

THE AI ECOSYSTEM IN CHINA

2020

BEIJING | SHANGHAI | HONG KONG

Executive Summary

This white paper defines the types of AI technology developing in China and highlights examples of AI adoption across several industries. We shed light on the unlimited potential that companies can leverage. In the global AI arena, China has an advantage in **data and adoption**, which make China an ideal place for a company of any industry to branch out into new high-tech endeavours.

AI will play key role in the future economic development of all nations alike. China is a prime example of how AI is leveraged to tackle structural challenges that hinder the country from unleashing its full economic potential. For China, the most important of these challenges is the need to escape the middle-income trap. As already outlined in the Made in China 2025 strategy, the Chinese government is investing considerable amount of resources to make sure that **China emerges as a world leader in AI technology**. In fact, AI industrial parks are being established across the country, in the cities of **Beijing** and **Shanghai**, and the provinces of **Guizhou** and **Guangdong** as the main contenders for the title of **AI capital** of Asia and perhaps the world.

With this project, daxue consulting decided to help both foreign and domestic companies learn about the current trends in the tech economy and applications of AI in industry. **First**, this **white paper** on the state of Artificial Intelligence is **divided in three macro sections**. The **first section** concerns the overview and market size of AI in China. In this part, the data regarding the different uses of AI technology across industries are shown in charts which **highlight the promising trends of AI technology in China**. Furthermore, at the end of this section we show how some companies are developing AI ecosystems that include smart transportation, education, robotics, biotechnology, security and more. **The second section** is goes further into the AI adoption in several industries. The topics covered are AI in the beauty industry, the new retail sector, the manufacturing sector, the transportation industry, the healthcare sector, the hospitality industry, the video game industry; public institutions, and advertising. The **articles provide in-depth analyses** of all the aforementioned sectors of the Chinese economy and the country's projected economic development over the next few years. Finally, **the third and conclusive section** of the paper provides information about daxue consulting and how businesses can contact us for tailor made research designed to answer the specific needs, whether new to China or already established in the market.

This white paper has been updated since the COVID-19 outbreak to include the latest AI contributions to fighting the virus in China.

While investigating the relationship between AI and the Coronavirus in China, we found unprecedented tech advancements in big data or AI in an effort to contain the outbreak. In fact, according to a WHO report that lists the finding of an expert investigation team sent to China between February 16 and 24, 2020, "the implementation of [the] containment measures has been supported and enabled by the innovative and aggressive use of cutting edge technologies." The section on AI and Combating COVID-19 explains what some of these technologies used during the recent outbreak are.

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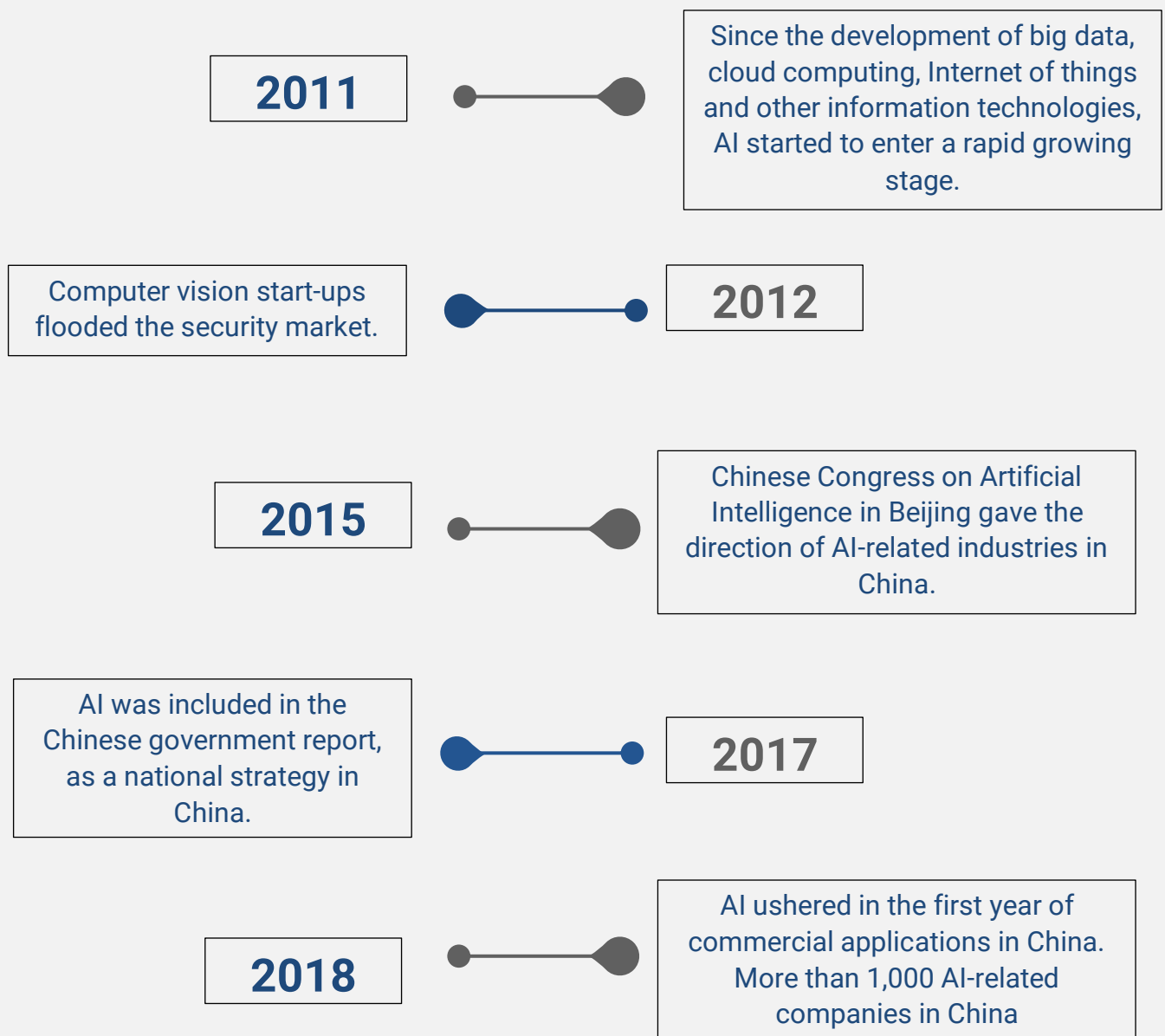
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Part One

INTRODUCTION

THE HISTORY OF ARTIFICIAL INTELLIGENCE (AI) IN CHINA

Along with the gradual maturation of artificial intelligence (AI) technology observed in recent years, many industry giants in China progressively increased their investment in this new market. The burgeoning applications of AI technology have also expanded the scope of this technology from niche research fields to broader commercial areas. In fact, today, AI has broad market prospects, particularly in China. Besides being among the leading nations—in terms of AI research output, China is ideally positioned for the rapid development of AI technology. With its population of 1.4 billion and some of the world's foremost AI research centers like Tsinghua University, Shanghai Jiaotong University and the Chinese Academy of Sciences, China disposes of enough data and brainpower to make significant breakthroughs in AI technology.¹



¹ 40 Years of AI Development History, finance.sina.com.cn

THE MAIN SECTORS COVERED BY AI

Delving into the AI market in China, we see that this technology already covers a wide range of segments. Some of the most dynamic areas include what daxue consulting defines as the **basic layer**—the basic parts and algorithms of AI products; the **technology layer**—technologies which support AI products—and **applications**, which are the AI products in the different industries. In the graph below, we have clustered Chinese companies, which make use of AI technology into four groups, depending on which specific segment the company's focus on: **Applications**, **Technology**, **Basic**, and **Comprehensive**, which refers to those companies that are working in all three areas.

China's Artificial Intelligence Companies

Applications



Technology



Base



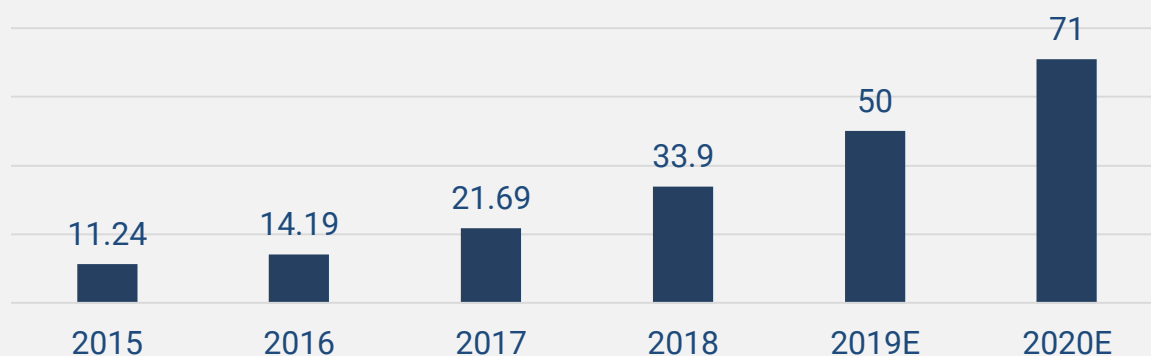
Comprehensive



MARKET SIZE OF AI TECHNOLOGY IN CHINA

China's artificial intelligence industry is becoming one of the most important in the world. However, the market of AI in China is not mature yet and there is still a large space for development. In 2018, the size of China's artificial intelligence market reached 33.9 billion RMB and the compound annual growth rate (CAGR) was more than 44% between 2015 and 2018. By 2020, the market size is expected to reach 71 billion RMB.²

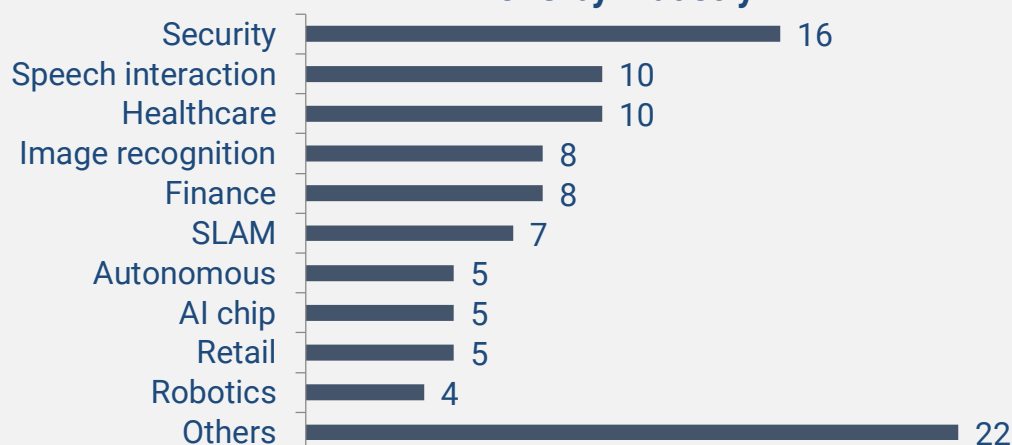
China's artificial intelligence market size
(billion RMB, 2015-2020)



DISTRIBUTION OF AI COMPANIES BY INDUSTRY

The AI-related companies established in 2018 mainly belong to the security, speech interaction and healthcare industries³. These areas have strong market demand and mature technology applications. A large portion of China's AI market share is from speech, computer vision and natural language processing technologies.

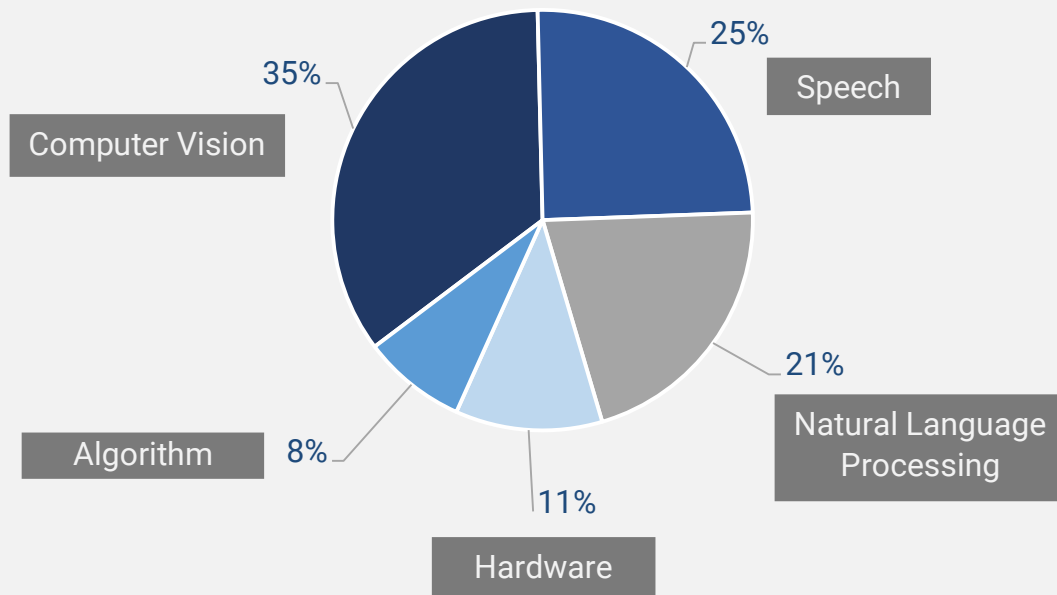
The number of AI-related companies established in 2018 by industry



² 2019 China AI Market Analysis, bg.qianzhan.com

³ Qinghua University, Chinese AI Development 2018

China's AI market share by industry (2017)

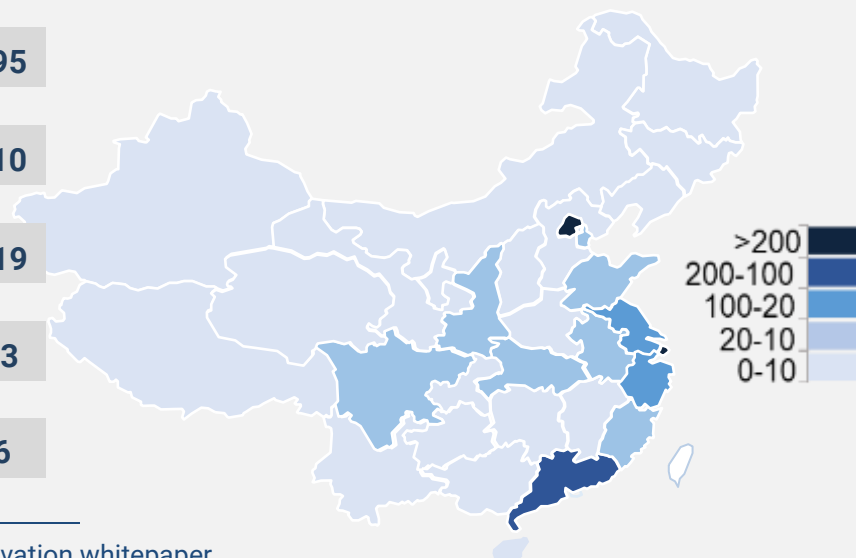


DISTRIBUTION OF AI STARTUPS BY REGION

AI companies are mainly concentrated in China's economically developed first and second-tier cities and coastal areas. Inland provinces are starting to grasp the development boom as well. Beijing, Shanghai, Shenzhen and Hangzhou are ranked among the Top 20 in the world for the quantity and industrial output of AI companies. As a result of its large and talented workforce, industrial resources and capital, which were superior to other regions and cities, Beijing recorded the highest number of AI companies.⁴

Number of AI companies by province in 2018

1	Beijing	395
2	Shanghai	210
3	Shenzhen	119
4	Hangzhou	63
5	Guangzhou	46



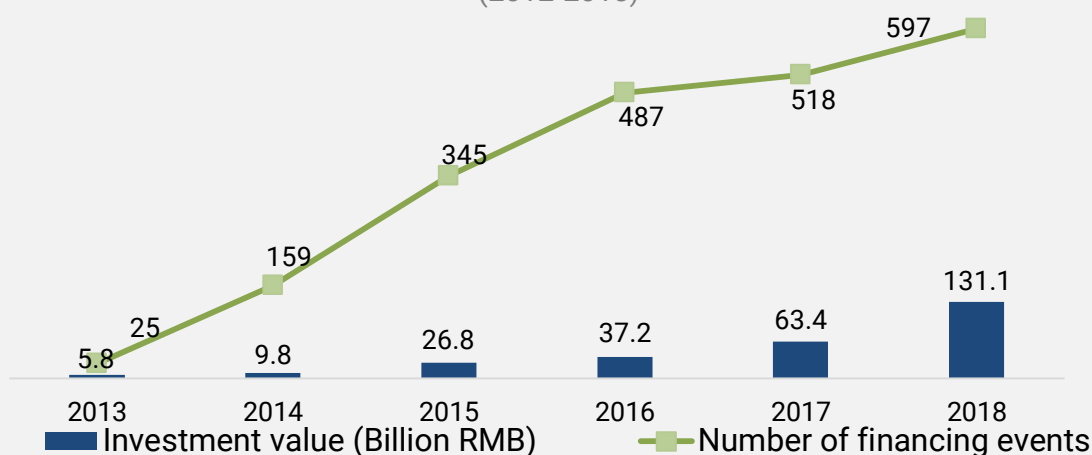
⁴ Deloitte Chinese AI Innovation whitepaper

INVESTMENTS IN AI

In 2018, the investment value in China's AI industry reached 131.1 billion RMB, which is an increase of about 67.7 billion RMB compared to 2017. The scale of the investments granted China the first position in the world ranking. Although the growth of AI financing events slowed down in 2018, the total investment value still increased significantly. Large financing events occurred frequently, and capital was more concentrated in leading companies⁵.

Investment value and the number of financing events in China's AI industry

(2012-2018)



WHY IS AI DEVELOPING SO FAST IN CHINA?

The ubiquity of the mobile Internet

China has a massive base of smartphone users. Mobile internet users create large amounts of data, which is the fuel that AI technology consumes to develop. By using apps on smart-phones, individual users can easily control products, such as smart-speakers and clearing-robots.



