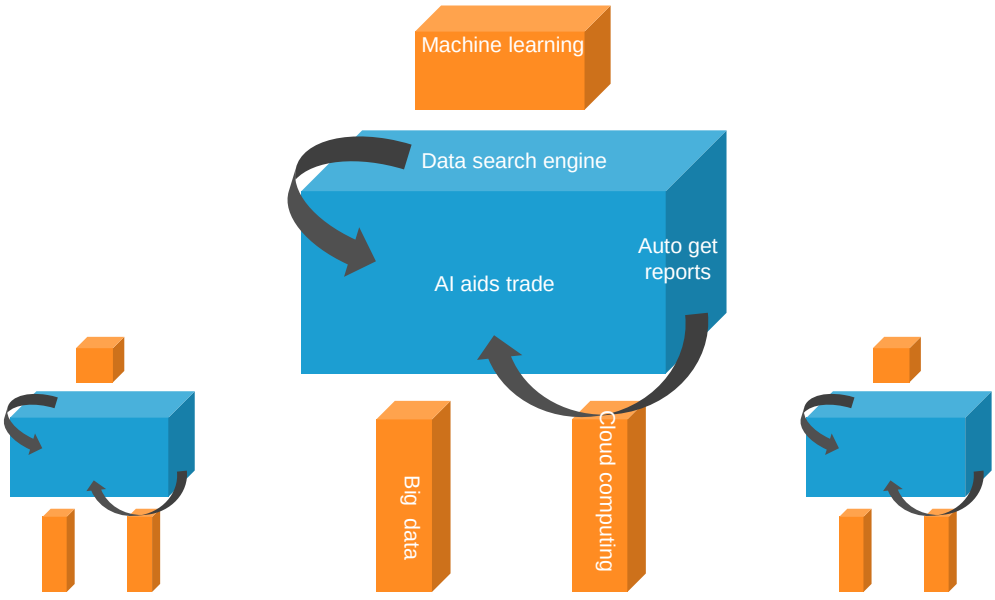
## The opportunities and challenges of the application of AI in some specific areas

**Portfolio Selection** : Portfolio selection is the further conclusion drew from the previous two steps. Customer analysis measures good risk preference parameters, and asset allocation is the formation of the portfolio of different risk preferences. The portfolio selection is to complete the first two steps one by one correspondingly. In this part, intelligent algorithm assisted with investment strategy generates and quantizes the investment strategy.

**Portfolio re-selection** : portfolio rebalance mainly refers to the real-time analysis and adjustment made by intelligent algorithms according to the external (macro events, markets, investor's preferences) changes. If the asset allocation is deviated from the target asset allocation, the portfolio-rebalance can implement the re-adjustment of the dynamic asset allocation to the static asset configuration (automatic wind control / automatic transfer).

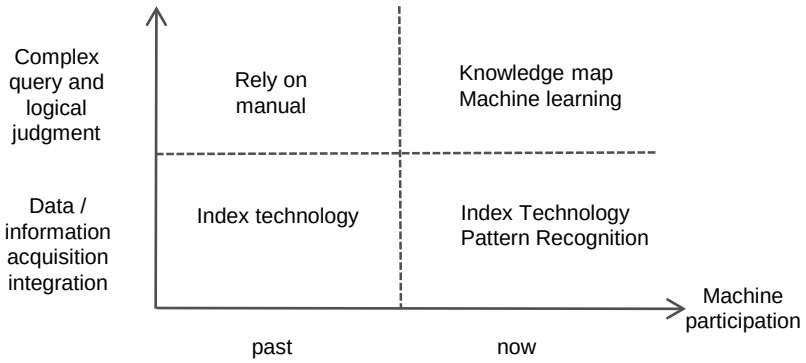
### ·Current specific application of "AI + investment adviser" = data search engine + automatic report generation + assisting quantitative transaction

Based on the analysis of the robo-adviser service chain in previous part, we clarified at which stages on the service chain are AI used, this following part will illustrate the specific applications of AI on investment advisers, which include the data search engine, automatic report generation and assisting quantitative transactions.



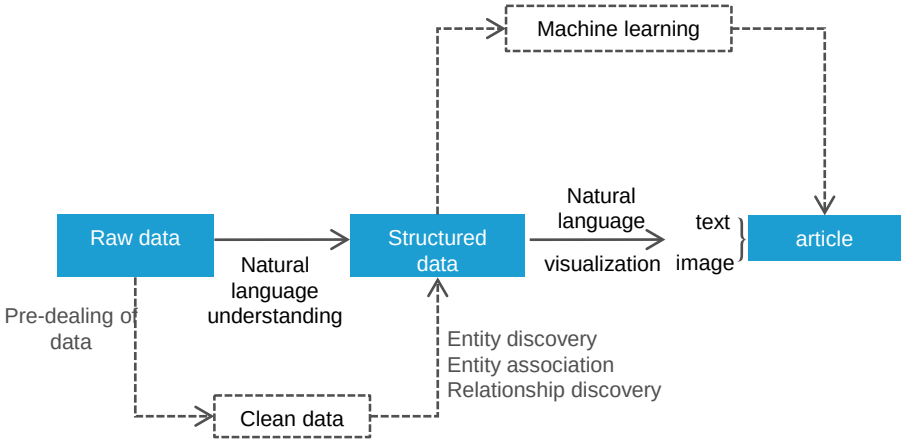

As shown above, "AI + investment advisor" has three main types of applications: data search engine, automatic generation of reports and AI assisting quantitative transactions. The first two categories build foundation for the latter one.

## The opportunities and challenges of the application of AI in some specific areas




**·Data search engine**

As shown above, in the past complex query and logical judgment relied on human power, and now the knowledge map and machine learning are used as a manual assistance.

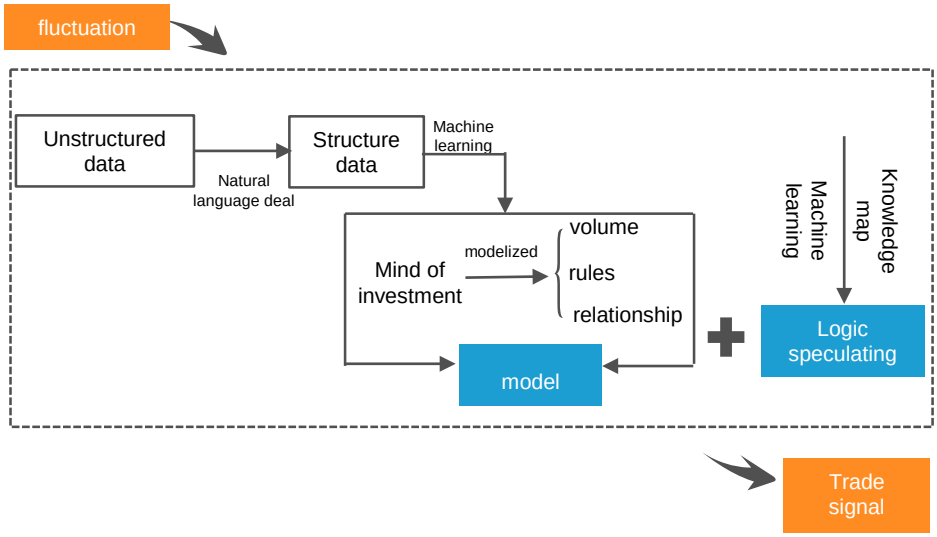



**·Automatically generated reports**

As shown in the above figure, it is divided into two steps: structuration of data and generation of narrative articles. It can be regarded as natural language comprehension and natural language generation (+ visualization) in a technique view. In general, the text is analyzed, and key information is extracted and embedded in the corresponding report template. Then reports are generated automatically.

## The opportunities and challenges of the application of AI in some specific areas

### ·AI facilitates quantitative trading ;




*【Quantitative trading refers to replacing the humans' subjective judgments with the advanced mathematical model to develop strategy, using computer technology to choose "probable" events which can bring excess returns from the sea of huge historical data. It greatly reduce the impact brought by the investors' emotional fluctuations, and prevent the market from making irrational investment decisions under extremely financial or pessimistic circumstances.】*

**Quantitative investment**: It is a method used in the investment strategy. The process of turning the empirical investment model into a certain amount, a certain rule, and a certain relationship, inputting data estimation model under the basis of price fluctuations, and generating trading signals was called the quantitative investment. Quantitative investment and traditional qualitative investment are essentially the same and both are based on the not effective or weak effective market theory. The difference between the two is that quantitative investment management is "quantitative application of quantitative thinking", which emphasis more on data.

**AI assisted quantitative transactions**: As shown above, the technologies used are mainly machine learning, natural language processing and knowledge map. Machine learning is mainly used for quantitative modeling from data to model. Natural language processing is mainly used to analyze unstructured text and incorporate those texts into the quantitative model. The knowledge map is mainly used to logic speculation from the knowledge-associated perspective. Using machine learning technology, combining with the forecasting algorithm, it can keep evolving based on historical experience and new market information, forecast the fluctuations of stocks, bonds and other financial asset prices and relationship between the fluctuations, thus to create a more suitable portfolio with the expectation.

## The opportunities and challenges of the application of AI in some specific areas

### ·robo-adviser pattern and the corresponding business map

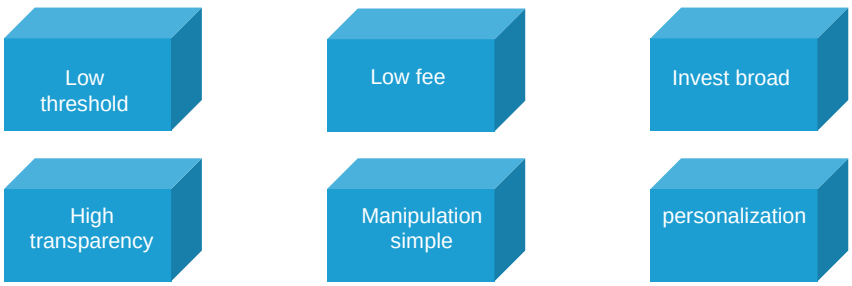

From the development trend of the industry, start-up companies are mostly technology-oriented, relying on traditional financial institutions to expand the market and the traditional financial institutions are also testing the environment of robo-adviser.

### ·The ideal of robo-adviser is challenged by reality

**·The algorithm has been existing for long time, and the development of robo-adviser in recent years mainly benefited from big data and the improvement of computing power**

The ultimate goal of AI is to imitate humans' brain. The basis of the algorithm has been rooted 20 years ago. Deep learning is a branch of machine learning and is a neural network with more layers. To use it, we need a huge amount of data to train models and add more complex algorithms to the basics to optimize them. It is also the support from big data, cloud computation, parallel computation and GPU hardware makes computing power progress sharply in recent years.

**·Overall, robo-adviser reduces the threshold of investment, attracts larger investment groups；**



## The opportunities and challenges of the application of AI in some specific areas

Comparing with the one by one investment and financial management services of traditional investment, which has lots of disadvantages such as high cost, less service objects, lack of knowledge reserves, less experience, high moral risks and other shortcomings, robo-adviser will take AI, big data and other technologies into the field of investment advisers. It can handle massive information, response to the times rapidly. As shown in Figure above, with low threshold, low cost, wide investment, simple operation, high transparency and personalized customization these six big advantages, the middle and long tail customers will be fully covered, achieving universal financial management.

**·In the process of consulting, AI is somewhat unprepared at where involves things of the cognitive level**

Thanks to the Internet of Fintech2.0, the increase in mobile Internet applications and the accumulation of data, the use of large data to identify user risk preferences can be used on thousands of people. On the one hand, relative to the traditional financial adviser face-to-face communication, robo-adviser in a certain extent can lower the cost and increase effectiveness. On the other hand, people cannot be totally sensible while investing. Fear and greed will change with the market's ups and downs, income levels and other factors' fluctuation. Big data identification can achieve Real-time dynamic data acquisition and calculation of the risk appetite and reduce the hysteresis.

So far, the superiority of AI is mainly reflected in the computing power. When it comes to the perception, cognition level, it still is climbing from the former to the latter. There still is a bottleneck in the middle waiting for being challenged. Likely, robo-adviser domain computer also can not completely replace the human. At some critical moment, professional experience is needed to make decisions, such as identifying the risk appetite at the time. The key is that the customers sometimes express risk appetite different with their real appetite. In fact, when it comes to cognition level, totally relay on computer will lead additional and unique risks. From the emotion management function, intelligence investment advisor will keep on a stage where AI and humans with professional experience exist in the same time for a long period.

From the steps in investment which AI can enter, AI can only replace the primary information collection and processing and other basic work. It is nothing more than a conception that using big data to build investment strategy. A mature market rarely does that. In many financial technology practitioners' view, AI is paid attention but far from being the center.

# CHAPTER 3.4

## The opportunities and challenges of AI technology in transportation

### 3.4 AI+ transportation

What is an unmanned car

Automation is one of the future mobile travel trends

Problems on unmanned regulatory system

## The opportunities and challenges of the application of AI in some specific areas

As time goes by, in modern life, more and more mechanical objects in human's life is controlled by the computer systems, and the vehicle is not an exception either. From the assisted control to unmanned authorized control, there is a test for the machine system that if it can face and adapt to the non-institutional environment outside.

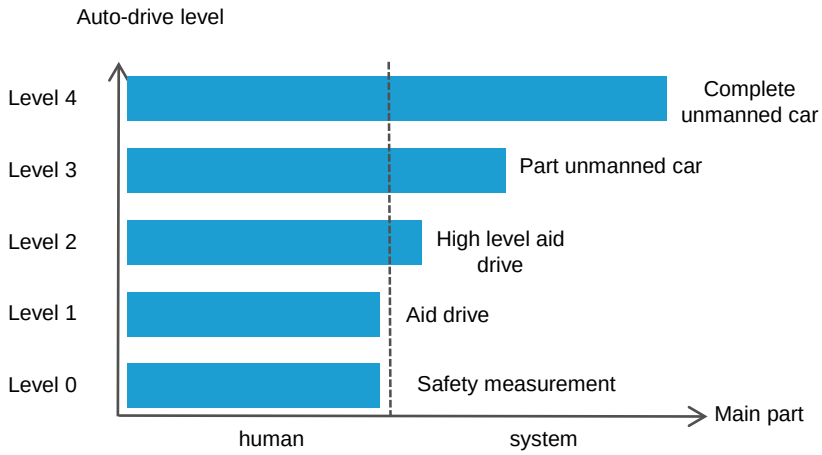
From the demand point of view, there is a need from urban residents for the unmanned, but they cannot fully trust its safety and reliability. The legal issues that cars manufactures need to burden restrict the development of unmanned and postpone the exist of high-tech in this field.