Big data and computing power

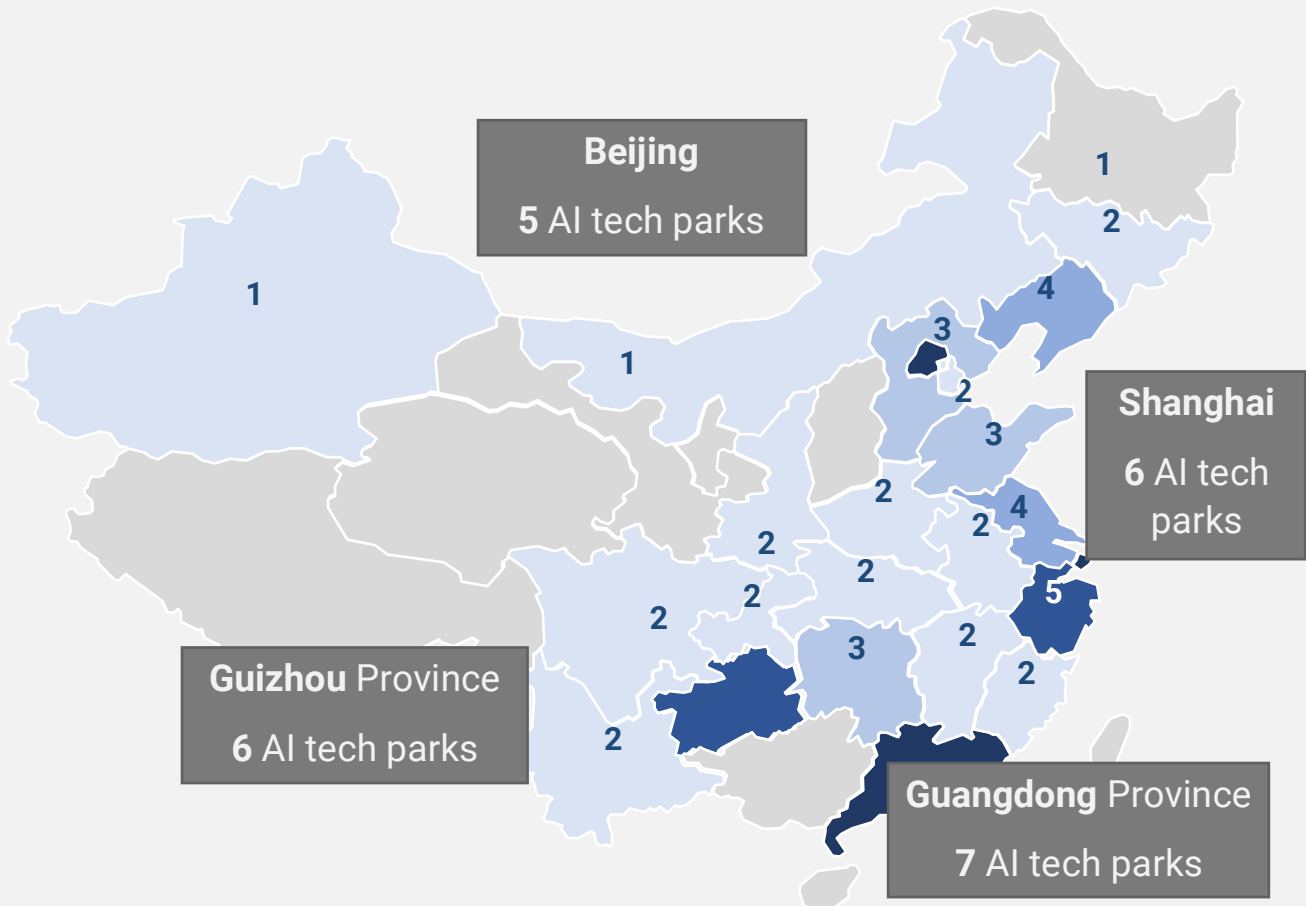
The fast-growing big data and cloud computing effectively improve machine learning and cognitive ability. In recent years, especially in specific application fields, there has been a great development in machine learning usage, which is a precondition for the creation of new AI technology.



⁵ Data Source: iiMedia, Chinese AI Industry 2018 report

TECH PARKS

In order to promote AI's development, the Chinese government launched a series of AI industrial parks in the eastern and southern parts of the country. In 2018, China had more than 60 AI tech parks. Industrial parks usually have preferential policies to attract AI companies, such as rental subsidies and tax concessions.⁶



Cities	AI industrial parks
Beijing	Zhongguancun Software Park, Mentougou AI Park, Vpark, etc.
Shanghai	Qingpu District AI Park, Linggang AI Industrial Park, etc.
Hangzhou	Binjiang AI Industrial Park, Hangzhou AI Town, etc.
Shenzhen	Shenzhen Bay AI Tech Park, Longhua AI Industrial Park, etc.
Guangzhou	Nansha AI Industrial Park, Guangzhou International AI Study Park, etc.
Nanjing	AI demonstration zone, Xingang High-tech AI Base, etc.

⁶ Data Source: Deloitte Chinese AI Innovation whitepaper

CHINESE PERCEPTIONS OF AI

An important element in the development of AI technology is the potential consumer perception of AI based products. The cocktail of information that has been surrounding AI research and its applications has created confusion among lay readers. In fact, catastrophist Hollywood movies like Terminator, or the nefarious predictions of famous entrepreneurs like Elon Musk come to the mind of many people, whenever they hear or read about artificial intelligence. In order to get an idea of what Chinese netizens think of AI, daxue consulting conducted a sentiment analysis on the platform Zhihu. **Zhihu** is the first Q&A website in China and has transitioned to a social media sharing platform, gathering more than 100 million answers on various topics. The platform is especially relevant for inquiries regarding higher- and well-educated social classes.

未来三十年内，哪些行业的工作人员可能会被人工智能取代？

YJango
机器学习、深度学习 (Deep Learning) 话题的优秀回答者



- AI 到底取代了什么
- AI 如何改变行业
- 李世石 vs 阿尔法
- AI 与 艺术
- AI 与 医疗、学术
- 如何避免失业与保持竞争力

In which industries will AI replace workers in the next 30 years?

- How will AI change industries
- AlphaGo versus Lee Sedol
- AI and art
- AI and healthcare and academia

On Zhihu, the most common questions and posts about AI consist of the following:

- How will AI change people's lives in the future?
- Which industries will be replaced by AI in the future?
- How to protect personal privacy when using AI products?

人工智能越来越逆天 我们的隐私该怎么办？

一度蜜智能，基于大数据的智能产品分销平台

点评：鱼和熊掌，如何兼得？

而这些数据最后落在谁那也是个未知数，反正不是用户自己。

当然，现在人工智能越来越逆天，物联网越来越盛行，一般的智能设备都能记录你的个人信息和行为习惯，尤其是智能语音、影响设备，不管你说啥都有可能被它记录下来。

据业内人士称，制作商会尽可能收集并保留这些数据，用来改进产品、用户体验，不过更多情况下，他们有可能会把这些数据卖给第三方，比如广告商，用来捞金。

With the rapid development of AI, what should we do about our personal privacy?

With the development of AI and the Internet, many smart devices can record personal information, including conversations we have.

According to industry insiders, manufacturers of smart devices collect and retain as much data as possible to improve their products, but they also sell the data to advertisers for money.

NETIZENS' PERCEPTION OF AI

Through a sentiment analysis on WeChat and Weibo, we unveil reasons netizens give for perceiving AI as having a positive or negative impact on their lives and the society in general.

Positive perceptions of AI

According to internet users, AI can play a very important role in facilitating the daily life of citizens. Some of the most frequently cited reasons on Weibo and WeChat for embracing the introduction of AI technology in the society are the following:

- AI can help to improve traffic conditions and reduce the occurrence of road crimes
- AI can improve the diagnosis and treatment efficiency in the healthcare industry
- AI can promote the innovation of teaching methods

Fears of AI

Despite the many positive opinions on AI that internet users share, some reservations regarding the more nefarious side of AI have emerged on social media. The following are some of the more common concerns on WeChat and Weibo:

- AI could cause social problems, such as mass unemployment in some industries.
- AI brings challenges to personal information protection.
- Autonomous driving technology cannot deal with emergencies with the same urgency as humans.

Ask an expert

*"In general, there is a **huge appetite** for technology in People are willing to try any tech gear. The environment is **very positive** for technology"*

Olivier Tollet, Greater China Enterprise Director at Cushman & Wakefield

TYPES OF AI IN CHINA

MACHINE LEARNING

What is machine learning?

Machine learning is an algorithm-based application of artificial intelligence that provides systems with the ability to automatically learn and improve from experience without being explicitly programmed. It lies at the core of artificial intelligence. In fact, AI breakthroughs depend on the progress made in machine learning techniques and their ability to emancipate as much as possible machines from human intervention. Algorithms in machine learning include supervised learning, unsupervised learning, reinforcement learning, feature learning, sparse dictionary learning, anomaly learning, and association rules.

Main Players in China

Baidu, Alibaba and Tencent all have open-source machine learning platforms, which rely on machine learning. Baidu's PaddlePaddle is the first Chinese open source machine learning platform, its applications include OCR, autopilot, image recognition, virus detection, translation and precise information recommendations. PaddlePaddle is fit for individual developers than enterprises. Alibaba's DTPAI has voice and image recognition, as well as urban traffic computing capabilities, and enterprise cloud computing. Tencent's Angel's service target is enterprises with big data processing needs as it is fit for high performance computing of large-scale data. Applications include Tencent video, social, advertising and user portrait mining. Developed outside of BAT, Seetatech is the only open-source machine learning project that started in Chinese academia. Its main application is face recognition, which it accomplishes with a low hardware threshold of a single Intel i7.

Applications of machine learning

Online Search:

Perhaps it is the most famous application of machine learning. The program observes how the user responds to the results when the latter uses a search engine.



If the user chooses the top-result, and remains on that webpage, the machine learning program assumes that the user just found what he or she was looking for. If the user chooses a result on the second page of the search engine, then, the program surmises that the search engine could not find the results the user was looking for.

Healthcare:

Machine learning algorithms can process more information and spot more patterns than their human counterparts can. Additionally, machine learning can be used to understand risk factors for disease in large populations.



Smart Cars:

A smart car can not only integrate into the Internet of Things (IoT), but also learn about its owner and its environment. It might adjust the internal settings — temperature, audio, seat position, etc. —



automatically based on the driver. In addition to autonomous driving, it can report and even fix mechanical problems, and offer real time advice about traffic and road conditions.

Data Security:

Malware is a huge and growing problem. Their learning model has only 2–10% variations, and we can predict which files are malware with great accuracy. In other situations, machine learning algorithms can look for patterns in how data in the cloud is accessed, and report anomalies that could predict security breaches.



Product Analysis

Autonomous electric cars:

NIO is a Chinese electric smart car producer. It uses machine learning to build its own autopilot system. In June 2019, its second generation of autonomous cars entered the market. Machine learning is the core of the autopilot systems. After becoming a hot topic, some of the more established Chinese car companies started to develop autopilot technology.⁷

Dark factories:

Foxconn, the world's largest foundry, uses robots for production in China. It currently has 10 fully automated production lines. At some Foxconn smartphone-component, factories are entirely manufactured by robots. Because there are no humans on the assembly line, there is no need to light the factories, hence the term "dark factories". This is possible due to machine learning and AI equipment.⁸

Finance:

Ant Financial is one of China's financial service agencies. Through machine learning in Micro credit and Credit Pay business, the false trading rate was reduced to 1/10th the previous rate. Alipay Document Audit System, based on machine learning, shortens document checking time from one day to one second. Applications of machine learning in financial institutions can include finding business opportunities, personalized customer service, and preventing fraud.⁹

Healthcare:

In 2017, the **Guangxi province people's hospital** started to use an esophageal cancer screening system developed by Tencent to assist the doctor's clinical diagnosis, with an accuracy as high as 90%. The Chinese AI company **iCarbonX** built a big data platform specialized on health management, called MiWo (觅我). The platform can analyse users' health condition based on aspects like physical activity, diet and skin condition.

⁷ Auto-testing.net

⁸ www.elecfans.com

⁹ Uses of AI in Finance report, 36Ke

NATURAL LANGUAGE PROCESSING

What is natural language processing (NLP)?

Natural language processing (NLP) is a subfield of artificial intelligence concerned with the interactions between computers and human (natural) languages. In particular, this field becomes relevant to understand how to program computers to process and analyse large amounts of natural language data. Types of natural language processing include voice recognition, parsing, natural language understanding and generation, text categorization, information retrieval and extraction, and question answering.

Market size and investments

By June 2017, China's total investment value for the natural language processing industry reached 12.2 billion RMB, which ranked second among all AI fields. 92 natural language processing start-ups were founded during 2017.¹⁰

In Nov 2018, Grand Data raised 160 million RMB in series B funding. It set a new financing record in the field of natural language processing in China.

Xiaomi technology co. LTD applied Xiaoai (virtual assistant based on natural language) to its smart devices such as phones, audio equipment, television sets, etc. By October 2018, more than 100 million smart devices were activated and there were more than 34 million monthly active users.

The revenue of IFLYTEK's B2C business based on natural language processing reached 2.52 billion RMB in 2018, up 96.54% compared with 2017.

Main players in China

The following companies are some of the top players in NLP:

- **Microsoft** focuses on developing natural language understanding and computer vision technologies.
- **Sogou** built a popular search input method software with natural language processing technology.
- **iFLYTEK** is the first listed company in China's natural language processing industry. Its NLP technology is applied to smart education, medicine, automobile and online services.
- **AlSpeech** provides natural language processing solutions to enterprises.
- **Unisound** is a leading player in China's AI service market.
- **Alibaba** built labs to develop AI technology for its products like smart speakers.
- **Data Grand** is devoted to the development of smart software (writing, searching, etc.) by natural language understanding and speech synthesis.

¹⁰ Tencent's US-China AI development report

Applications of NLP

Intelligent Search

NLP tools and techniques help process, analyze, and understand unstructured “big data” in order to operate effectively and proactively.



Machine translation

Machine translation includes language to language, text to speech, speech to speech, and text to emotion translations. iFlytek applies MT to generate intelligent hardware voice interaction solution for 2C products.



Retail

NLP is greatly applied in both pre-sale and after-sale customer services.

For example, JD’s intelligent customer service robot and voice navigation.



Spam detection

NLP, combined with concepts of machine learning, can build spam filters for email or SMS text messages.



Finance

NLP might allow a company to garner insights that can assess a creditor’s risk or gauge brand-related sentiment across the web. Three main applications include credit scoring, sentiment analysis, document search.



Question Answering

A question answering parses queries for natural language questions and then integrates with back-end systems to deliver direct answers rather than just a list of results containing the keyword.



Product Analysis

Medical diagnosis chatbox:

Tencent Medpedia is a medical science information app. Based on the combination of NPL and big data technology, its virtual assistant system can automatically answer questions about basic medicine knowledge. It also can accurately provide relevant knowledge about 600 kinds of diseases.



[Tencent Medpedia's virtual assistant interface]

Translation device:

iFLYTEK applies NPL technology to translation devices. Its second-generation translators sold more than 200,000 units in five months. The latest generation of translation machine supports photo translation based on OCR (Optical Character Recognition) technology. It only takes two seconds to complete the translation.

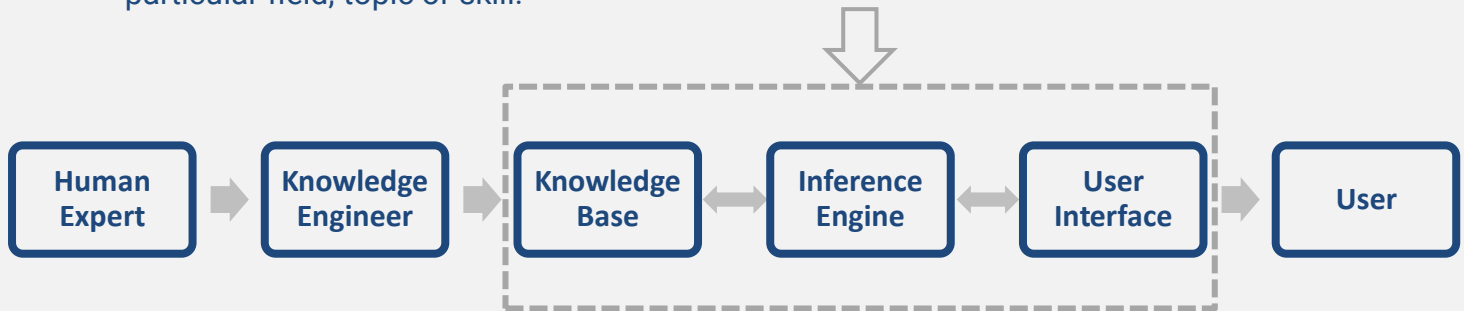


[iFLYTEK's translation device can translate over 50 languages]

EXPERT SYSTEMS

What is an expert system?

An expert system is a computer program that is designed to emulate and mimic human intelligence, skills or behavior. It is mainly developed using artificial intelligence concepts, tools and technologies, and possesses expert knowledge in a particular field, topic or skill.



Expert systems are used in a wide range of fields such as science, like chemistry, medicine, and geology, as well as agriculture, education and the military. Below are some examples of expert systems uses:

Education: Educational resources utilization, academic performance analysis, psychological quality assessment, online teaching, etc.

Military: Strategic planning, forecasting, combat simulation, command and decision making.

Agricultural: Providing the index of yield and benefit. Inferring the cause of problems and providing solutions.

Medical: Explanation, prediction, diagnosis, and treatment plans.

Geological: Geological disaster prediction, engineering risk assessment and construction countermeasures.

Chemical: Chemical synthesis design, physical property estimation model selection, equipment selection and process synthesis.

Applications of expert systems

TCM computer-aided diagnosis and treatment system

Collects data from patients' tongues, pulses etc. to compare data against a database to diagnose according to the principles of traditional Chinese medicine.



Forecasting agricultural diseases and pests

Expert systems can categorize diseases and pests based on geographical regions. Users input information about diseases and pests that are affecting their agriculture, and then the system automatically maps this information and can apply it to calculate forecasts.



Chemical process development expert system

The system not only assists chemical engineers solve chemical process design, development, production optimization, process program evaluation and screening, but also improves work efficiency and saves a labor costs.



CPNEES- expert system for coalfield exploration

Based on geological data, the system simulates the judgment of human experts and bonds to the advantages of computer numerical processing, which makes the exploration of coalfields more precise and efficient.



Product analysis

Expert System for Optimizing the Production Planning (ESOPP) of Sinopec Group

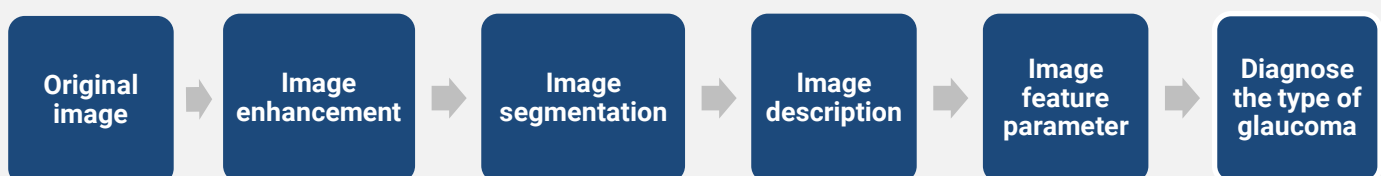
The ESOPP system is based on Sinopec's production target and actual completion in recent years. It uses linear programming to calculate the preliminary plan of refinery production with the goal of maximizing profit. The crude oil distribution and product structure adjust according to the obtained expert knowledge and linear programming information.