The following talks about unmanned technology, the city residents' unmanned needs, as well as the importance of unmanned behind the regulation.

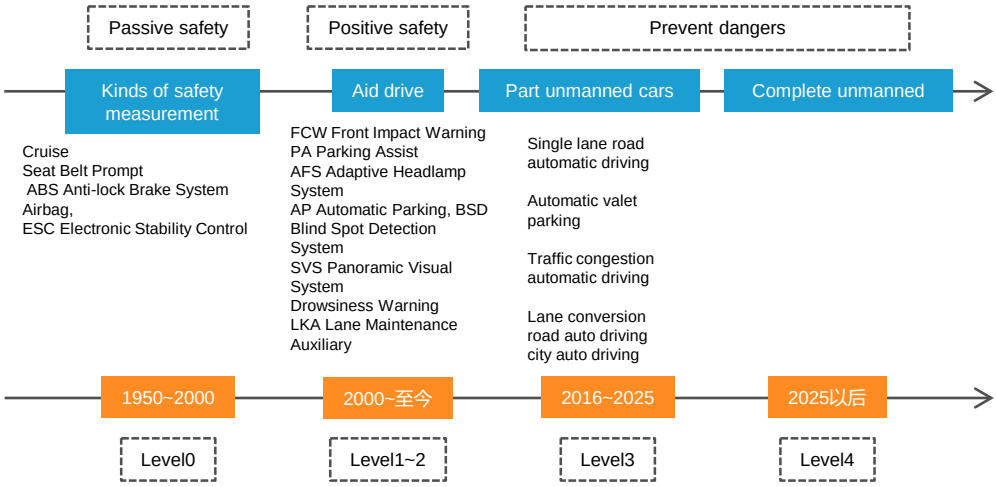
### ·What is an unmanned car

Self-driving car is a kind of outdoor wheeled mobile robots, which relies on AI, sensor, positioning system and navigation system co-operation, so that the computer can active operation without any human, automatically and safely operate motor vehicles, and bring a new experience to human traffic safety and efficiency.

**·The process of evolution of unmanned stages is also a process that computers get the right of control of vehicle from human gradually**



## The opportunities and challenges of the application of AI in some specific areas



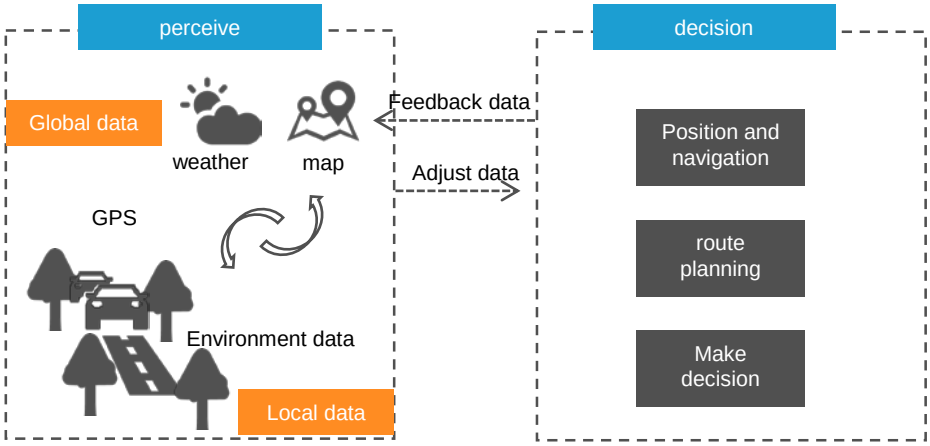

It is also a process of continuous improvement of safety (as shown above, from passive safety to active safety，then to preventive security).

Combined with general cycle predicted in the current industry, Yiou Intelligence believes that unmanned driving is expected to start commercialization in 2025, and commercialization of completely unmanned will have to wait until after 2025. Before that, ADAS (Advanced Driver Assistant System, Advanced Driving Assistance System) will play an important role.

**·Technologies involved in unmanned vehicles = environmental perception + position navigation + path planning + decision control**

Unmanned technology can be divided into two levels: perception and decision-making. As shown below, on the one hand, cars obtain local data (the vehicle itself and the surrounding environment data) through the sensor data, and on the other hand, builds global data, combined with high-precision maps and weather data. Data will be integrated to coordinate the application of the decision-making layer. The assistant system does the locating and navigating, plans paths combined with the algorithm model, controls vehicle steering and speed, to achieve driving automation. The data got by the decision layer will also return to the high-precision map.

## The opportunities and challenges of the application of AI in some specific areas




**·Environmental perception = local data perception + global data support**

The vehicle's perception function obtains data mainly through the sensor. The sensor is equivalent to the eyes of unmanned vehicles, and is used to observe the dynamic changes while driving. It is an indispensable part of unmanned vehicles, commonly used sensors include cameras, laser radar, ultrasonic radar, GPS, gyro Instrument, etc.. Camera and laser radar are the two most common sensors.

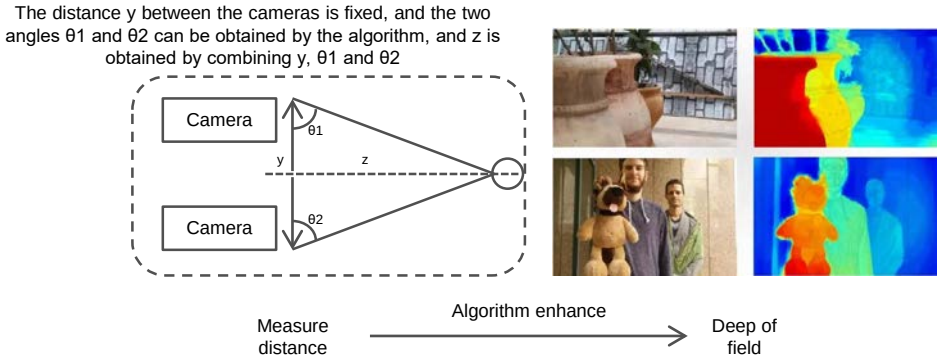
**·Camera**

At present, shooting with camera, recognizing the image and video, determining the vehicle front environment, are the main means for unmanned vehicles to perceive the environment, and are main research and development contents of many unmanned companies. As a widely used sensor, camera has the advantages of low cost, large amount of information collection and so on. At present, the car camera is divided into two kinds: monocular and binocular.

Monocular camera gets road images and identifies the environment mainly based on the principle of machine learning and the use of large amounts of data for training. Because of cheaper prices and mature technology, monocular camera received a part of the company's favor, even though it needs the support of big data and performs poor than binocular camera in poor light environment,

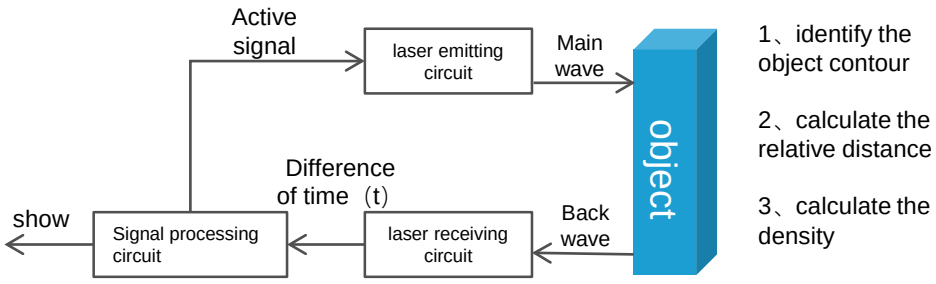
The binocular camera is based on the parallax principle (as shown below), and can be used without enough data. It can detect the environment in front of a car (trees, pedestrians, vehicles, pits, etc.), and get accurate distance data. Enhanced with algorithm adjustment, it can get the depth of field of the environment, and help the unmanned system to execute the car's centralization.

## The opportunities and challenges of the application of AI in some specific areas




**·Radar**

The working principle of the lidar is to emit the electrical pulse into an optical pulse by the transmitting unit, and the receiving unit reverts the light reflected from the target back into the electric pulse. By calculating the time difference between the transmitted signal and the received signal, it is possible to accurately measure the relative distance between the edge of the object contour and the device in the field of view. These contours make up the so-called point cloud and draw the 3D environment map. The accuracy can reach centimeter level, as shown below.




Lidar radar can penetrate far distance and high-performance laser radar can achieve the high accuracy up to centimeters level 3D scene scan reproducing in the range of 200 meters, so as to help unmanned system to achieve the route planning in advance. At present, multi-line laser radar is likely to be the future of unmanned vehicles necessary sensors, and is closely related with high-precision map and driving system core algorithm. At present, multi-line laser radar has not yet produced in a large scale. Although the mechanical rotary multi-line laser radar has been widely used, the volume is too large and the price is too expensive. The mature products of pure solid-state laser radar with smaller volume and lower cost have not existed.

## The opportunities and challenges of the application of AI in some specific areas

Millimeter-wave radar, ultrasonic radar: Except for laser radar, in recent years, millimeter-wave radar and ultrasonic radar has gradually become an equipment involved in multi-sensor information fusion sensing in unmanned vehicle. Among them, the most well-known example is Tesla in its smart car. Tesla does not use laser radar but the millimeter-wave radar + camera. In addition, the intelligent driving giants like Bosch and Continental, also has a more profound technical accumulation and application experience in lower cost sensor equipment such as the millimeter-wave radar and ultrasonic radar. In China, millimeter-wave radar manufacturers such as Autoroad, also actively pursues technology innovation to catch up with the international giants.

**·Unmanned locating and navigation**

Unmanned will regard itself as a particle and the organic combination of the environment through the locating technology to accurately perceive their own relative position in the global environment.

Navigation technology helps unmanned vehicles "know" their travel speed, direction, path and other information.

In the practical application, the two will be combined by information fusion technology, so the environmental information and body information will work as an integral whole.

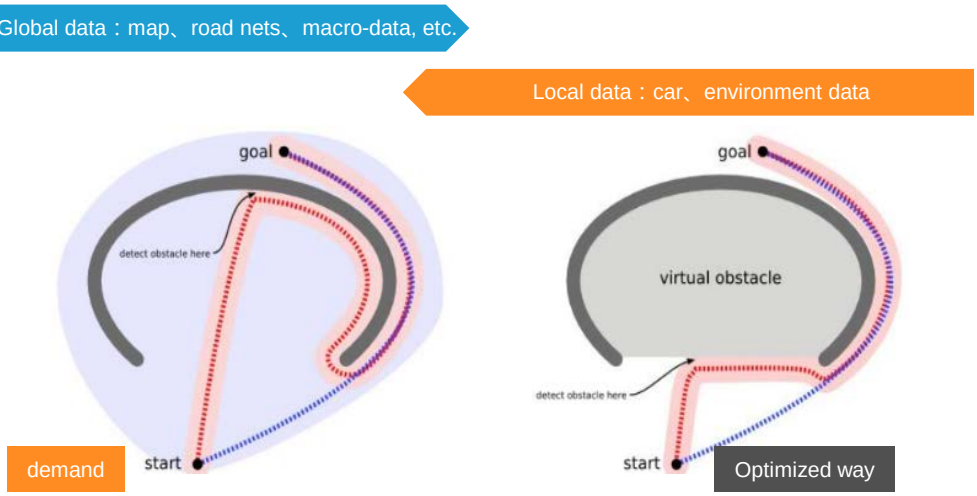
A high-precision map is the foundation for unmanned to achieve navigation and follow-up path planning. These years, based on the improving satellite navigation and laser radar-based 3D environment modeling technology, the quality of high-precision map mapping is gradually improved, which provide quite a lot of help for automatic driving research and development. Domestic high-precision map companies are headed by Baidu map, AMAP, Navinfo; In foreign countries, Here and TomTom have the greatest reputation.

**·Unmanned route planning, decision control**

Path planning technology can provide the optimal driving path for unmanned driving. In the process of unmanned driving, at first, as the travel demand, the system draws all the feasible routes without collision from the start point to the destination on the high-precision map based on the road network and macro traffic information(including the calculation of road length, Speed, road grade, traffic waiting time, etc.) . Then the system selects the optimal path according to the data of the local environment information and the condition of the car itself.

## The opportunities and challenges of the application of AI in some specific areas

Thanks to the lidar, as shown in the following figure, algorithms make computers can perform path planning on larger scales, slowly changing maps and longer paths, instead of noticing the trouble in the final.




**·Algorithm built the foundation for unmanned technology by detecting and tracking dynamic obstacles**

Deep learning in the unmanned sensing level mainly deal with the local data the camera and radar collected (combined with global data). Based on the characteristics of the dynamic image of the great amount of information and that it is difficult to manually model, the deep learning can maximize its advantage.

At the decision level, the first thing need to solve in the research process of unmanned technology is the security problem. The lidar can only provide sparse environmental information, while unmanned driving on the road will face a dynamic changing environment. Thus, to improve the detecting and tracking accuracy of dynamic obstacles and to reduce the rate of making mistakes are the critical problems to solve for unmanned vehicles in the environmental perception.

In order to avoiding collision with dynamic obstructions during travel, the unmanned system requires the aid of the algorithm to reach the following three conditions:

First, it is necessary to reliably detect dynamic obstructions that may affect the travel. It requires the sensor accurately measures the position change of the obstacle, extracts the obstacle feature for the matching of obstacles at different times, and completely tracks the same obstacle;

## The opportunities and challenges of the application of AI in some specific areas

Second, the movement path of the dynamic obstacle must be predicted;

Finally, the types of dynamic obstacles needed to be identified. Different obstacles have different sports characteristics, which directly affects the final obstacle avoidance strategy made by the unmanned vehicles.