The purpose is to simplify the production process of petrochemical enterprises. There are many kinds of crude oils. The system allocates the output of crude oil and each product to maximize the economic benefits of Sinopec Group.¹¹

The production plan formulated by this system was similar to the original plan from Sinopec Group, reducing the difficulty of implementation. However, the system's plan made with less time and money.

Glaucoma diagnosis expert system based on computer image analysis

This system reads the symptoms of glaucoma using seven image characteristic parameters through back propagation, which is an algorithm for supervised learning of artificial neural networks using gradient descent. The training samples are obtained from clinical data. The purpose is to improve glaucoma diagnosis by removing objectivity and human error.



This expert system realized the quantitative measurement of fundus tissues, made a clear difference between normal and abnormal tissues, Standardized the diagnosis process of glaucoma. It improved the accuracy, reliability, and consistency of the diagnosis results. Also opened up a broader application prospect.¹²

¹¹ Design of Automatic Control System for Mixed C4 Solvent Deasphalting Unit, Li Jimin and Wang Jian

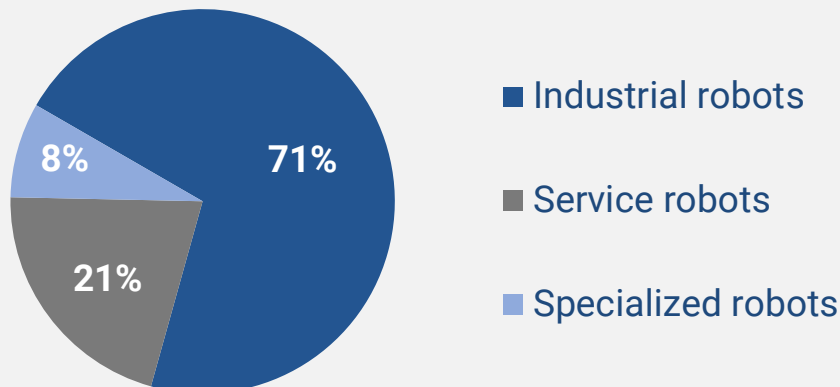
¹² In View of the Diagnosis Calculating System of Glaucoma, Wang Yaming and Zheng Rui

ROBOTICS

Types of AI robots used in China

Most market demand of robots in China is for industrial robots. Service robots show good potential in China's market since many families accept household robots.

Market share of types of AI robots in China
(2018)



Industrial Robots

Industrial robots used for manufacturing include welding robots, transport robots, palletizers, packaging robots, painting robots, cutting robots, and more.

Service Robots

Service robots operate semi- or fully autonomously, to perform services useful to the well-being of humans, they usually include household/domestic robots, medical service robots and public service robots.

Specialized Robots

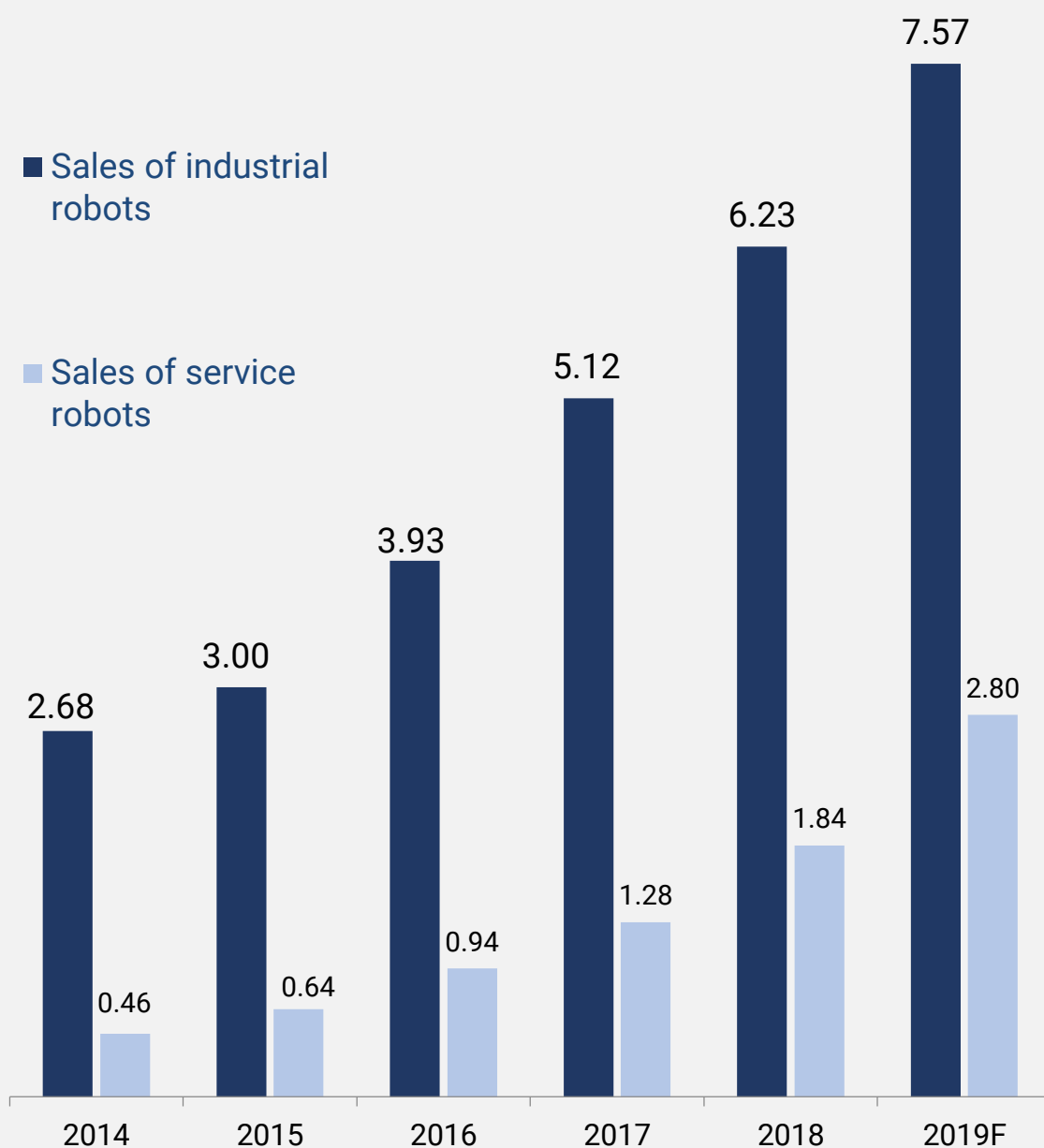
Specialized robots are purpose-built for particular task, such as working in high-risk environment. They generally include military robots, emergency rescue robots, etc.¹³

¹³ China's robotics industry development report, Sohu

Market size and consumption

China is the largest industrial robots market in the world, making up 1/3 of global industrial robots demand. An increasing aging population feeds the demand for medical and housekeeping services¹⁴

The sales value of industrial and service robots in China
(billion USD, 2014-2019)



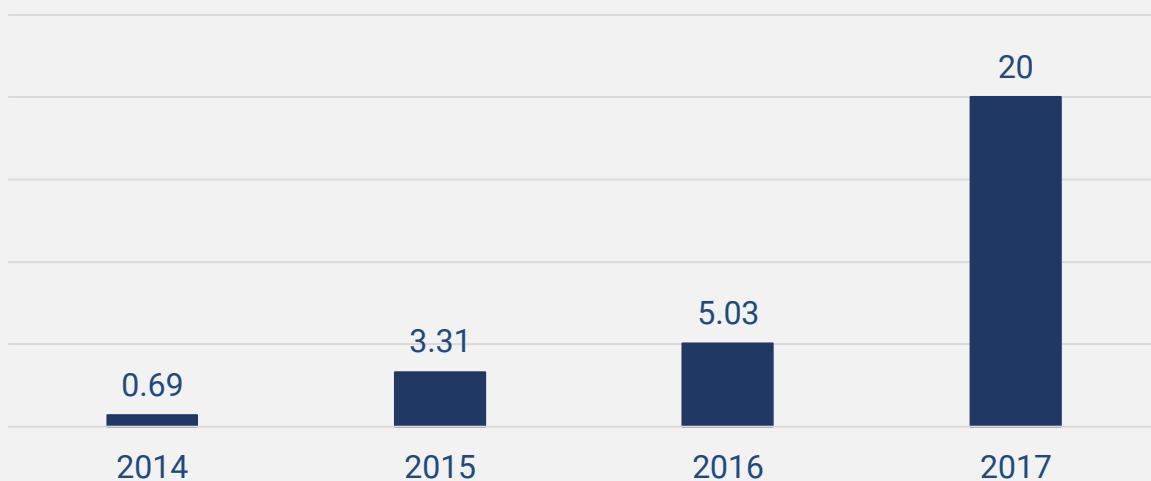
¹⁴ Data Source: China's robotics industry development report, Sohu

Investments in AI robots

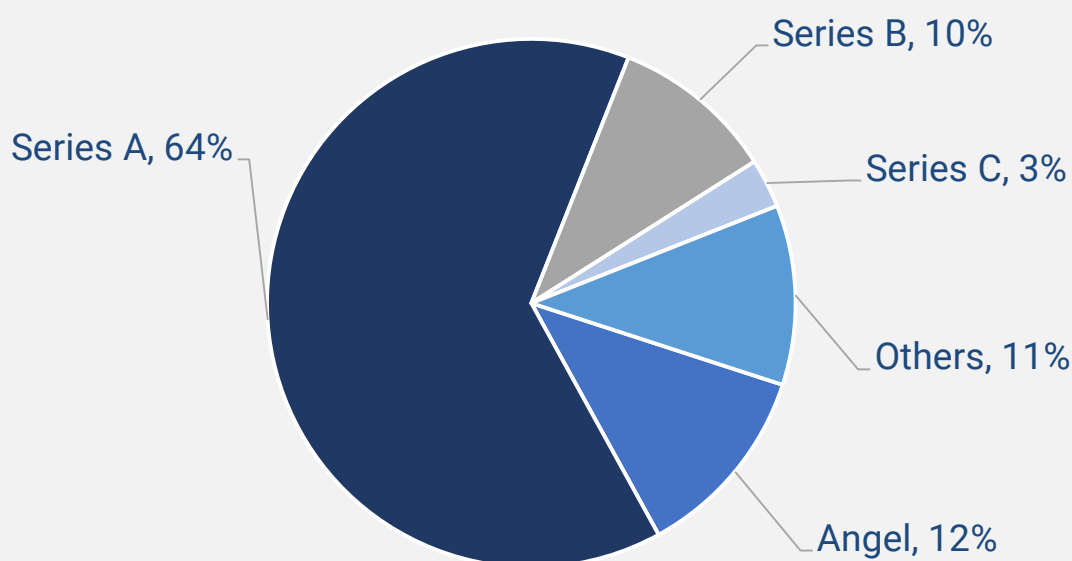
In 2017, the investment value of AI robotics was up to 20 billion RMB, about 29 times of 2014. By June 2018, there have been 7,544 robot-related companies built in China. Policy subsidies were important reasons for the rapid growth of investment in the robotics field.

In 2018, financing activities in the field of industrial robotics were mainly concentrated in Series A round. It means most industrial robotics companies in China were still at the initial stage.¹⁵

The investment value of robotics in China
(billion RMB, 2014-2017)



Financing activities in industrial robotics by round
(2018)



¹⁵ Data Source: Online Robotics Report, RoboticsChina.com

Main Players in Robotics

Step is mainly engaged in the research & development, production and sales of industrial automation control products. It has R&D centers and manufacturing centers in China and Germany.

Siasun was the first listed robotics company in China. Its main business includes industrial robots production, logistics and warehousing automation equipment, automatic assembly machines and traffic automation systems.

Estun was founded in 1993 and listed on the Shenzhen Stock Exchange in 2015. Its main businesses include automation core components & motion control systems and industrial robots & intelligent manufacturing systems.

Topstar was founded in 2007 and its main business focuses on research & development, manufacturing and sales of industrial robots.

Where industrial robots are used

Along with the progress of “industry 4.0” and “Made in China 2025”, China is developing its manufacturing industry towards automation, integration and intelligence. Industrial robots are becoming more and more widely used.

Ask an expert

*“In China, we have a strategy of **2025 for industry 4.0**, and it’s a country level strategy. We have all the good policies from the government side. Today in China, the automation level is low compared with western countries. But the **demand is huge**, which means that if you have a good product if you have a good technology you have a huge chance to succeed in the automation business.”*

Shuyang Cao, Co-Founder of Malu Innovation

Applications of robotics

Appliances

The application of industrial robots in the field of home appliances is inevitably driven by objective factors such as a significant increase in labor costs, a gradual disappearance of China's demographic dividend and improved manufacturing.



Food and beverage

The application of industrial robots in food and beverage consist of packaging, picking, palletizing, and processing.



Chemicals

The chemical industry is one of the main application areas of industrial robots. Faced with the requirements of precision, high purity, high quality and miniaturization of modern industrial products, cleaning technology brought by robots are critical for quality.



Metallurgy

Robotic technology realizes automation on mass scale, ensuring continued economic competitiveness, high productivity, and at the same time alleviating heavy workloads for workers.



Electronics

In the field of electrical and electronic, industrial robots excel in a series of processes such as sorting and packing, tear film systems, laser plastic welding, and high-speed palletizing.



Other Manufacturing

Industrial robots are also widely used in other manufacturing workspaces to handle tasks such as drilling and fastening, inspection, welding, painting, sealing, collaborative assembly, etc.

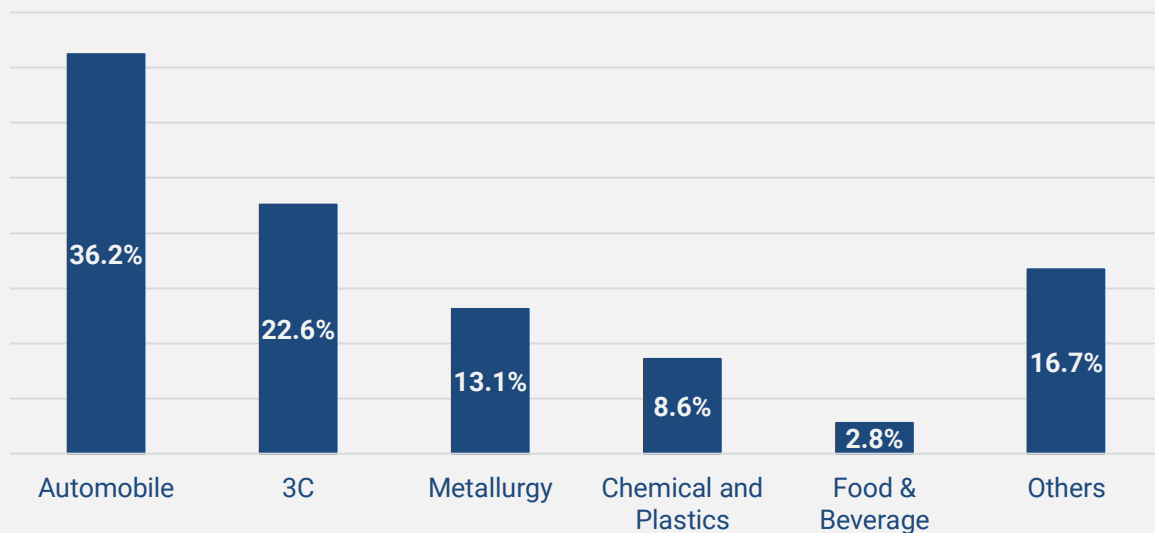


Industrial robot consumer analysis

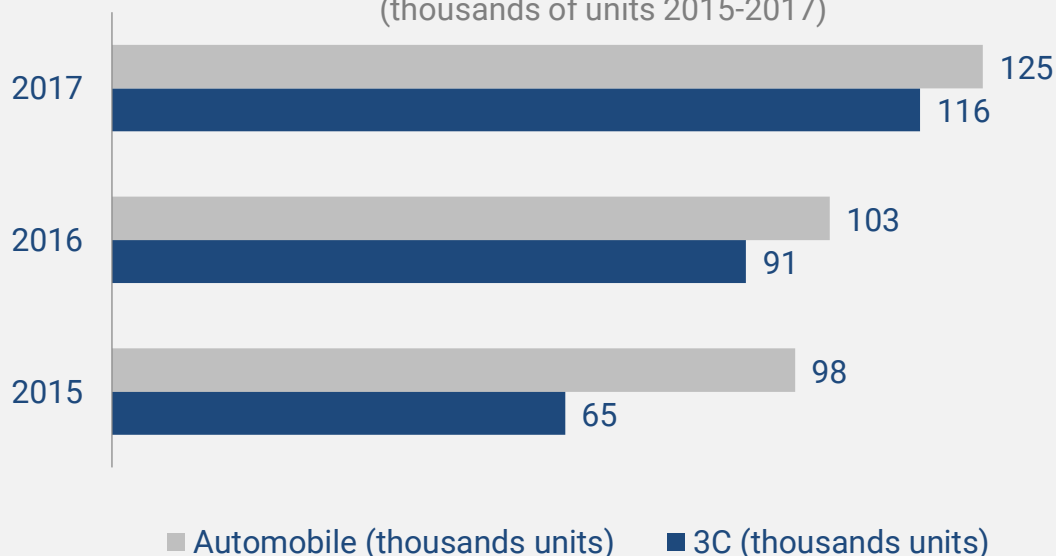
Automobile and electronic (3C) companies are the two major buyers of industrial robots in China. In addition, the product is also in demand in the field of metallurgy, chemicals & plastics, food and beverage, etc.

While both displaying an upward consumption trend, the 3C industry in China develops more rapidly than the automobile industry. As the second largest buyer in China, the 3C industry shows an increasing demand for industrial robots in use of electronic equipment manufacturing¹⁶

Main Buyers of industrial robots
(2018)

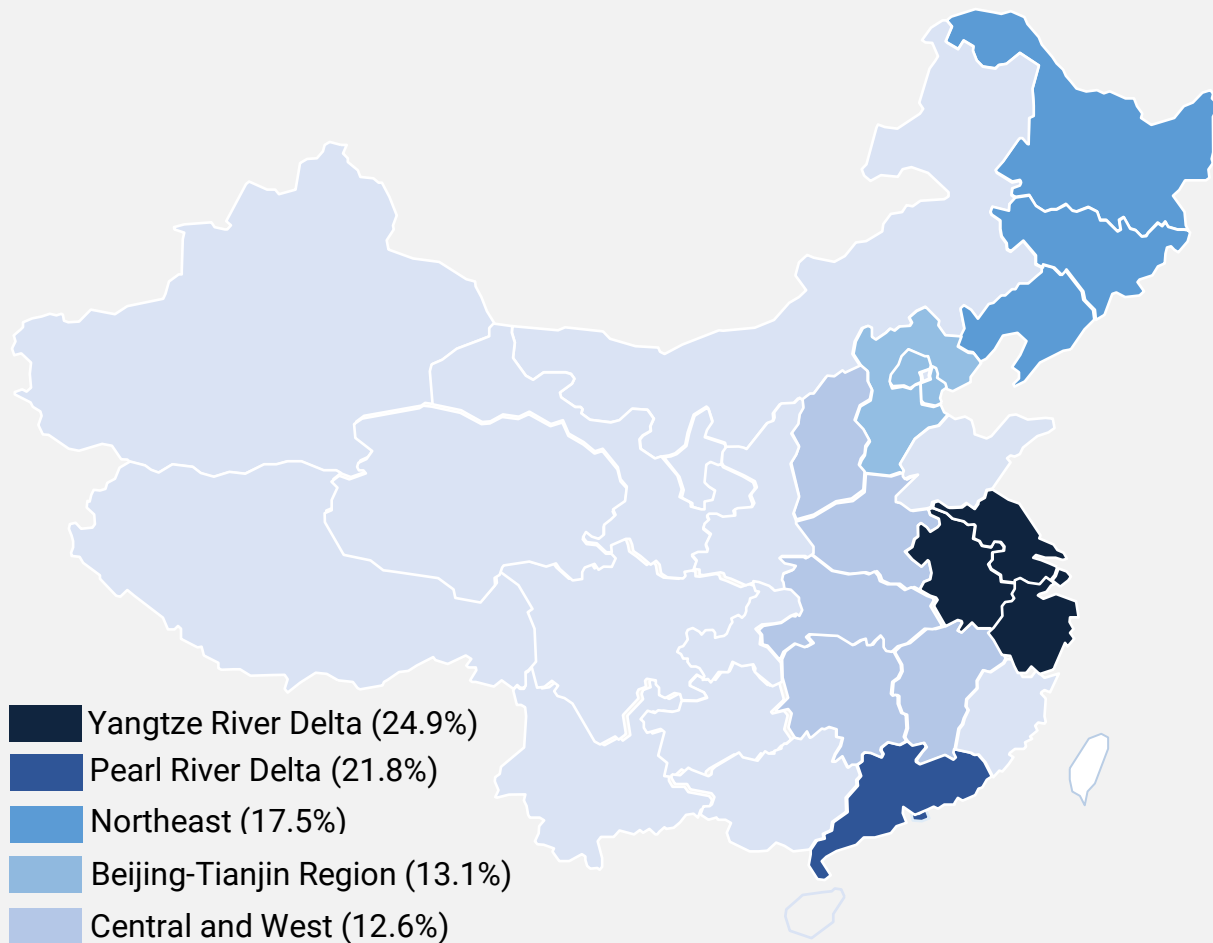


Automobile vs 3C on consumption of industrial robots
(thousands of units 2015-2017)



¹⁶ Data Source Source: *Industry overview of industrial robots in 2018*, qianzhan.com

Distribution of industrial robots consumption in China (2017)



1

Yangtze River Delta

2

Pearl River Delta

3

Northeast

The region gathers both a large proportion of factories, who are the buyers of industrial robots, and many AI companies as suppliers.

High expectation for productivity and product quality have strengthened the demand for industrial robots in the Yangtze River Delta.

The Pearl River delta is where the electronics industry (3C) is most developed. Major customers include Huawei and Foxconn.

Consumers in Northeast are mainly from the automotive industry, pharmaceutical industry, plastics and rubber industry.

There is a strong demand for industrial robots such as spot welding robots and assembly robots.

Benefits of industrial robotics

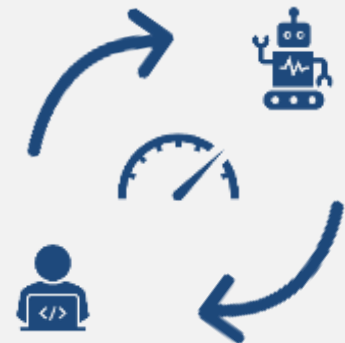


Labor cost

Along with the economic growth and currency appreciation in China, the production costs have increased significantly. High labor costs encourage factories to seek cheaper substitutions; and industrial robots are no doubt their primary choice.

Productivity

Cooperation between industrial robots and workers can yield unprecedented productivity. High efficiency brought by machines optimizes the manufacturing procedure, leading to an automated production line.



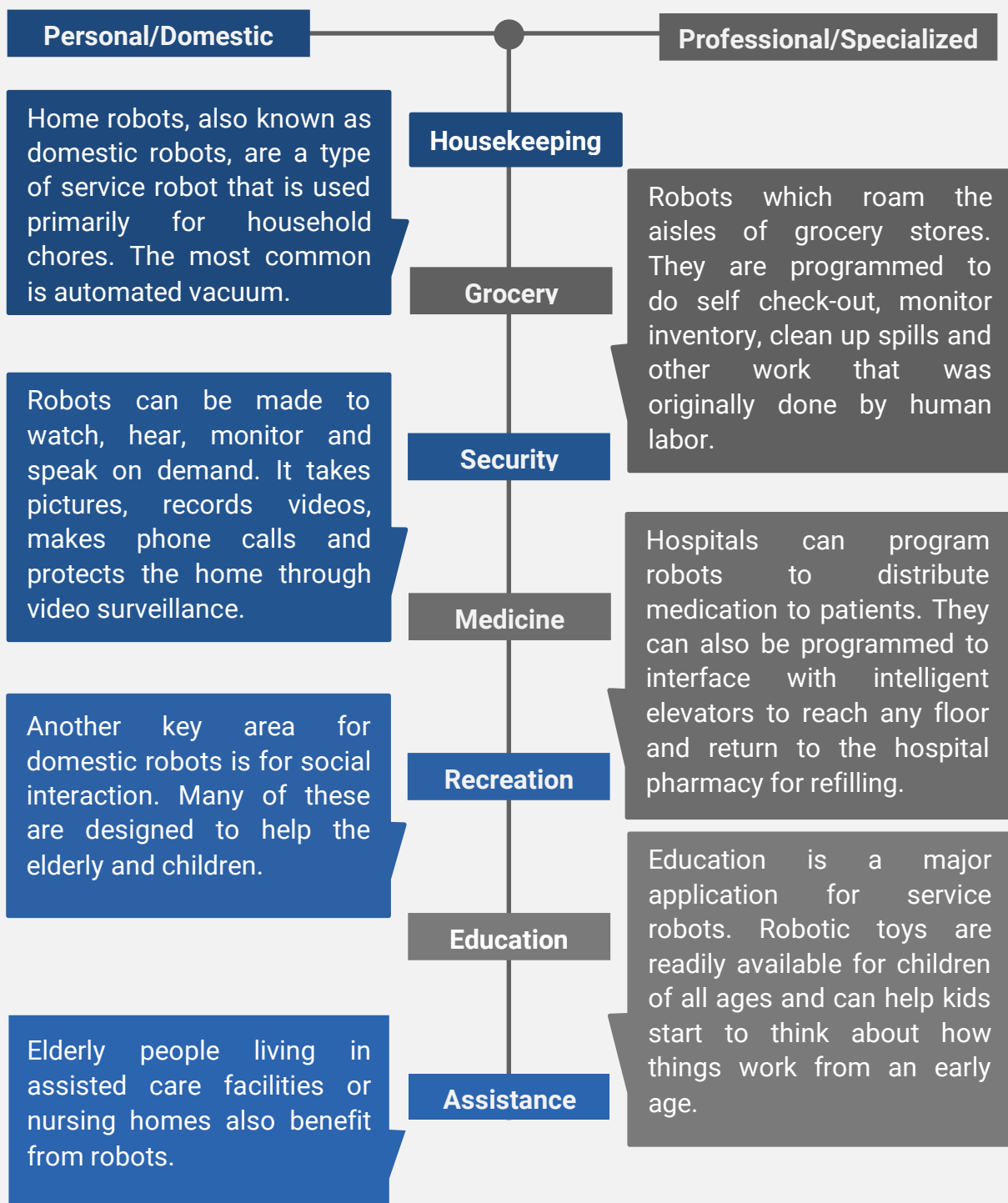
Precision & Quality

Modern industrial products face increasingly strict requirements for precision and quality. However, such high expectations can be hardly met by human workers. For instance, cleaning technology brought by industrial robots is critical to product purity for buyers in the chemical industry.

Where are robotics used – Service Robots

Service robots refer to various advanced robots other than industrial robots for non-manufacturing use. There are two main types: personal/home service robots and professional service robots.

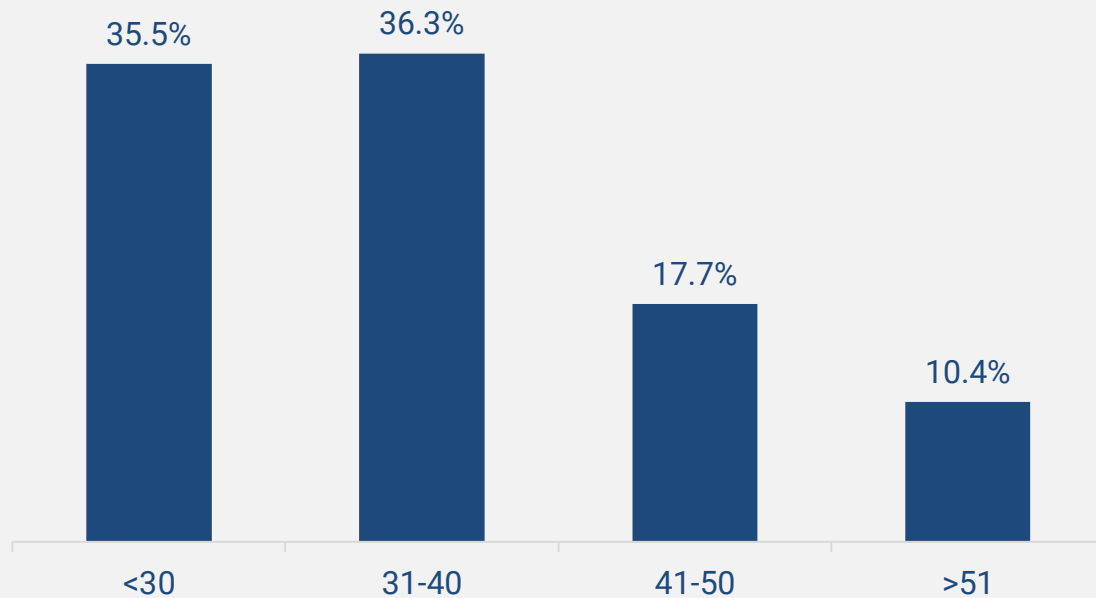
Healthcare, finance, logistics, and catering are the most common industries for public service robots. Service robots also increasingly appear in households, for example cleaning robots, accompanying robots, entertainment robots, etc. Below are examples where service robots are intensively used.



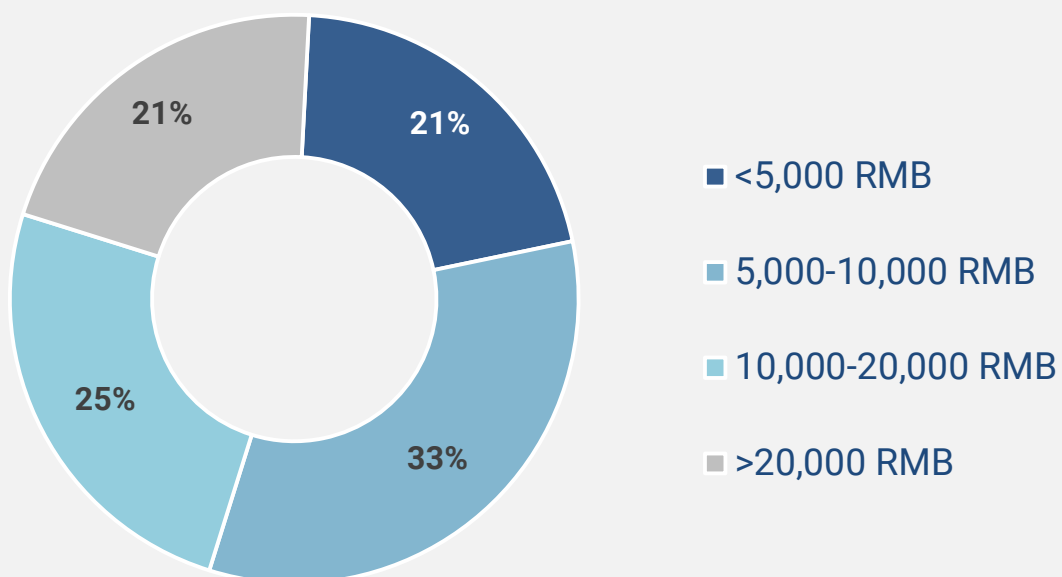
Consumer analysis: Household Service Robots

Post-90s and Post-80s are the main buyers of domestic service robots. About 80% of the consumers earns a monthly income over 5,000 RMB. People who are younger in age with a higher income tend to show more purchase power, holding a higher price acceptance.¹⁷

Age distribution robot consumers in China
(2019)

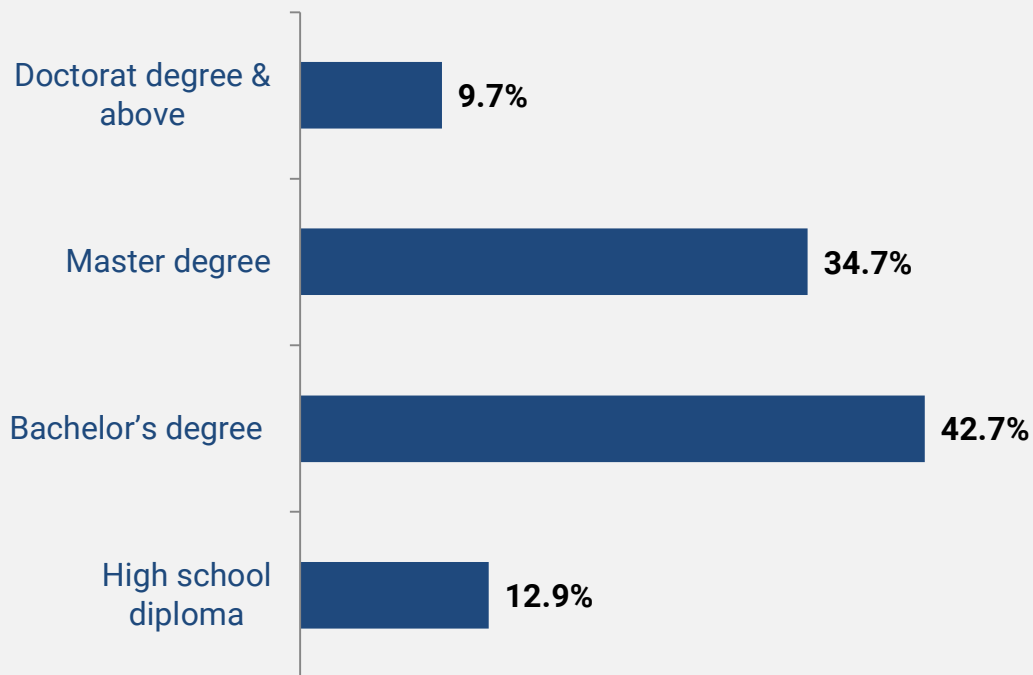


Monthly income distribution of Domestic robots customers
(2019)

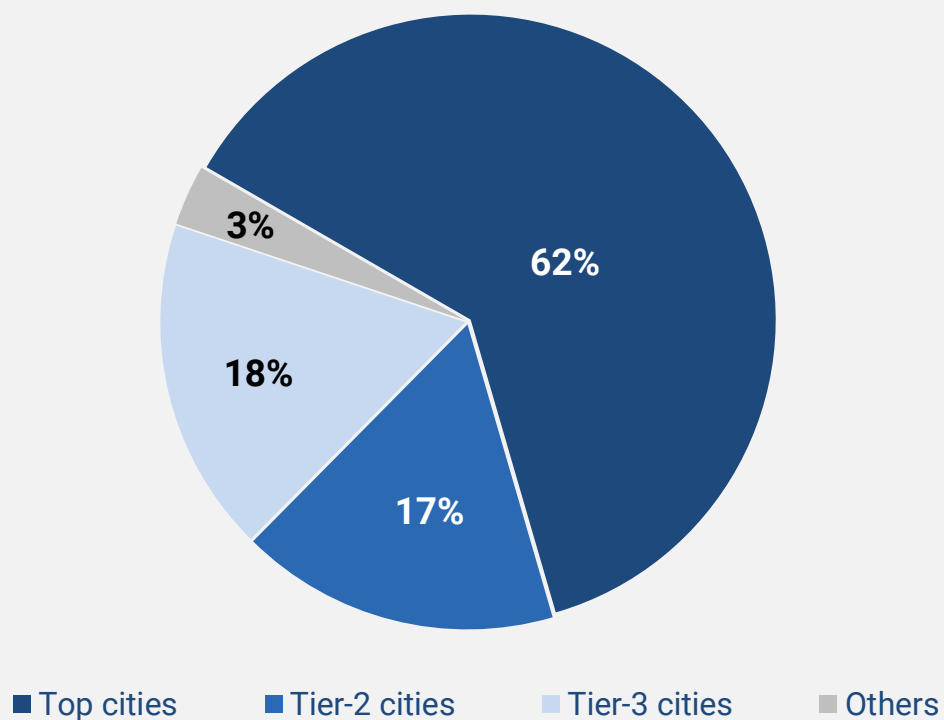


¹⁷ Data Source: "User Behavior Analysis of Personal / Family Service Robot", China Academic Journal Electronic Publishing House, January 2019.

Education level of household robot customers (2019)



Geographic distribution of household service robots customers (2019)



¹⁸ Data Source: "User Behavior Analysis of Personal / Family Service Robot", China Academic Journal Electronic Publishing House, January 2019.

COMPUTER AND MACHINE VISION

What is computer & machine vision?

Computer vision

Computer vision (CV) is an interdisciplinary field that deals with how computers can gain high-level understanding from digital images or videos. From the perspective of engineering, it seeks to automate tasks that the human visual system can do.