Except for the perception and decision-making, unmanned driving also involves vehicle control, automotive dynamics, automotive engineering and many other technical disciplines, and at the same time needs the support from accessories such as car control (brake, steering, lighting, throttle, etc.).

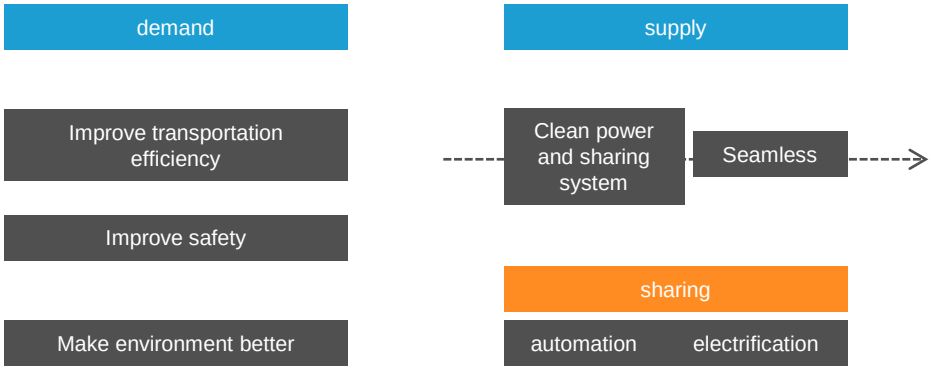
**·Unmanned business map**


**·Automation, as one of the trends of transportation in future cities, supports suppliers to accomplish people's demand**

**·Demand and supply in transportation industry in the future**

urbanization and population growth will push the city's average population density increase by at least 30%. At that time, the demand for mobility in densely populated cities will be doubled (if the individuals travel mileage remains stable, and the ratio between car ownership and GDP growth remains at the historical level). There is no doubt that people's demand for mobile will increase, causing traffic congestion (especially in peak time) and greatly reducing people's traffic efficiency. From the (China super line city) residents point of view, on the one hand, the traffic should be efficient and on the other hand, it should be safe and reliable. Meanwhile, people care about the global regulation of tail gas emissions derived from livability and sustainability, and support renewable energy to improve air quality.

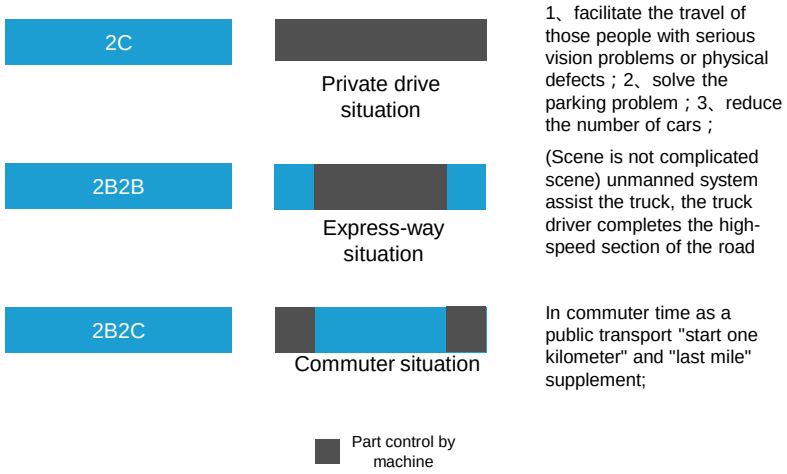
## The opportunities and challenges of the application of AI in some specific areas




McKinsey has proposed three trends: electrification, sharing and automation, in its "Prospects for Future Travel (Mobility)" report, based on China's specific urban conditions ( population density, economic development, infrastructure, etc.). In the future, China's cities (in a short-term, this view will appear at those super-line city, such as Beijing, Shanghai and Shenzhen) will gradually transfer from "clean energy and sharing system" to "seamless mobility." In general, sharing bikes, as a supplement to the public transport system, would be the core. Electrification and automation mainly provide the technique upgrading for the sharing part, pushed by the requirement of improving the air quantity and the transportation efficiency.

Automatic driving is automating the original vehicle system with big data. As shown above, automation, as the future trend of urban mobile travel, supports the suppliers to satisfy the three kinds of demand of people.

### ·Three business models of unmanned in the future



## The opportunities and challenges of the application of AI in some specific areas

From the business pattern, after unmanned vehicles become more mature in the future, the commercialization to the customers will achieve as two forms: "selling products" or "providing services". "Selling products" mainly faces to the customers with high income to provide private self-driving cars. "providing services" can be divided into B2B2C (the middle B-side work as an operator, providing sharing self-driving cars to customers), and B2B2B (at relatively closed, simple traffic scene, like trucks in the middle section of highway, people can turn on the self-driving system). At present, the later one(B2B2B) will achieve commercialization faster.

**·Before the unmanned comes to the market, the regulatory system is still a problem**

Now the society is transferring from the assistant driving ADAS to the unmanned and completely unmanned. From the perspective of urban residents' needs, such as "improve traffic efficiency" and "improve air quality", it is hoped that unmanned technology can be available as soon as possible, but the safety and reliability of unmanned driving make people hesitate.

Nancy G. Leveson, a professor at the Massachusetts Institute of Technology in the United States, points out that the security problem of ADAS is not in the individual program parts, but in the integration of the system. A study by the German TüV safety certification institution indicates that when the driving support system begins and shows some (Semi-)automatic actions, it is sometimes accompanied by a number of unstable "unnecessary system behavior", which in serious cases will threaten personal safety.

From current study, the transition process from the assistant driving to the unmanned, is a continuous improvement of the process of adapting to the unstructured environment. There are kinds of hidden dangers and hidden dangers caused by the errors: 1, hackers' intrusion to network or improper interference to vehicle sensors; 2, the understanding of the environmental situation is not complete resulting in security accidents.

In the trend of the car network and other data sharing, the first category of security risks are also decreasing. The second type error can be subdivided into: (1) vehicle braking system is suddenly activated without reasonable reason, causing safety problems (2) the technical level of the system does not meet the security and causes the system to do the wrong "classification" and "understanding"; (3) system build on machine learning has unknown risk, which may lead to the final behavior deviating from the car manufacturers' expectation. These risks may at any time lead or directly cause a traffic accident.

## The opportunities and challenges of the application of AI in some specific areas

The mode of joint control by human and machine has a complex problem of fault judgment. In fact, in the transition process from the assistant driving to the partial unmanned or even completely unmanned, there is a trend that the traffic accident liability moves from the residents to the cars' manufacturers. Worried about the large legal liability, unmanned car manufacturers may consider limiting the ability of the car due to security risks, and ultimately lead to the failure of high technology to be fully into the community.

Consequently, whether the unmanned car can finally enter the community or not, is not depending on the technical maturity, but at the same time on the bottom-up social acceptance of people and the up-down policy and legislative control considerations. "Even the best car safety technology cannot ensure that every life is saved," said by Dr. Medford, director of safety at Google's unmanned car project. "The limitation of the efficiency of technology depends on the way people use it.

Before the unmanned comes to the market, the regulatory system is still a problem.

# Appendix

## Yiou Intelligence: List of the core AI talents from the main enterprises in China (215 people)

**YIOU Intelligence: map of the core AI talents from the main enterprises in China**

| Job/Position | | | Educational background | | |
|---|---|---|---|---|---|
| Name | Company/Institution | Title | School | Major | Degree |
| Shen Xiangyang | Microsoft Asia Research Institute | Global executive vice president | Carnegie Mellon University | Computer machine | Ph.D. |
| Guo Baining | Microsoft Asia Research Institute | Vice president | University of Cornell | Computer science | Ph.D. |
| Zhang yongguang | Microsoft Asia Research Institute | Chief researcher | Purdue University | Computer science | Ph.D. |
| Liu Tieyan | Microsoft Asia Research Institute | Principal | Tsinghua University | EE | Ph.D |
| Zhang Hong | Microsoft Asia Research Institute | Senior researcher | Massachusetts Institute of Technology | EE | Ph.D. |
| Zhang Yizhao | Microsoft Asia Research Institute | Vice president | Massachusetts Institute of Technology | EE | Ph.D. |
| Li Jiang | Microsoft Asia Research Institute | Researcher | Zhejiang University | Applied Mathematics | Ph.D. |
| Li Jin | Microsoft Asia Research Institute | Researcher | Tsinghua University | EE | Ph.D. |
| Liu Wenyin | Microsoft Asia Research Institute | Researcher | Technion –Israel Institute of Technology | Science | Ph.D. |
| Xie Xing | Microsoft Asia Research Institute | Manager of research team | China University of Technology | CS | Ph.D. |
| Mei Tao | Microsoft Asia Research Institute | Senior researcher | China University of Technology | Pattern Recognition & Intelligent control | Ph.D. |
| Yuan Jing | Microsoft Asia Research Institute | Researcher | China University of Technology | / | Ph.D. |
| Lu Pinyan | Microsoft Asia Research Institute | Manager of research team | Tsinghua University | CS | Ph.D. |
| Zhou Ming | Microsoft Asia Research Institute | Chief researcher | Harbin Institute of Technology | CS | Ph.D. |
| Wang Xuedong | Microsoft Asia Research Institute | Chief researcher | University of Edinburgh | EE | Ph.D. |
| Hua Gang | Microsoft Asia Research Institute | Chief researcher | Northwestern University | EE | Ph.D. |
| Zheng Yu | Microsoft Asia Research Institute | Chief researcher | Southwest Jiaotong University | Information Security | Ph.D. |
| Zeng Wenjun | Microsoft Asia Research Institute | Chief researcher | Princeton University | EE | Ph.D. |
| Tong Xin | Microsoft Asia Research Institute | Chief researcher | Tsinghua University | Computer GRAPHICS | Ph.D. |
| Hong Xiaowen | Microsoft Asia Research Institute | Dean | Carnegie Mellon University | CS | Ph.D. |
| Wang Jian | Microsoft Asia Research Institute | Executive vice president | Hangzhou University | Psychology | Ph.D. |
| Deng Li | Microsoft Asia Research Institute | Chief scientist | University of Wisconsin-Madison | EE | Ph.D. |
| Song Pingping | Microsoft Asia Research Institute | Chief scientist/ Director | Stanford University | EE | Ph.D. |
| Huo Qiang | Microsoft Asia Research Institute | Chief researcher | University of Science and Technology of China | / | Ph.D. |

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| Name | Company/Institution | Title | School | Major | Degree |
| Wu Jiajun | Microsoft Asia Research Institute | Intern researcher | Massachusetts Institute of Technology | CS | Ph.D. |
| Zhang Yaqin | Baidu | President | Georgetown University | EE | Ph.D. |
| Wang Jin | Baidu | Chief Manager | Chinese Academy of Sciences | CS | Ph.D. |
| Zhu heng shu | Baidu | Data scientist | China University of Technology | CS | Ph.D. |
| King Kun | Baidu | Chief manager | / | / | / |
| Wang Haifeng | Baidu | Vice president | Harbin Institute of Technology | CS | Ph.D. |
| Lou Tiancheng | Baidu | Engineer | Tsinghua University | CS | Ph.D. |
| Zhang Tong | Tencent | Director | Stanford University | CS | Ph.D. |
| Yu dong | Tencent | Vice director | / | / | / |
| Liu Wei | Tencent | Head of computer vision center | Columbia University | CS&EE | Ph.D. |
| Yao Xing | Tencent | Vice president | / | / | / |
| Min Wanli | Alibaba Group | Chief scientist of AI Department | University of Chicago | / | Ph.D. |
| Chu min | Alibaba Group | Department Inspector | / | Signal Processing | Ph.D. |
| Zhou Jingren | Alibaba Cloud | Chief scientist | Columbia University | CS | Ph.D. |
| Tangzi Nan | Alibaba Cloud | Product manager | Chinese Academy of Sciences | Software | Ph.D. |
| Huaxian sing | Institute of Data Science & Technologies | Senior scientist | Peking University | Applied Mathematics | Ph.D. |
| Chu min | Institute of Data Science & Technologies | Principal | Chinese Academy of Sciences | Signal Processing | Ph.D. |
| Ma Weiying | Toutiao | Vice president | University of California, Santa Barbara | EE&CS | Ph.D. |
| xiang liang | Toutiao | The expert of machine learning | Chinese Academy of Sciences | Automation | Ph.D. |
| Cao huanhuan | Toutiao | Chief Algorithm Designer | China University of Technology | CS | Ph.D. |
| Li lei | Toutiao | Pricinpal | Carnegie Mellon University | CS | Ph.D. |
| Zhangyi woo | Toutiao | CEO | Nankai University | Software | Master |
| Yang Qingwei | Didi Chuxing | Principal | University of Illinois at Urbana - Champaign | EE | Ph.D. |
| He xiaofei | Didi Chuxing | Senior Vice President | University of Chicago | CS | Ph.D. |