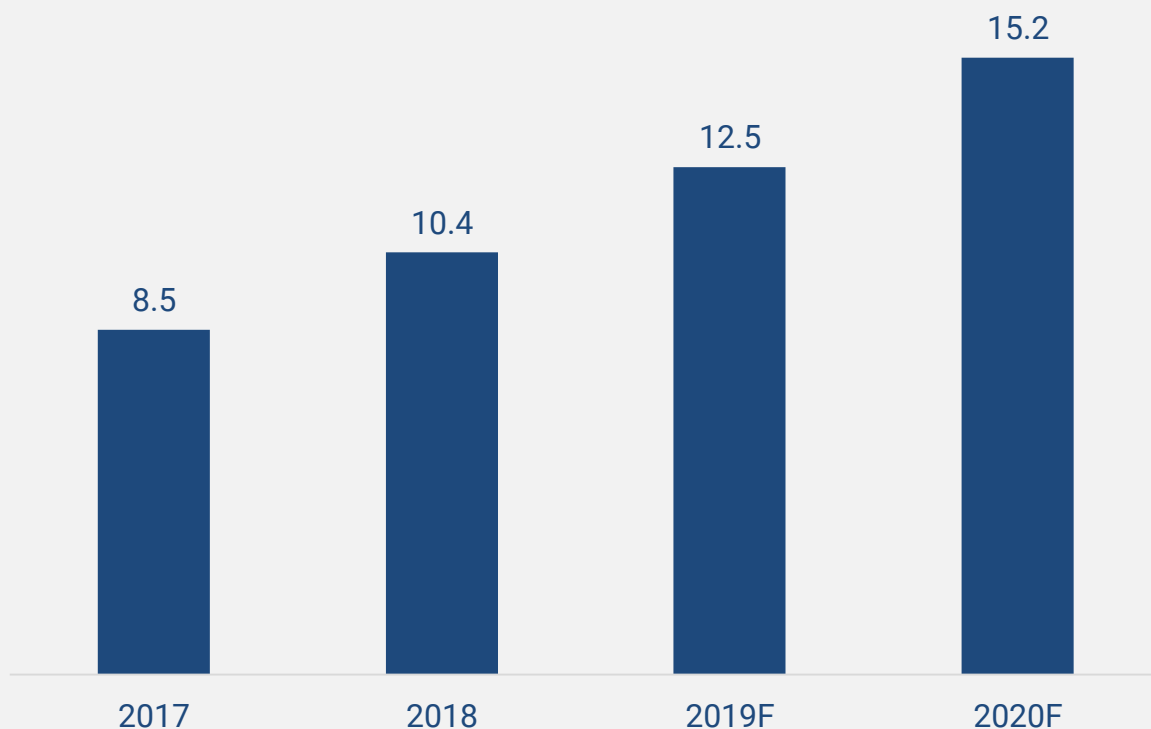
Machine vision

Machine vision (MV) is the technology and methods used to provide imaging-based automatic inspection and analysis for such applications as automatic inspection, process control, and robot guidance, usually in industry.

Market size and consumption

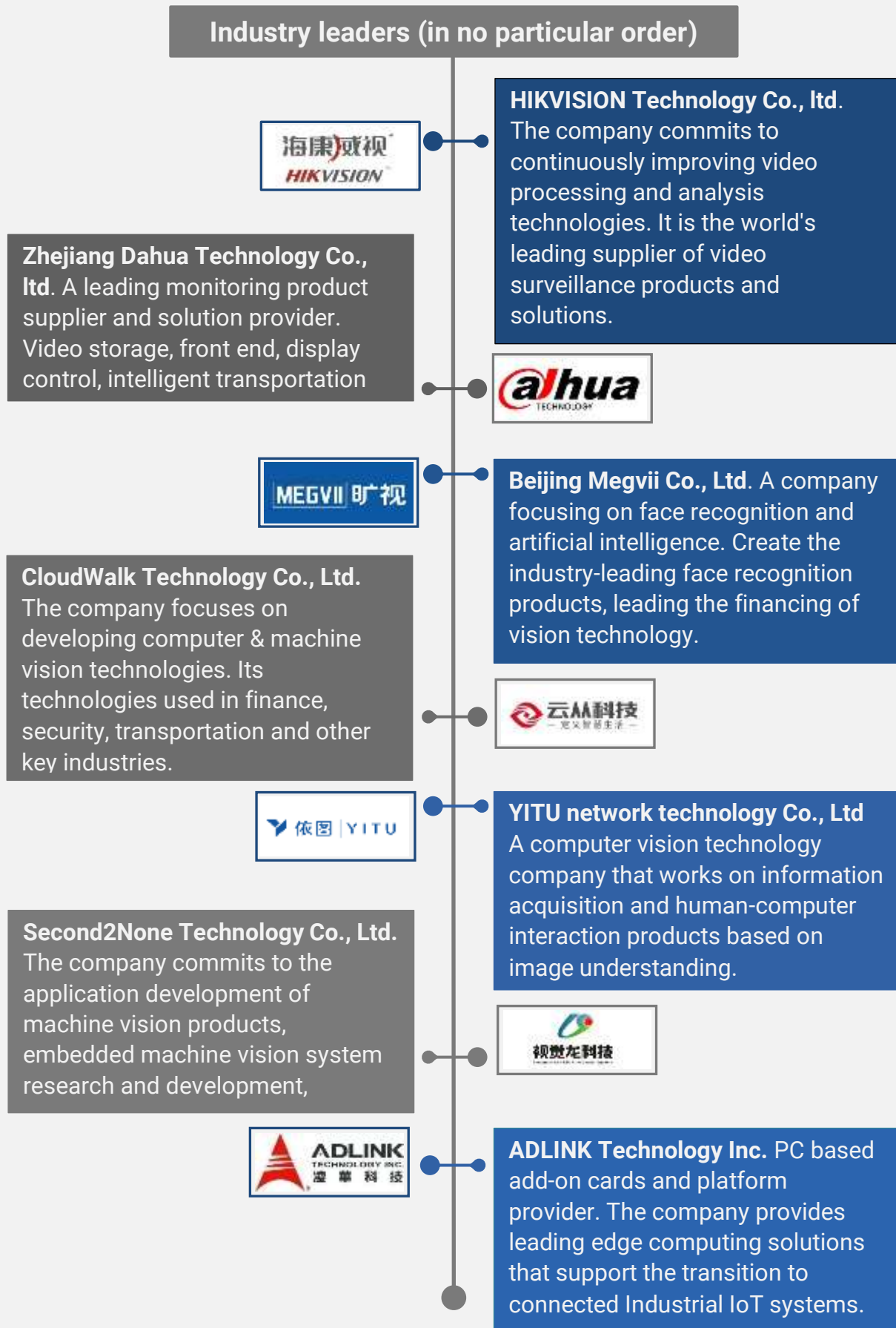
Since machine & computer vision can effectively reduce labor costs, the demands for the technology are wider and wider in China, such as security, finance, etc. China is one of the largest machine vision markets in the world.¹⁹

The market size of China's machine vision industry
(billion RMB, 2017-2020)



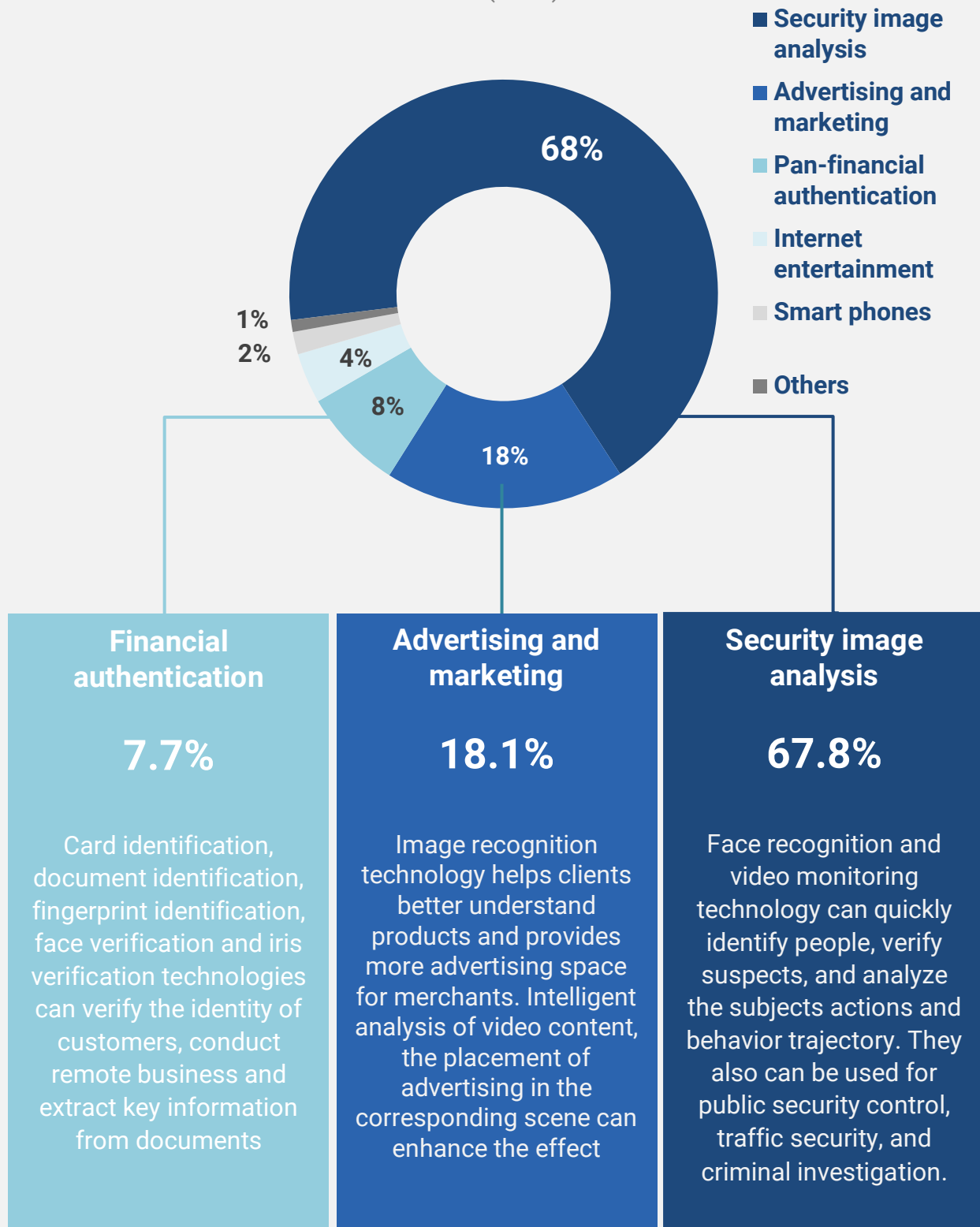
¹⁹ 2018 China Machine Vision Industry Development Prospects, Prediction and Investment Recommendations, Gongkong.ofweek.com

Main players in the vision sector



Where computer vision is used²⁰

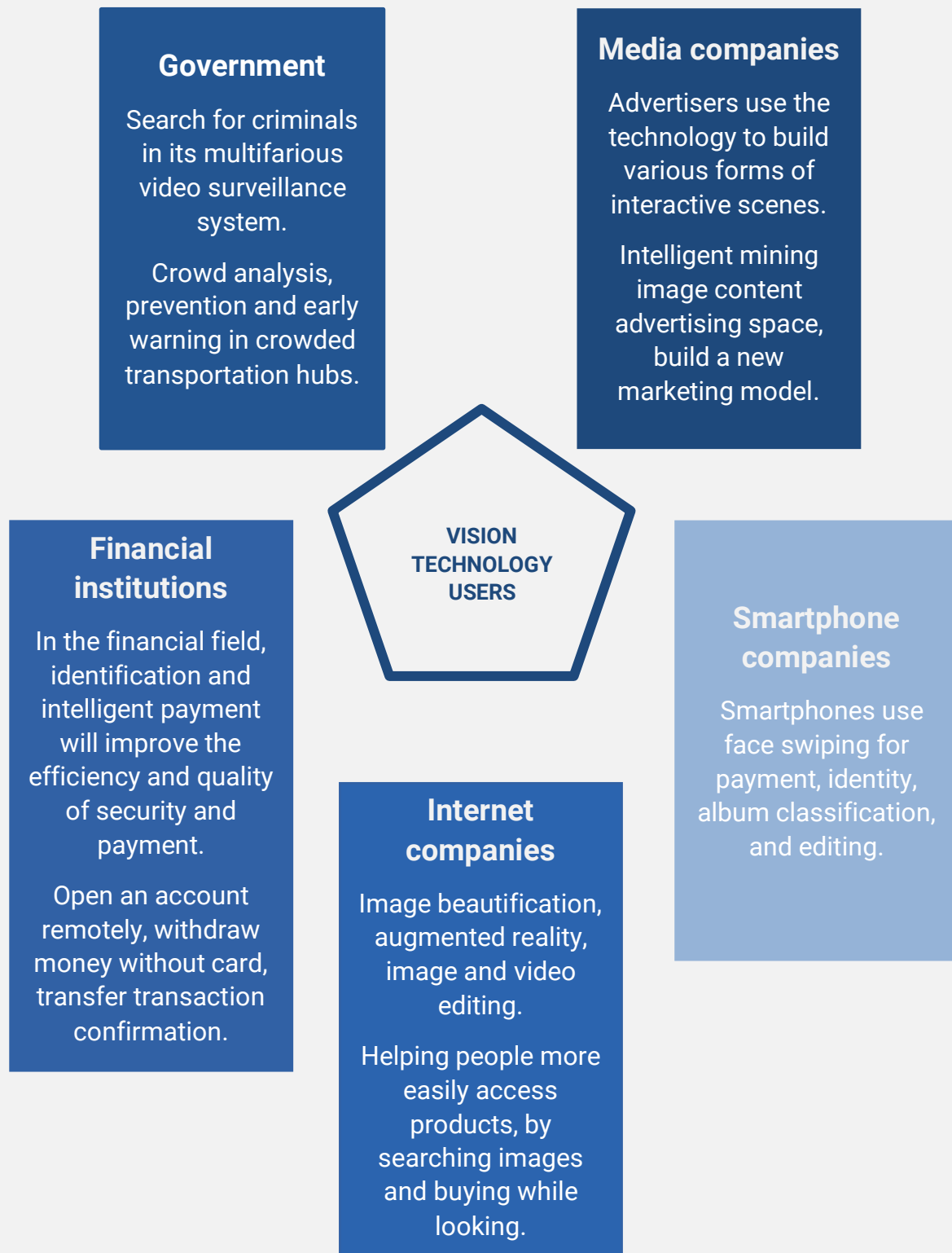
Market share of China's computer vision applications according to usage (2017)



20 Data Source: 2017-2018 China's calculator vision market research report, iimedia

Vision technology consumer analysis

According to the market share, the government, smartphone companies and financial institutions constitute the top 3 fields of computer vision applications.



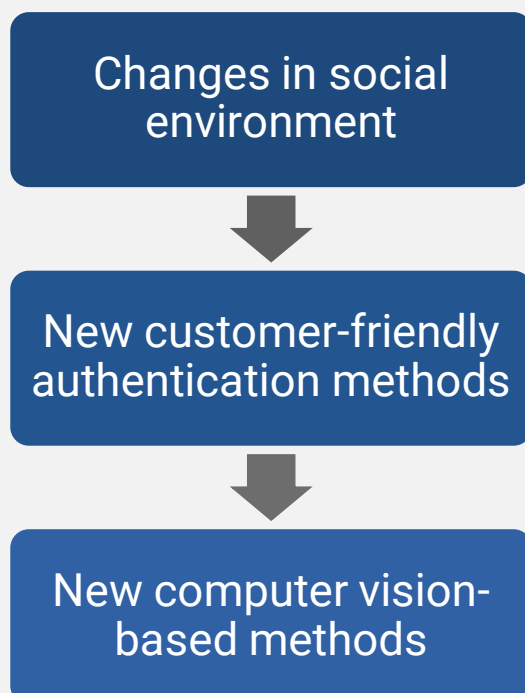
Reasons of purchase

Government

With the acceleration of urbanization, a large number of migrants are pouring into cities; the large demographic influxes make it difficult to manage urban populations.

After the June 1 robbery in Nanjing, Nanjing police extracted nearly 2,000T of video data from more than 10,000 cameras in the city, and mobilized more than 1,500 police officers to search for video clues, which took more than a month.

According to Xu, co-founder of SenseTime, the two facial recognition systems they provided identified 69 criminal suspects in the first 40 days of operation in Chongqing last year.



Financial institutions

National policies support face recognition technology, which it firstly used by major domestic banks for promotion and increased trading volumes in the financial sector.

Human eye judgment, SMS verification and bank card binding.

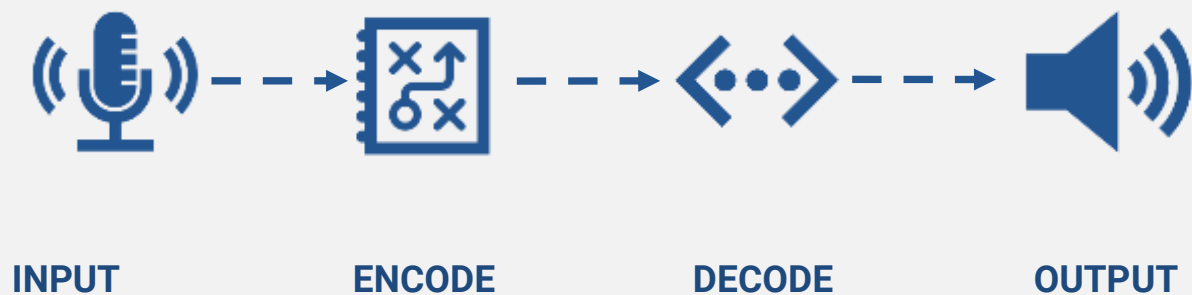
Remote account opening, remote identity authentication and remote payment can be verified through face recognition technology.²¹

²¹ 2018 AI Industry Status and Company Simple Analysis, Maggie Wu and Silvia Wei, hexun.com

SPEECH

What is AI speech?