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|---|---|---|---|---|---|
| Name | Company/Institution | Title | School | Major | Degree |
| Ye Jieping | Didi Chuxing | Vice president | University of Minnesota, Twin Cities | CS | Ph.D. |
| Zhang bo | Didi Chuxing | CTO | Chinese Academy of Sciences | Software | Master |
| Jia Yangqing | Facebook | Research scientist | UC Berkeley | CS | Ph.D. |
| Longfei | Facebook | Senior Manager | University of Florida | Statistics | Master |
| Chen Wenlin | Facebook | Researcher | University of Washington at St. Louis | CS | Ph.D. |
| Zhou Bowen | IBM | chief scientist | University of Colorado - Boulder | / | Ph.D. |
| Shen Xiaowei | IBM | CTO / Dean | Massachusetts Institute of Technology | EE&CS | Ph.D. |
| Suzhong | IBM | Director | Tsinghua University | CS | Ph.D. |
| Liu Qingfeng | IFLYTEK | Chairman of the board | China University of Science and Technology | Signal Processing | Ph.D. |
| Hu Yu | IFLYTEK | Dean | China University of Science and Technology | Signal Processing | Degree |
| Paint far | Antfin | Chief data scientist | Massachusetts Institute of Technology | / | Ph.D. |
| Cheng Li | Antfin | CTO | Shanghai University | cs | Master |
| Xu Chenyang | Siemens | General manager | Johns Hopkins University | / | Ph.D. |
| Zhou Shaohua | Siemens | Chief image analysis expert | University of Maryland - Parker | / | Ph.D. |
| Zhou Xiang | Siemens | Head of medical department | Tsinghua University / Ivy Champagne | Economics/ Computer Vision | Ph.D. |
| Kai-fu Lee | Sinovation Ventures | Founder | Carnegie Mellon University | CS | Ph.D. |
| Ma lei | Atman | Founder/CEO | Tsinghua University | CS | Degree |
| Xiao Jianwei | Auto X | Founder | Massachusetts Institute of Technology | / | Ph.D. |
| Cao Liangliang | Customer Service AI | Co-founder | University of Illinois at Urbana - Champaign | EE&CS | Degree |
| He Kaiming | Facebook | Research scientist | Tsinghua University | Basic Science | Ph.D. |
| Xia Yan | Linkface | Co-founder | Microsoft Asia Research Institute | Computer Vision | Ph.D. |
| Huang Xianjun | Linkface | CTO | Singapore Nanyang Technological University | CS | Ph.D. |
| Liu Guoqing | Minieye | CEO | Singapore Nanyang Technological University | CS | Ph.D. |
| Cao Xudong | Momenta | CEO | Tsinghua University | EM/Economics | Ph.D. |

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|---|---|---|---|---|---|
| Name | Company/Institution | Title | School | Major | Degree |
| Ren Shaoqing | Momenta | Head of research team | China University of Science and Technology | Information Security | Ph.D. |
| Feng Xinpeng | NextVPU | CEO | University of Southampton | Micro-electronics | Ph.D. |
| Yu Tianyue | Quanergy | Vice president of product | Cornell University | Chemical | Dgree |
| Liang Sheng | Racher Labs | CEO | Yale University | CS | Ph.D. |
| Li Renjie | Riot Games | President | University of Rochester | / | Master |
| Liu Yingbo | ROOBO | Founder | Beijing Jiaotong University | / | Degree |
| Wang Xiaoyu | Snapchat | Researcher | University of Missouri - Columbia | Statistics/EE | Ph.D. |
| Xiao Wenfeng | Talkingdata | CTO | Tsinghua University | Automation | Master |
| Sun Tianqi | Vincross | CEO | Nanjing University of Aeronautics and Astronautics | CS | Degree |
| Huang Junjie | Viscovery | CEO | - | / | / |
| Dai Jingwen | XIMMERSE | CTO | Chinese University of Hong Kong | Computer Vision | Ph.D. |
| Wang tao | IQIYI | Chief scientist | - | / | / |
| Berlin Sen | Baifendian | Founder/CEO | University of Illinois | Physics$EE | Ph.D. |
| Tao Hai | Vion Tech | Chairman of the board | University of Illinois | / | Ph.D. |
| Chen Jie | Boyunvision | CEO | Beijing University | / | Ph.D. |
| Li Zhifei | Chumenwenwen | CEO | Johns Hopkins University | / | Ph.D. |
| Xiao Hongbo | Senscape | CTO | Tsinghua University | EM | Master |
| Li Lijun | Cxrobotics | Chairman of the board | University of Melbourne | Project Management | Master |
| Yue Fei | uSens Ince | CTO | Rice University | | Master |
| Yong Hu | luobo tech | CEO | Tsinghua University | CS | Master |
| ShuaiXiang Dai | Moran | | Xiamen University | AI | Master |
| Weimeng Zhang | Moran | Founder | CASS | Chinese signal Processing | Master |
| Ruoli Dai | Noitom Technology | CTO | Chinese University of Hong Kong | Mechanical Automation | Ph.D. |
| Qiong Yang | 91 paiyipai | Founder | Tsinghua University | Text Recognition | Ph.D. |

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|---|---|---|---|---|---|
| Name | Company/Institution | Title | School | Major | Degree |
| Jing Xiao | Pingan Tech | CEO | Carnegie Mellon University | CS | Ph.D. |
| Weinan E | princetechs | CEO | UCLA | | Ph.D. |
| Quanzhong Li | pachira | CTO | University of Arizona | CS | Ph.D. |
| Guotao He | pachira | CEO | Philadelphia University | CS | Master |
| Shaoshan Liu | PerceptIn | Founder | | | |
| Shuicheng Yan | 360 | Chief Scientist | Peking University | Mathematics | Ph.D. |
| Renyin Dou | HUMAN+ | CTO | Beijing University of Posts and Telecommunications | Space Machine | Master |
| Chao Yuan | tricom technology | CTO | | | |
| Yongpeng Wei | shangque | CTO | Tsinghua University | CS | Master |
| Fan Yang | SenseTime | Co-founder | | | |
| Li Xu | SenseTime | CEO | Chinese University of Hong Kong | CS | Ph.D. |
| Yijian Wu | yuanqutech | CEO | University of Science and Technology of China | Special Class | Bachelor |
| Peijiang Yuan | Sensingtech | Co-founder | University of Western Ontario | EE&CS | Ph.D. |
| Xiaoliang chen | Soundai | CEO | CAS | Phonics Signal | Ph.D. |
| Song Song | tricom technology | CTO | Tsinghua University | | Master |
| Kuan Wu | shuangjisha | CTO | Tsinghua University | EE | |
| Lie Wei | voiceontech | CEO | George Washington University | Engineering | Master |
| Kai Yu | aispeech | Chief Scientist | University of Cambridge | Engineering | Ph.D. |
| Shikai Chen | slamtech | CEO | Shanghai Jiaotong University | CS | Bachelor |
| Zhen Chen | qfeeltech | CEO | Tsinghua University | CS | Master |
| Chunxin Qiu | robosense | CEO | Harbin Institute of Technology | Control Science | Ph.D. |
| Jun Wang | iCarbonX | CEO | Peking University | Biological Information | Ph.D. |
| Tao Yao | Xtecher | CEO | University of Auckland | Machine Learning | Ph.D. |
| Kun Zhen | TaoBao | Researcher | Peking University | CS | Ph.D. |

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|---|---|---|---|---|---|
| Name | Company/Institution | Title | School | Major | Degree |
| kaiShuang Yin | falcon | CEO | | | |
| Dashan Gao | 12sigma | CTO | UCSD | EE | Ph.D. |
| Xiaodi Hou | tusimple | CTO | California Institute of Technology | CS& Nervous System | Ph.D. |
| Huangshuoyu Wong | datamorrow | CTO | | | |
| Jun Yao | WeBank | Principal | DePaul University | CS | Master |
| Lufeng Zhai | askat | Founder/CEO | Hong Kong University of Science and Technology | | Master |
| Enda Wu | Baidu | Chief Scientist | University of California, Berkeley | | Ph.D. |
| Weijia Gu | Ling | | Tsinghua University | Design Administration | Master |
| Runchun Wang | westwell | Chief Scientist | University of Western Sydney | Medical Engineering | Master |
| Pinpin zhu | xiaoi | CTO | CAS | AI | Ph.D. |
| Bin Lin | xiaomi | Co-founder | Drexel University | CS | Master |
| Le Dong | symboltech | Chief Scientist | Queen Mary University of London | Multimedia & Computer Vision | Ph.D. |
| Qiming Xu | yiducloud | CTO | CAS | | Master |
| Chenxi Lin | yitu tech | Founder | Shanghai Jiaotong University | CS | Master |
| Ren Wu | Novimind | CEO | Queen Mary University of London | AI | Ph.D. |
| Junmin Zhu | exocr | CEO | CAS | Automation | Bachelor |
| Xiaobo Li | imgnb | CTO | | | |
| Jiqiang Song | intel | Principal | Nanjing University | CS | Ph.D. |
| Jianxin Pang | Ubtech | R&D Director | University of Science and Technology of China | EE | Bachelor |
| Hongyu Yao | YOYOSYSTEM | CEO | University of Wisconsin | CS | Ph.D. |
| Gansha Wu | Deep Security | CEO | Fudan Univeristy | CS | Bachelor |
| Yan Jiang | Deep Security | Co-founder | | | |
| Jinglei Zhao | ReadSense | CEO | Shanghai Jiaotong University | AI | Ph.D. |