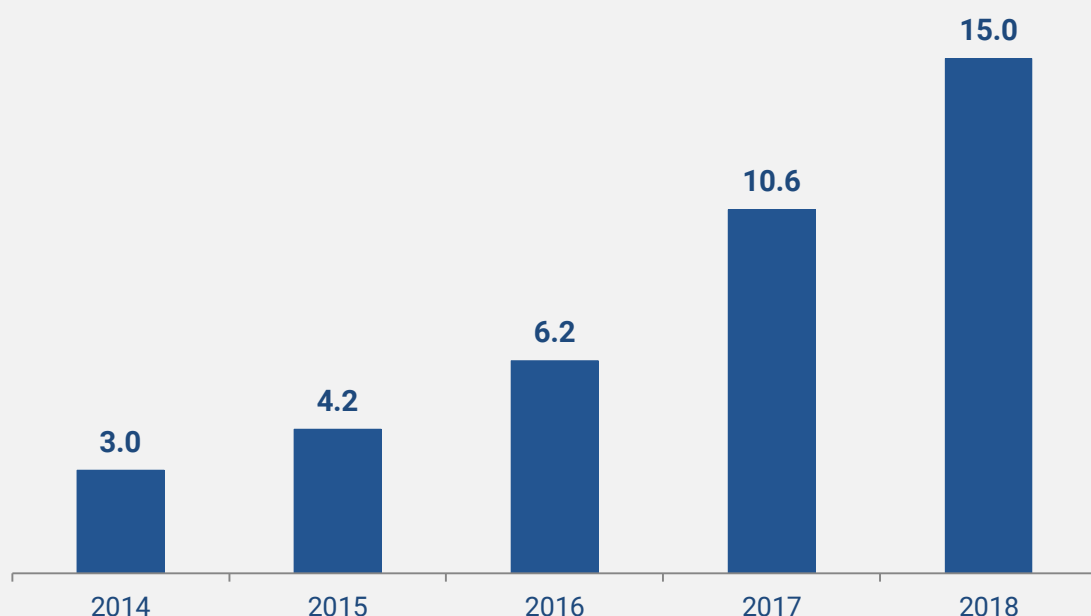
AI speech is the ability of a machine or program to identify words and phrases in spoken language and convert them to a machine-readable format. It works through the process of extracting text transcriptions or some form of information from speech inputs.



Market size and consumption

China's AI speech market had surging growth in recent years, the main reasons are the fast developing mobile Internet and the increasingly popular smart speakers among consumers.²²

Market size of China's AI speech industry
(billion RMB-2014-2018)



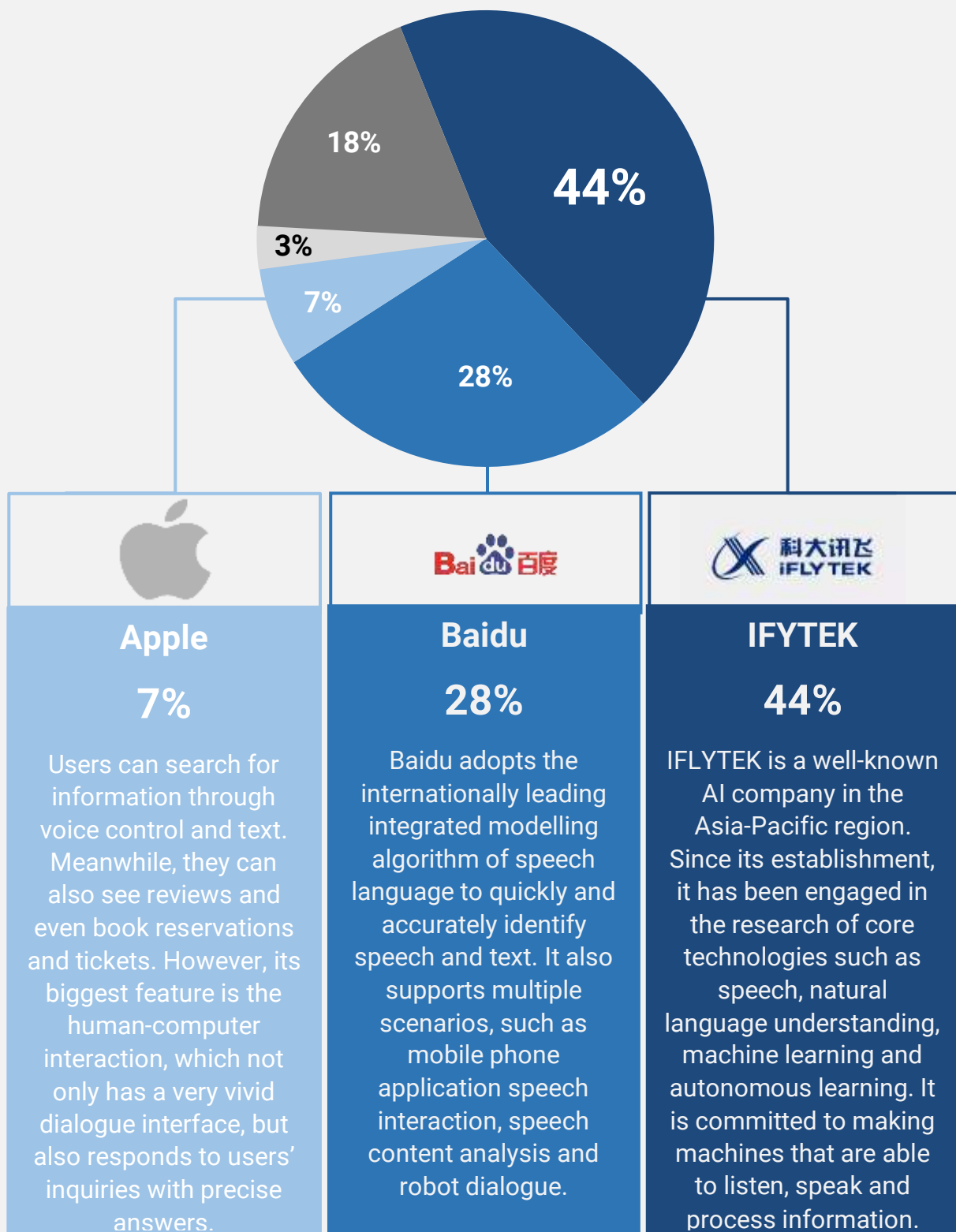
²² Data Source: China AI Speech Industry Development Trends and Predictions, Chyxx.com

Main players in the AI speech sector²³

Market share of brands in China

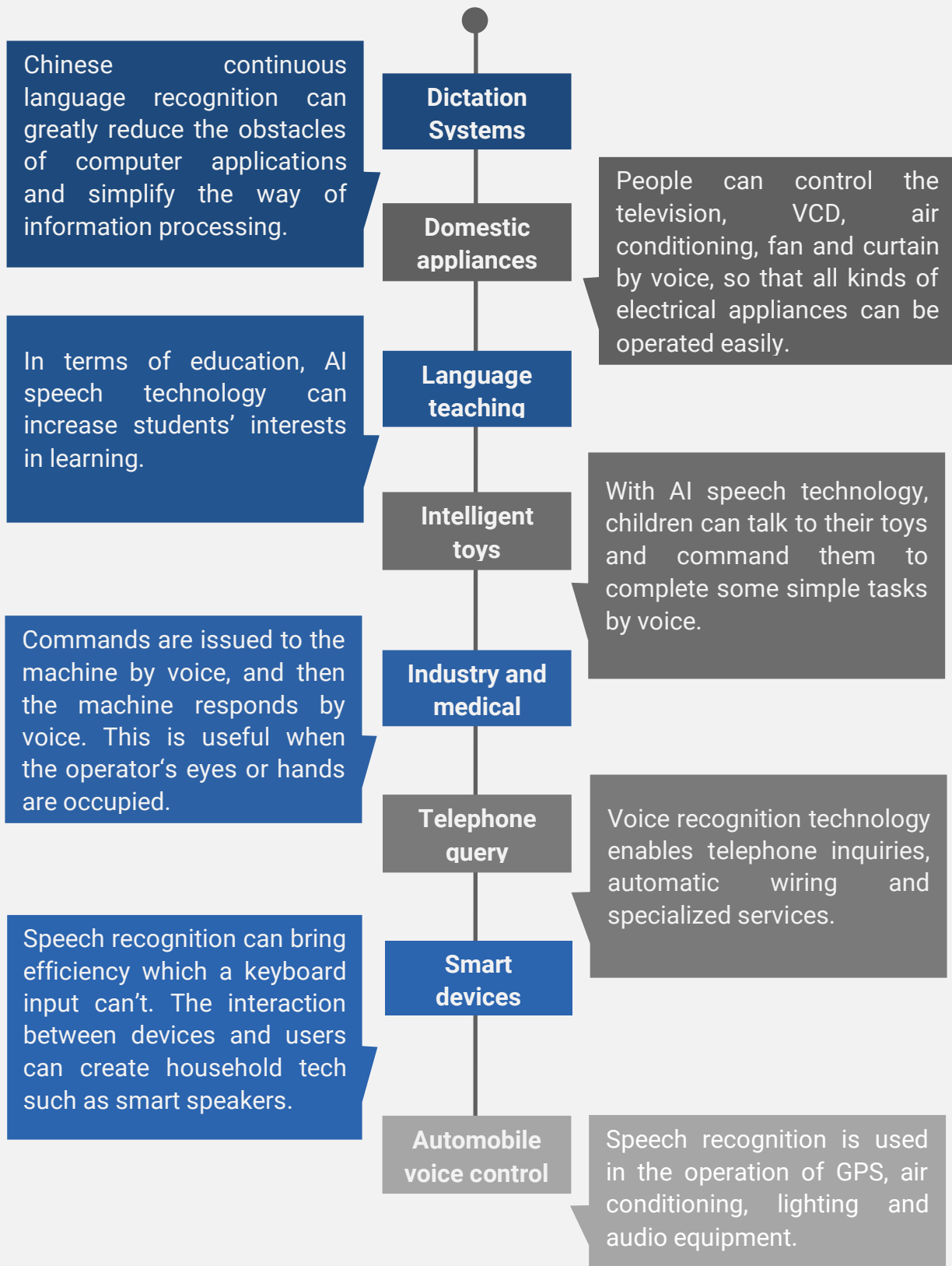
(2018)

■ iFLYTEK ■ Baidu ■ Apple ■ Nuance ■ Others



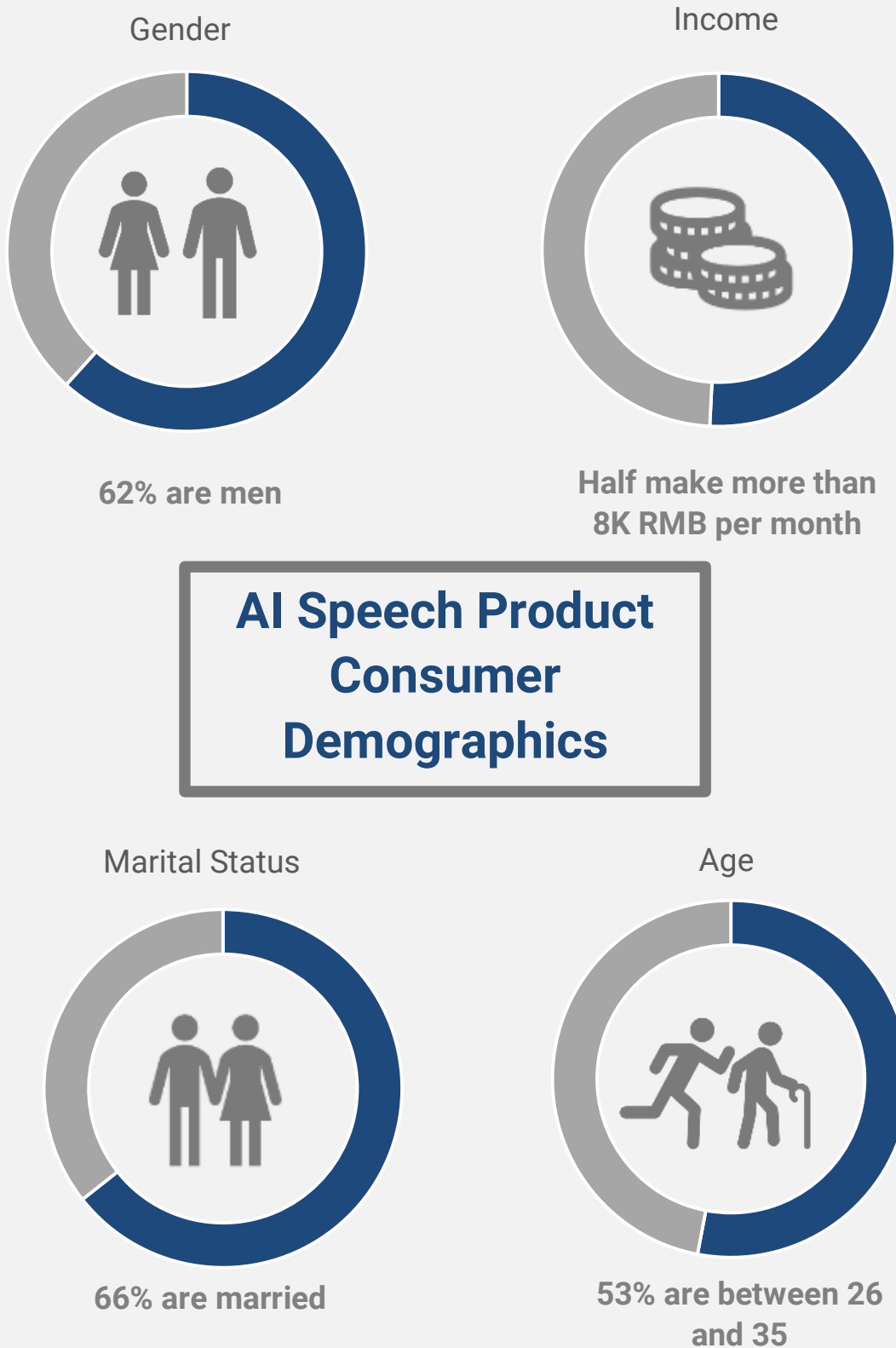
²³Data Source: Public Information organized by Qianzhan.com

Where is AI speech used



Consumer analysis

The main personal consumers of AI speech products are 26-35 years old men with a family and relatively high income.²⁴



²⁴Data Source: Shenzhen China Commerce Statistical Department

Where do consumers live?

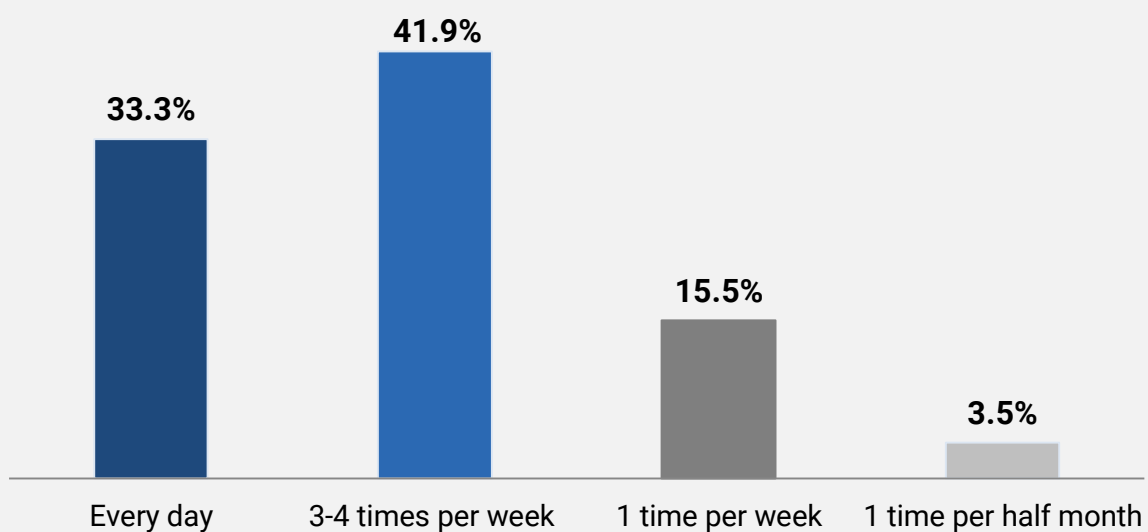
Consumers are mainly from the developed areas and cities, people living in those regions are more willing to purchase AI speech-based products in order to facilitate their daily life.²⁵

Consumers distribution by cities
(2018)



54% live in tier-1 cities

AI speech product consumer frequency of use
(2018)



²⁵ Data Source: Shenzhen China Commerce Statistical Department

CASE STUDIES

Mariedalgar & Unmanned Stores

Mariedalgar is a Chinese cosmetics brand using AI technology since 2015. The brand launched its unmanned lipstick vending machine in 2015 and built China's first unmanned beauty shop named "TO GO" in 2018.



Unmanned vending machine

After scanning the machine's QR code, customers enter the product page. They can browse lipstick shades and purchase a mini lipstick for only 5 RMB. The whole shopping experience can last less than 1 minute and 30 seconds.

The unmanned vending machine sells high quality lipsticks in smaller sizes, cheaper price through a much more novel experience.



Unmanned beauty shop

Inside Mariedalgar's unmanned beauty shops are self-service vending machines, shopping guider robots, AR virtual makeup, and more. Consumers purchase cosmetics through QR codes.

The unmanned shops improve shopping experience and meet the young consumers' demands for interests and fashion.

The brand collects consumer information and makes personalized product recommendations.

Ratio Café's state-of-the-art robot

Ratio Café is a Chinese coffee shop with a state-of-the-art robot modeled after the arm and hand of a real bartender. Customers order on a WeChat mini-program or by scanning the QR code and can watch the robot prepare their orders in front of them. Consumers can also customize their coffee or cocktail when ordering. The orders are ready in 2-3 minutes. By having robot bartenders, a coffee shop or bar can effectively attract customers who are keen on high tech or those looking for a novel experience. Besides, coffee shops also can save part of costs since they have less human workers.

Scan QR code



Menu on mobile phone



The robot prepares coffee



The coffee is made



MeiTuan's food delivery robots

Meituan is a Chinese food purchasing and delivery platform. It launched an autonomous food delivery system in 2018 and it is going to be rolled out gradually in 2019 starting in Beijing. Meituan has more than 300 million active users, 4 million suppliers, and more than 20 million daily orders. Meituan is working with AI companies such as Uditech and Segway-GX which have developed autonomous delivery robots for the platform.



SMART FUNCTIONS

By using machine vision, GPS, face recognition and other AI technology, delivery robots can automatically avoid automobiles, pedestrians and other obstacles during. They also can self-lock and have an automatic alarm to protect the products they deliver.

DELIVERY EFFICIENCY

Delivery robots have low weather influence and can work uninterrupted for a long time.

Thus, they usually finish every delivery task with less time than human workers.

LABOUR COSTS

In China's tier-1 and 2 cities, the labor costs of delivery people are increasing. By using delivery robots, Meituan can effectively reduce costs and have a desirable alternative.

Ford Motor Company's smart vehicles

Chinese consumers are accustomed to high connectivity; they seek innovative in-car services and are even ready to pay subscriptions for content. By working with Baidu, Ford Motor Company has built a AI system named SYNC+ to connect cars with smartphones.



SYNC+ system

Car drivers can control navigation, reservations (such as at a restaurant) and entertainment systems by voice. Through the system, drivers also have services such as vehicles maintenance reservation, roadside assistant, etc. After downloading the mobile app, the system allows the driver to connect a smartphone to the car through the app, also the car itself can connect to Baidu's smart home devices such as smart speakers.

Ordering by facial recognition at KFC

In China, KFC can predict customer choices based on data. Through the intelligent software that scans the customers' faces and recalls the customers' previous orders, KFC is able to offer a menu adapted to each customer. The facial recognition technology was developed in partnership with Baidu.

Through facial recognition, KFC can harvest data from the Chinese consumers and customize a menu for each diner based on preferences, local tastes and age.

For consumers, purchasing KFC's food by scanning face saves their time in queues, especially at peak times.

KFC saves the preferences of returning customers, and those preferences are listed first when the familiar face is scanned. Then, the system can help them improve the efficiency of ordering with the record.



iFLYTEK: The leading AI brand in China

The main business of iFLYTEK

iFLYTEK started its AI business in 1999, now it is one of the leading players in China's AI market.

The company targets both B2B and B2C market by developing natural language processing, machine learning, AI speech, robotics and other AI technology & products.



Education

Medical Equipment



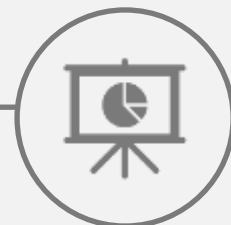
Language Translation

Digital Services



Automobile

Office Equipment



Revenue in 2018

In 2018, the total annual revenue of iFLYTEK exceeded 7.9 billion RMB and increased 45.41% compared with 2017. The sales revenue of B2C products has exceeded 2.5 billion RMB in 2018, which occupied 31.8% of the total revenue.

iFLYTEK: Advanced AI speech and NPL technologies

iFLYTEK has the most advanced AI speech and NPL technologies in China, it already occupied 44% of the AI voice & speech market. The technology has been used in its B2C products, including recorders, translating machines, office equipment, etc.



Smart Recorder



Smart Translator

Smart Office Equipment



Intelligent study
Equipment



During the double 11 shopping day in 2018, iFLYTEK's translating machines reached the highest sales (300,000 sold items) among all kinds of similar products on Taobao/Tmall. During the 618 shopping day in 2019, iFLYTEK's 6 AI products achieved the best sales among similar products on both Tmall and JD.

iFLYTEK: Marketing strategy in China

Two important offline marketing strategies for the company



Offline AI experience stores

iFLYTEK built offline AI experience stores in Shanghai and Shenzhen to promote its products. The offline experience stores are big adjustments of its business, the brand started to expend more efforts on B2C market.



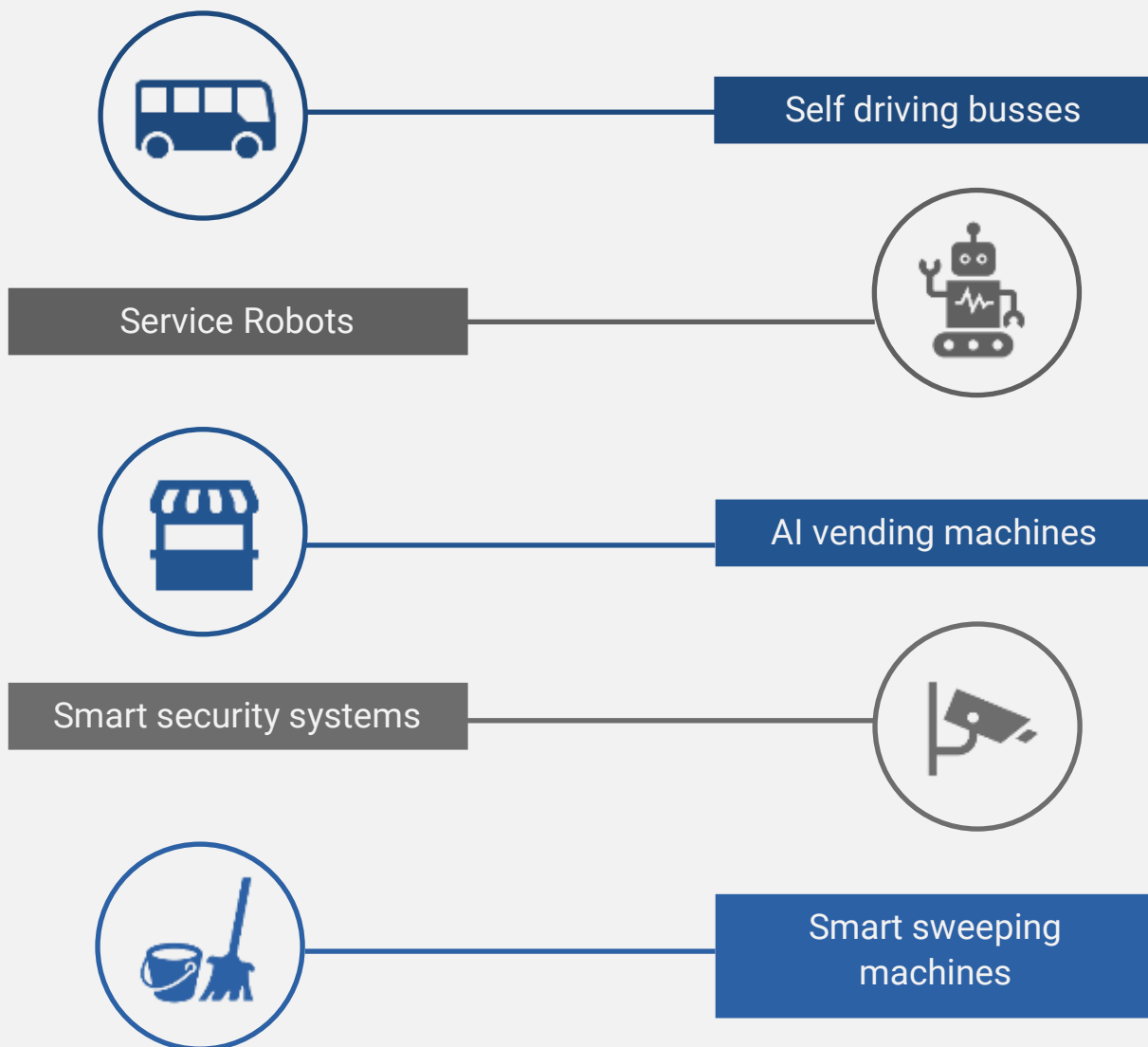
Smart cities

In order to open up new market and increase its brand awareness, iFLYTEK widely participated in the construction of China's smart cities. By working with local government, the company provided technical support for public services.

DeepBlue Technology: The world-class AI developer in China

As one of the leading AI developers in China, DeepBlue Technology is devoted to developing AI applications, software/systems, hardware, robots, etc. The brand's core technologies are machine & computer vision, self-driving technology, biological intelligence, etc.

Many AI products of DeepBlue Technology target B2B market, they are also involved in China's smart city development.



DeepBlue Technology: Domestic and international strategy



Cooperating with real estate developers

DeepBlue Technology built strategic partnership with the Greenland Group (a large real estate developer in China) to participate in the creation of smart communities, smart transportation and smart cities in China.



The Belt and Road Initiative

In order to expand overseas market, DeepBlue Technology actively worked with European countries, such as Greece and Italy, through The Belt and Road Initiative. The company provides AI products to support the public service and smart cities in those countries.

Part Two
AI DEVELOPMENTS IN CHINESE
INDUSTRIES

AI TO COMBAT COVID-19

Cutting edge technology to defeat COVID-19

A boost in big data and mass surveillance

The most visible use of new technology during the Coronavirus in China are thermal scanners at train stations and airports. With thousands of passengers coming and going each day, these detection gates can accurately identify the body temperature of dozens of passengers simultaneously.

Facial recognition and infrared scanners

Megvii, a Chinese AI company specialized in Facial Recognition, announced on February 7th that it had built a solution that “integrates body detection, face detection, and dual-sensing via infrared cameras and visible light.” This new temperature detection system has been supported by the Chinese Ministry of Science and Technology and was first deployed at a subway station in Haidan District on February 4th. The system is capable of simultaneously check the body temperatures of 15 people every second, even when masks or hats cover people’s faces.



[Source: Megvii, “New software equipped with facial recognition and temperature checking cameras”]

Megvii is known to have been blacklisted by the US administration in October 2019 for its alleged human rights abuses. Facial recognition is indeed a subject of controversy, even in China. The widespread use of this tool to better control populations during the epidemic could, however, bury the privacy concerns of Chinese citizens. Megvii facial recognition devices are now being installed in more and more subway, train, and airport stations. The use of facial recognition by the authorities could, therefore, be enforced in the long term.

Big data powered QR codes

The Alipay's Health code is another example of the use of big data to implement epidemic control, a newly automated form of social control that could persist long after the epidemic subsides.



[Source: New York Times, "Color codes, one of the AI solutions to the Coronavirus in China"]

Launched at the end of February by Alibaba's part-owned Ant Financial, the QR code is available in more than 200 cities across China on the popular wallet app Alipay. The color code, green, yellow, or red, indicates people's health status. A green QR code allows free access to public places such as subways, malls, or even supermarkets. The yellow QR code forces you to a seven-day quarantine, while the red one requires a fourteen-day quarantine.

Government tracking of APPs feeds AI development during the Coronavirus

While QR code checkpoints are becoming standard across China, neither the company nor officials have explained how the system decides whether someone is green or not. However, it seems that the QR code bases its arbitrations on the history of the user's location coupled to information data on the Coronavirus. A yellow or red code may be therefore given to someone who has visited cluster areas or had contacts with an infected person.

There is still no consensus regarding how to marry the right for privacy and the responsibility of the government to stop a deadly epidemic. A huge amount of data has been made available by the authorities' consistent tracking of so many apps, which feeds Artificial Intelligence in China during the Coronavirus.

New healthcare technology to fight against the Coronavirus

In the first weeks of the outbreak, much has been written in scientific journals across the globe after Baidu has developed an algorithm that only takes 27 seconds to solve the RNA secondary structure of the Covid-19 which is 120 times faster than the top classic algorithms. On January 30, the tech giant that operates the country's largest search engine opened up its prediction algorithm, 'LinearFold' to global genetic agencies and scientific research institutes,

for free. This scientific feat took place in the early stages of the outbreak in China, followed later by other AI solution to the Coronavirus in China. These advances in healthcare technology could set a new precedent for pandemic prevention in the future.

AI to diagnose Coronavirus

Deep learning, the same technology that makes possible facial recognition or autonomous driving, is also making it possible to diagnose Coronavirus faster than doctors. We have seen giant Chinese tech companies relying on machine learning to develop diagnosis chatbots on their platforms. Based on thousands of real diagnoses, as well as questions asked to the user through the chatbot, Baidu or Tencent algorithms can identify if the user's symptoms match those of the Coronavirus.

Smart CT Scans

New technology from the Coronavirus in China also include capabilities to read computed tomography (CT) scans. CT scans of the chest are indeed a critical method in diagnosing the Coronavirus. Alibaba and health insurance company Ping'An has developed smart image reading systems that can deliver results in about 15 seconds with an accuracy rate above 90%. Such tech advancements from the Coronavirus in China significantly speed up the process, as radiologists can spend up to 15 minutes reading the CT images of a patient suspected of contracting COVID-19.



[Source: Infervision, "Tech advancements from the Coronavirus in China to help reading CT scans"]

Infervision is another Chinese Artificial Intelligence startup that has developed CT Pneumonia reading software to detect lesions from possible pneumonia caused by the Coronavirus. Before the outbreak, the company was specialized in detecting lung cancers through CT chest scan reading. Bringing its AI solutions to the Coronavirus in China, the whole diagnosis

analysis process can take as little as 10 seconds. As of March 5, the Infervision's system has been deployed in 34 hospitals across China and reviewed over 32,000 cases.²⁶

Deployment of disinfection robots

In hospitals often overwhelmed by new cases, addressing hospital-acquired infections remains a considerable challenge for medical workers. Given the contagiousness of the Coronavirus and the density of patients in Chinese hospitals during the outbreak, the deployment of unmanned disinfection systems is a necessity.

UVD robots is a Danish company which supplies Chinese hospitals with disinfection robots during the Coronavirus. The robots consist of a base equipped with sensors, surmounted by powerful UV lamps. This kind of disinfection technology using UV lamps has been around for a while – used in the disinfection of drinking water, for example – before being deployed in hospitals. This technology consists of pointing a high-intensity UV light – which can be harmful to human skin or eyes – on contaminated areas during a few minutes.

The robot scans its environment using its lidars, creating a digital map that medical workers can annotate, indicating the areas to be disinfected. The robot can then navigate on its own, relying on simultaneous localization and mapping (SLM), without any human interaction. The disinfection of a room can takes up to ten minutes. For safety, the robot shuts UV lights off when detecting a person through its sensors.



[Source: Spectrum, “Danish UVD robots to push AI innovation in China during the Coronavirus epidemic”]

During the epidemic, the Danish company shipped robots to China by plane every week to cope with the demand. On February 19, UVD Robots announced that it would equip all the Chinese provinces, deploying its robots in more than 2,000 hospitals. Given the globalization

²⁶ BioWorld.com, China uses AI in medical imaging to speed up COVID-19 diagnosis

of the epidemic, UVD robots will be deployed at other medical facilities in the United States. In the near future, this kind of technology could also extend to schools, cruise ships, or other usually crowded spaces that offer like-hospital structured places.

Spreading information faster than the Coronavirus

In times of pandemic, giving accurate and precise information to the public is the first step to ensure broad awareness and implement prevention to strengthen epidemic control. But with people getting scared, it is easier for fake news and hoaxes to spread better than a valuable accurate piece of information. Moreover, with a situation evolving really fast, something that was still true a few hours ago may now be out of date. To ensure proper transmission of information to populations, AI and Big Data in China during the Coronavirus intensified their effort towards new ways of informing Chinese people.

Online information centers rely on Chinese AI and big data during the Coronavirus

As previously noted, AI solutions to the Coronavirus in China include the recourse to machine learning processing bots. On February 4, in the early weeks of the epidemic, JD launched a 'smart epidemic assistant' integrated into the WeChat account of Wuhan's Mayor to accurately answer Wuhan's dwellers' inquiries. Its functions are further detailed in this article. More generally, the giant Chinese companies such as Baidu, Tencent, Alibaba, JD, Meituan all released a big data-powered information center on their platforms. These powerful tools inform people about the latest news on the Coronavirus, displaying statistics, transmission rates, and other virus-related queries. It also provides information about the nearest hospitals, self-testing features, and online medical services.

Baidu AI technology in China

These tech advancements quickly became widespread in China, with 34% of the Chinese said they tried online medical consultancy for the very first time thanks to the epidemic. **The image on the right is a screen shot of Baidu App's COVID-19 Information Center.** As of March 17, the most consulted online health center, which is Baidu's, has been seen close to 5 billion times.

The Baidu application provides real-time information on the outbreak of COVID-19, including current confirmed cases, suspected cases, and cases in critical condition, cured cases and deaths for each city. The map feature on the APP also shows precisely where in each city there are active cases.



Big data-powered maps

Among AI solutions to the Coronavirus in China, Baidu, the tech giant that operates China's largest search engine, launched several maps to help people find their way through the epidemic. An 'epidemic map' displayed the number of contaminated and suspected cases in a certain area, while a 'migration trend map' was helping people check the migration status of Mainland cities during the Spring festival. The two apps were making it easier for people to manage their travel plans to go back home at the end of the holidays, as well as avoid risky places.

Last to date is the 'resumption work map', which shows all the shops open around. Since the quarantine that forced millions of stores to close, it's indeed hard to tell what's open from what's not. This new feature is available in more than 300 cities and allows the user to select the type of spot they want to search for, from supermarkets to parks and hotels. Those identified as open appear on the user's screen.

The adoption of AI and big data in china during the Coronavirus at all levels of society

From disinfection robots to color codes, China is perhaps the best example of how technology has moved from being nice-to-have to essential to address the disease. The examples listed above are some of many highlighting the widespread use of AI and Big Data in China during the Coronavirus. Tech advancements from the Coronavirus in China are now everywhere for everyone, boosting innovation in China.

Big data platforms to help the Chinese government with decision making

During the epidemic, more than 20 province's government worked with technology companies to build AI solutions to the Coronavirus in China to report epidemic related data and feedback, providing invaluable advice for public crisis management of priority populations. Deeper cooperation between the two parts to fight the Coronavirus supported tech advancements from the Coronavirus in China.

From March 2020, two months after the outbreak, Chinese authorities are now focusing their efforts to find a balance between epidemic prevention and control, and sustainable economic and social development recovery. Proof that AI and big data during the Coronavirus in China has been of invaluable help at the highest political levels in managing the crisis, Chinese President Xi Jinping said on March 5 that unprecedented expenditure on "new infrastructures such as 5G networks and data centers" will top the Chinese response to the economic impact of the Coronavirus. The comment confirmed that investments would be made to support new technology and innovation in China. Stocks related to AI, big data storage center, and 5G, surged in response.

The real power of technology

Ordinarily, only a few people try new tech products and help to push the boundaries of technology further. These people are called early adopters, geeks, or innovators. The Coronavirus situation forced the majority, the later adopters, to catch up fast. As it created an unprecedented launchpad for AI, big data, and robotics developments in China, consumers,

producers, marketers, and decision-makers will come better to understand their potential in all walks of life.

If no one knows when the pandemic will end, it looks certain that new technology from the Coronavirus in China will last. These AI solutions to the Coronavirus in China, but not only, were born out of a necessity to cope with an unprecedented situation. With the virus expanding worldwide, tech advancements from the Coronavirus in China will be of great help to other countries globally. By its essence, technology has no borders or nationality. It can easily scale up to solve threats elsewhere.

AI IN HEALTHCARE

AI healthcare trends and applications in China

The use of AI in China's healthcare industry

In the early 1980s, China began to develop research in the field of artificial intelligence in healthcare. Although it first lagged behind developed countries, it has caught up quickly. Since the beginning of the 21st century, AI in China's healthcare industry has made significant progress in more segments of healthcare. With a rapidly aging population, the increase in the chronic diseases, the shortage of quality medical resources, and the rising public medical expenses, the application of AI in the healthcare sector in China has brought new development direction and motivation to the medical field. Currently, investment in AI in the healthcare industry in China is ranked first in the world, and the quality of research is among the top three. The Asia Pacific healthcare AI market will witness considerable growth of about 44.4% by 2025 thanks to the rising investments in R&D, which are necessary for development of the pharmaceutical and biotechnology sectors.²⁷ It is estimated that the market size of China's healthcare big data industry will exceed 80 billion Yuan by 2020.²⁸

This section focuses on the five main applications of AI in the healthcare industry in China, namely medical imaging, auxiliary diagnosis, drug development, health management, and disease prediction.