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| Job/Position | | | Educational background | | |
|---|---|---|---|---|---|
| Name | Company/Institution | Title | School | Major | Degree |
| Xi Zhou | CloudWalk | Founder/CEO | University of Illinois at Urbana-Champaign | | Ph.D. |
| Bin Chen | dding | CEO | Tsinghua University | EE | Master |
| Benyu Zhang | CloudBrain | CEO | Peking University | CS | Master |
| Benfeng Chen | allmobilize | CEO | Hong Kong University of Science and Technology | CS | Master |
| Ning Chen | IntelliFushion | CEO | Georgia Institute of Technology | EE&CS | Ph.D. |
| Dihong Tian | IntelliFushion | CTO | Georgia Institute of Technology | EE&CS | Ph.D. |
| Wei Huang | unisound | CEO | University of Science and Technology of China | | Bachelor |
| Jiaen Liang | unisound | Co-founder/CTO | CAS | Automation | Ph.D. |
| Gang Li | qed-tech | Co-founder/CTO | Beijing University of Technology | CS | Bachelor |
| Shi Ting Yang | qed-tech | Chief Researcher | Chang Gung University | Medical Engineering | Ph.D. |
| An Yan | zhiweiCloud | Co-founder/CTO | Brown University | CS | Ph.D. |
| Kun Liang | Zlime | CTO | Peking University | CS | Master |
| Linan Wu | sobot | CTO | | | |
| ShengYan Zhou | autor | CEO | Beijing University of Technology | Graphics Processing | Ph.D. |
| An Jiang | smartereye | CEO | CAS | Automation | Ph.D. |
| ShiGuang Shan | Seetatech | Prisident/CTO | CAS | CS | Ph.D. |
| Weiting Jian | SMIC | | Texas A$M University | Engineering | Ph.D. |
| Kewei Wu | sinoits | CEO | Beijing University of Posts and Telecommunications | communication engineering | Master |
| Rui Tang | zongmutech | CEO | Tsinghua University | EE | Bachelor |
| Song Yao | Deephi Tech | CEO | Tsinghua University | EE | Bachelor |
| Yu Wang | Deephi Tech | CTO | Tsinghua University | EE | Bachelor |
| Lianyi Zhang | sinovoice | Prisident | Tsinghua University | Environment Engineering | |
| Ziqing Li | AuthenMetric | Founder/Prisident | University of Surrey | | Ph.D. |

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| Job/Position | | | Educational background | | |
|---|---|---|---|---|---|
| Name | Company/Institution | Title | School | Major | Degree |
| Zhenhua Cai | Kuaishang | Co-founder | Xiamen University | AI | Ph.D. |
| Peng Ding | DeepCare | CTO | Dartmouth College | Engineering | Ph.D. |
| Donghui Zhan | reconova | Founder/CEO | Nanjing University | EE | Bachelor |
| Ni Wang | quantgroup | Co-founder/CTO | Georgia Institute of Technology | Statistics | Ph.D. |

# Afterward

The rise of AI in recent years can be attributed to the encouragement from the explosive growth of the database and stronger computing power, which pushing the multi-layer neural network to the spotlight. About the deep learning, there is an interesting phenomenon: The Internet provides a carrier for the flow of data and convergence, but the improvement of the application of the deep learning in the Internet (advertising, recommendations, etc.), is not as significant as in the areas of voice and images.

The reason is that we can collect the voice and image data actively through the corpus, so that we can cover each iPhone, or even each camera, but the collection of social behavior on the Internet, such as "to click or not", " to read or not " and "to participate in the interaction or not", for each individual of each of the current environment, are very uncertain data. In general, deep learning needs to be able and have a large number of annotated data to reach the evolution of the model.

ImageNet, the data set with 15 million annotated images was set by 48940 workers from 167 countries, taking 2 years to clean, sort and mark 1 billion images. But ImageNet is still a generic data set. If start-up companies need to establish their own barriers in specific areas, such as medical, carrying out data collection in the field is needed, and then the data should be marked, the more refined the better.

There is a total of 21 responses to the question "Is there a man in the big company who is responsible for marking the data?" on Zhihu. Respondents from large companies have indicated that they have launched "all human beings to mark tens of thousands of images by manpower" or to "work in a branch with relatively low labor costs". Small companies will have it "deal by the department next door with all women ", or "marked by their own people in order to save money". In addition, outsourcing it to the outsourcing company is the most common option.

We can see this from the job requirements on the recruitment site. If you type "data labeling" on Zhaopin, you can find 60 directly related positions. In lagou.com you can find nearly 400 - managing outsourcing team and other related positions are also counted into them.

To a certain extent, to determine whether a business is having AI as its core, you can check how much it spends on data marking every month.

# Afterward

This is the information which Yiou Intelligence team concludes after spending more than three months for desktop research, visiting the enterprise to see and think. The report focus on the combined landing of technology and industry, and of course, this is our first report about the overview of the AI industry. Inevitably, there are many deficiencies and omissions, and please kindly remind us if you find any.

# Disclaimer

The data used in this report are derived from compliance channels. The analysis logic is based on the author's professional understanding, and clearly and accurately reflects the author's research views. We tried our best to keep an independent, object and impartial mind. The conclusions are not subject to any third party's intention or influence.

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# About us

## Yiou

Yiou(www.iyiou.com) is a platform, which focuses on new technologies, new conceptions and their combination with every industry, with the duty to help industries creation and update. Yiou now have 5 products: iyiou.com, Yiou Intelligence, SEER, B2B Database, Tianchuang.

## Yiou Intelligence

Yiou Intelligence belongs to Yiou and focuses on providing researching and consulting services. Yiou Intelligence pays a close attention to some advanced technologies, such as AI, Big data, the Internet and Fintech, and their combination with specific industries. Based on deep consideration and careful observation, Yiou intelligence tries to output thought-provoking and inspiring research reports and to provide professional and customized consulting services. All Yiou intelligence members come from famous researching institutions or strategy department of big companies. We hoped that through our products and services, we can help investors or customers from all over the world build a clear mind about the advanced techniques and new industries occurrence in China and draw a image of their development.

# Yiou

Platform for industry innovation