Ask an expert

*"There is a **shortage** of human professional elderly care providers in China, so we cannot just count on human providing services. There will be a **bigger gap** in the future when every year there are millions of seniors in China coming in healthcare. Now doing a Yin and Yang with MedTech, insure tech, and biotech, all in one, connected in an **AI-based** preventative platform, should help us align with the needs of the seniors in China."*

Charles Bark, CEO and Founder of HiNounou

The development of healthcare AI companies in China

There are four pain points in Chinese medical field: insufficient medical resources, a long training period for doctors, high medical costs, and a high doctor misdiagnosis rate. AI may be leveraged to solve some of these problems.

²⁷ Healthcare Artificial Intelligence Market Size by Application, Sumant Ugalmugale

²⁸ 2018 AI in Healthcare Industry Development Trends Analysis, Qianzhan.com

AI in Medical imaging

Medical imaging is one of the most common AI applications in China's healthcare industry

Medical imaging refers to the specific application of AI technology in the diagnosis of medical imaging. AI may find multiple applications, from image acquisition and processing to aided reporting, follow-up planning, data storage, etc. AI is expected to massively affect radiology. Currently, it is the second-largest market segment of artificial intelligence medical applications in China and was predicted to grow at a growth rate of more than 40% and reach a scale of 2.5 billion US dollars in 2024³⁰. In addition, AI medical imaging in China is considered by industry insiders to be the first market to commercialize in AI in the healthcare industry in China. Due to the huge gap in the number of professional doctors in medical imaging in China, the rate of misdiagnosis and missed diagnosis is high, and the speed of manual diagnosis is limited. AI in medical imaging can help to process image data in the following aspects: reading mode, time, accuracy, objectivity, memory, modeling conditions, information utilization, and repeatability, the difficulty of quantitative analysis, experience transmission, and cost. Patients, physicians, and hospitals will all benefit from the use of AI in medical imaging in China. AI in medical imaging has become the most commonly used depends on several developments of AI in the healthcare industry in China. First, the medical imaging data is huge; more than 90% of the medical data comes from medical images. The picture data structure is simple, which is convenient for machine learning. It is estimated that the volume of medical data will reach 40 trillion RMB by 2020, 30 times that of 2010. Another developing advantage of AI in China's healthcare industry is about the fast iteration of big data, and intelligent image diagnosis algorithm is relatively mature. In addition, national policies are supportive of the medical imaging industry. The government has issued several policies to increase support for domestic medical imaging since 2013. In 2017, the total amount of financing in this field exceeded 1.7 billion RMB.

The current business model used in medical imaging in China

At present, AI in medical imaging products is mostly used for disease screening, especially cancer and chronic diseases. Most of the roughly formed AI medical imaging products in China are in the trial stage of hospitals, and the healthcare AI companies in China have not realized profits yet. The three business models used in medical imaging in China include cross-border Internet technology giants, device companies, and technology companies. Cross-border Internet technology giants have the capital and technology to support the development of projects with their own strong financial resources. Device companies rely on medical imaging equipment or systems to gain access to medical facilities. Technology companies focus on the application layer, with their algorithms that provide final solutions based on industry data.

In 2017, Tencent launched the AIMIS (觅影), an AI-powered diagnostic medical imaging service. This health tech in China currently has accuracy rates of over 90% for preliminary diagnoses of esophageal cancer, 95% for lung sarcoidosis, and 97%

for diabetic retinopathy. According to Tencent, AIMIS has reached cooperation with more than 100 hospitals (3AAA Hospitals) in China to promote the research and application of AI in the healthcare industry in China.

AI in Diagnosis

Current AI applications in assisting diagnosis in China

In addition to medical imaging, AI in diagnosis in China also provides Electronic medical record (EMR), medical robot, virtual assistant and other services.

Electronic medical record

The traditional electronic medical record (EMR) system of healthtech in China does not meet the needs of specialization of disease data, structuring of medical case data, and cannot provide clinical decision support based on medical records. Healthtech in China can use natural language processing technology to standardize and structure medical records and use speech recognition and speech synthesis to process large amounts of text entry.

Medical robots

China's medical robots mainly include surgical assistants (orthopedic and neurosurgical robots), gastrointestinal examination and diagnostic robots (capsule endoscopes, gastroscope diagnostic treatment, and auxiliary robots, etc.), rehabilitation robots and other robots for treatment (intelligent intravenous infusion drug configuration robot). The Boston data shows that the compound annual growth rate of the global medical robot market will be about 15.4% in the next five years. Recently, medical robots as a driver of the healthtech in China are gradually breaking the monopoly of imported robots. Domestic surgical robotics companies conduct business primarily by selling robots to hospitals and providing long-term maintenance services. Others provide parliamentarians with a model of the overall engineering solution for the surgical center.

Virtual assistant

Virtual assistants can provide real-time support to doctors. For example, patients need to know the necessary information about the disease when they go offline for consultation, and these highly overlapping contents take up a lot of doctors' time. AI technology in China's healthcare industry can help doctors respond to inquiries based on a large amount of historical information, saving time and energy. Since most of the AI-assisted diagnosis products are software and hardware integrated solutions, healthcare AI companies in China cooperate with hospitals and continuously train models and optimize algorithms through hospital desensitization medical records data. Hospitals can use the products mostly free. In the future, when the product becomes more mature, AI in diagnosis in China may be inclined to adopt the service charge business model.

Airdoc -Diagnosis in the blink of an eye

Airdoc is a fast-growing healthcare company specializing in AI in diagnosis in China. It has leveraged an AI-driven system that can seek out signs of many chronic illnesses by images of the retina at the back of each eyeball. By conduct screening in and outside medical institutions, Airdoc fundus disease recognition has become the doctor's assistant for chronic diseases. This healthtech in China has been highly recognized by the international community. In 2017, Airdoc boarded the 'Peace Ark hospital ship' and visited six African countries on behalf of China, providing AI medical services to the crew and people living in these countries.

AI in Medicine discovery

Artificial Intelligence improves China's drug research and development field, Medicine discovery is a notoriously expensive process, and it has four main stages. AI has already been successfully applied in all stages in drug development: identify target molecules, discover effective drugs, speed up clinical trials, and find biomarkers for diagnostics. At present, medicine discovery in China has several problems to be solved. Some of which can serve as the directions of AI development. Specifically, medicine discovery in China always takes a long-time duration, high costs, high-risk, and low rate of return. It is developing a new drug that costs \$2.6 billion and takes 10 years to develop²⁹. However, the union between artificial intelligence and drug discovery can greatly reduce time and development costs. Artificial intelligence can quickly select the right compound through a large amount of data to generate hypothetical drugs, which shows the potential for more efficient development of medicine. Current medicine discovery in China is still focused on generic drugs and improved drugs, while innovative drugs dominate foreign R&D. Therefore, in the field of drug R&D, international research goes further than in China.

The business model of medicine discovery in China

There are three major categories of healthcare companies specializing in AI in drug research and development: AI technology companies, drug research institutions, and large pharmaceutical companies. AI technology companies in China do not produce drugs but provide technical services to large pharmaceutical companies or medical institutions. As a service platform, drug research institutions offer support to national pharmaceutical enterprises in preparation, metabolism, safety evaluation, etc. The trend of large pharmaceutical companies is to seek cooperation or investment opportunities with AI technology companies by using their massive data. Accutar Biotechnology is a Chinese pharmaceutical AI company specializing in medicine discovery, which raised \$15 million in funding in 2017. Accutar Biotechnology computational projections of 3D operators and deep chemical structure networks have greatly improved pharmaceutical efficiency and success rates in China.

²⁹ How artificial intelligence is changing drug discovery, Nic Fleming, nature.com

AI in Health management

Big data as a breakthrough to achieve accurate health management

There are two main issues in health management in China. The first is smart wearable devices in traditional health management fail to solve data correlation. Wearable devices only focus on data extraction, collection, and trend analysis, but fail to provide users with health portraits and improve their health. Secondly, staff in the health management field are not always professionally trained; most having a non-medical background. Massive big data is a prerequisite for the development of health management in China. From the technology-driven perspective, AI can make personalized health management possible through efficient calculation and accurate decision analysis. Even in the future, nutritionists and sports experts can generate accurate health intervention plans based on the AI system of healthtech in China.

Current state of health management in China

China's current amount of smart wearable device hardware is not high enough, and the accumulation of disease-related data is insufficient. Therefore, the main application of AI in health management in China is chronic disease management (such as diabetes and hypertension), maternal management, mental health management, and population health management. Health management operation is mainly based on physical examination, including health assessment and promotion, but follow-up health management services have not been fully popularized. In addition to employee health management services, some enterprises cooperate with insurance companies. In the future, the cultivation of individual users' payment habits is expected.

AI in Disease prediction

Genetic testing as an inalienable development approach

AI technology in disease prediction in China are mainly used in gene sequencing and detection to forecast disease occurrence. Gene testing is the cornerstone of medicine. Current business models of genetic testing services of AI in China's healthcare industry can be divided into two types: a hospital delivery model and third-party testing model. Compared with the hospital delivery model, the third-party testing model requires a higher threshold of qualifications, personnel, and funds of medical inspection institutions.

Industry pain points and emerging benefits of disease prediction

Genetic testing is not easy to implement. Firstly, the amount of genome data is huge, and manual experiments are time-consuming and labor-intensive. Traditional gene sequencing costs too much. In addition, the general algorithm of gene sequencing diagnosis in different stages is ineffective and has low accuracy. The advantage of disease prediction in China is the increasing market size and the development of the supercomputer. According to the trend of disease incidence, cancer incidence, and death rate have been continuously increasing in China in recent years. Data show that from 2007 to 2016, China's revenue from gene sequencing increased by 62.2

percent annually, reaching 5.06 billion RMB in 2016. It is estimated that by 2022, China's gene sequencing market is expected to reach about 30 billion RMB³⁰. Additionally, if supercomputer's powerful data processing ability is applied to gene sequencing, it will greatly shorten the time of gene testing and improve efficiency.

Policies regarding AI in the healthcare sector in China

At the national level, AI manufacturing was first mentioned in the “*Made in China 2025*” issued by the State Council in 2015. In the past three years, it has released big data about national health and Internet medical care. Such policies have promoted the rapid development of big medical data and laid a good foundation for the development of AI in the healthcare sector in China. At the provincial level, as of 2018, 19 provinces in China have released AI strategies, among them, Beijing, Shanghai, Hangzhou, and Shenzhen. Other cities are in the early stages of AI development.

How to collaborate with leading healthcare AI companies in China

There are several possible ways to collaborate with leading AI companies in China. Firstly, foreign research institutes can cooperate with healthcare AI companies in China. InferVISION (推想科技) is a Chinese AI company, which provides services in the ‘AI as a Service’ mode and launches the medical imaging deep learning center to provide medical researchers with deep learning capabilities. While cooperating with more than 300 domestic hospitals, it also focuses on the overseas market expansion.

Another type of collaboration is between two tech companies — for example, iMedical Cloud from Tencent and Mediway. The iMedical Cloud builds an industrial internet ecological IT platform featuring cloud, security, sharing, and collaboration. Therefore, the key is to find healthcare AI companies in China that can complement each other's resources and integrate companies' technology. In addition, many Chinese healthcare AI companies started as software systems and found a way to generate revenue by combining with medical devices manufacturers. In terms of medical discovery, cooperation between AI technology companies, pharmaceutical enterprises, and medical research institutions can be mutually beneficial. Foreign pharmaceutical enterprises can use the data from domestic AI technology companies to conduct drug research and development more efficiently.

³⁰ 2019 China AI in Medicine White Paper, Shanghai Jiaotong University

AI IN BEAUTY

AR try-ons to unmanned vending machines, the future of beauty is here

The development of artificial intelligence(AI) in China is very rapid; artificial intelligence can be found in every corner of the consumer journey. From mobile phone payment to face recognition of unmanned shops, AI creates a more convenient and efficient service experience. AI in China's Beauty and Cosmetics industry is making changes at the level of customers acquisition, products, and even management.

Digital transformation of the beauty industry in China: Customer's experience enhanced by AI

As the beauty industry is always agile to fashion trends, it naturally does not miss the AI technological application. Customer experience is enhanced by the digital transformation of the beauty industry in China, such as automated retail, virtual makeup try-on & removal, and voice-guided mirror.

Automated retail in Beauty and Cosmetics in China

At the moment, different industries are exploring automated business models, ranging from self-service convenience stores to more innovative product lines such as magazines kiosks and umbrellas rental stands. AI in cosmetic retail industries recorded one of the most successful expansions in the automated retail industry. Mariedalgar is a domestic cosmetic brand that launched its self-service vending machine at Hangzhou West Lake Yintai. Upon scanning the machine's QR code, customers enter the product's page; they can follow the Tmall online store, and browse and purchase a mini lipstick for only 5 RMB. The whole shopping experience can take less than 1 minute and 30 seconds. The main purpose of the event is to get much more exposure to the brand. Mariedalgar's Hangzhou vending machine sold a total of 1,550 lipsticks in three days, which is equivalent to a week's regular in-store sales. Mariedalgar will also cooperate with Tmall to complete docking of its online and offline membership system, analyze customer insights, and membership programs.

Makeup Virtual Try-On and Removal supported by AR

The virtual makeup technology uses 3D dynamic makeup, which is the most widely used AI technology in the beauty industry in China. Consumers can try lipstick, eye shadow, blush, eyebrows pencil, false eyelashes, and other products in less than a second. Customers have the option to buy the products after digitally trying them on, which reduces costs and expands beauty retail terminals. The purchase of products brings a convenient experience. At the same time, brands can also use AI technology in the beauty industry to collect consumer's information, make personalized product recommendations and development based on big data. In April 2017, Watsons also launched "Style Me, Color me," which is one of the applications of AI in beauty. It can automatically identify the customer's face when they sit in front of the in-store mirror tablet, providing make-up suggestions virtually applied to the customers' face on the mirror. In addition to the pre-shopping experience service, Watsons has also implemented AI technology to enhance the consumers' experience. With the newly established self-service checkout counter, customers can pay online with their mobile phone and can choose between pick up from the store or home delivery within 4 hours.



[Source: Mariedalgar "Lipstick vending machine"]

Voice-guided mirror, convenient customer shopping guide

"Mirror, mirror on the wall, who's the fairest of them all?" This speaking mirror not only exists in Disney's fairy tale "Snow White" anymore, now with the "Tmall Elf Queen," everyone can have their own "magical mirror. At the Tmall Gold Makeup Award in 2019, a voice-guided mirror attracted much attention. This voice guided mirror can chat with people, tell stories, play music, and control electro-domestics at home. This is an 8-inch diameter mirror surrounded by LED lamp beads which can provide the best light source during makeup. It could also simulate the illumination under different weather conditions, to make sure that the makeup is suitable for indoor as well as outdoor circumstances. This smart beauty mirror was developed by the Alibaba Artificial Intelligence Laboratory, and according to the on-site staff, in addition to the professional makeup mirror and lighting effects, the mirror also provides professional skin testing, sunscreen index inquiry, beauty reminders, and beauty knowledge.



[Source: Daxue Consulting "Snow White Mirror & Tmall Elf Queen Mirror"]

Applications of AI in marketing and logistics of beauty products

Personalized Recommendations

Every month, about 6 million photos are produced by the users of Meitu Matrix App. Meitu's big data resource provides a powerful foundation for Meitu AI. Based on big data and cooperation with medical research, Meitu recommends cosmetics for users personalized to their own needs. Through skin tests, big data analysis, and personalized recommendation, Meitu builds a personalized service for user's deep experience.

Precision management of logistics

In terms of after-sales, Meitu's artificial intelligence optimizes operational logistics and management. By using AI in cosmetics retail, Meitu investigates the trends to make sales forecasts, selects a suitable address of warehouse for storage, and the best delivery route planning, to provide the best delivery experience to customers.

A union of cosmetic brands and AI companies in China

AI is increasingly integrated into the beauty and cosmetics industry in China. At the basis layer, by analyzing big data, the beauty industry in China is thereby showing a better understanding of consumer demands, and a greater ability to serve their needs. Represented by Alibaba group and other companies, AI is used in the beauty industry to provide beauty data. At the technical level, the adoption of AI in the beauty industry covers all of the technology's employment areas. For example, the voice-guided mirror requires both speech recognition applications as well as mapping/semantic analysis. AR is widely used in the beauty and cosmetic industry, further examples are virtual makeup, try-on and removal. AI technology in the beauty industry also needs the support of image recognition. Companies like Unisound, Sensetime, and Alibaba group are working on this. At the application level, the virtual assistant could better satisfy customers' needs with quick replies to customer service inquiries. Future applications of AI in the beauty industry could extend to logistics, marketing, and personalized promotion.

In conclusion, China's beauty industry has benefited from the digital transformation brought about by AI technology. It has enhanced customers' experience by applying enhanced marketing, logistics, personalized promotion, big data, and other artificial intelligence areas. This is a further demonstration of how AI uses in the beauty industry are becoming more and more important for both the businesses and the customers.

AI IN NEW RETAIL

Not just unmanned stores

The Chinese retail industry is reaping the benefits of China's economic growth. The offline retail industry is now moving towards "New Retail" to find a new room to grow. New Retail is the merging of online and offline retail, eliminating the data boundaries between different channels. By integrating AI in new retail, retailers can find a better way to improve business efficiency, as well as provide a holistic shopping experience for customers.

Integrating AI technology in Chinese retail

As the first emerging store-model, which was proposed after the new retail concept, China's unmanned stores started sprouting up in China starting in 2017. The market size of unmanned stores is expected to exceed 3.3 billion in 2020³¹. At this stage, AI technology in unmanned retail is mainly divided into three categories: bar codes, radio frequency identification devices (RFID), and machine vision. The following are the major technology of leading enterprises among unmanned stores in China:

QR codes

The QR code, in other words, the two-dimensional code provides information storage on both horizontal and vertical axes. It enables consumers to pay for goods by scanning codes on the products. It is fundamental to unmanned stores with the advantages of lower costs and quick payment. Smaller unmanned stores such as Bianlifeng and Xiao E micro shop use this technique.



[Source: Daxue Consulting, "the QR code in China's unmanned stores"]

³¹ 2017 China's Unmanned Retail Industry Research Report, iResearch

Radio Frequency Identification Devices (RFID)

RFID is relatively mature in using electromagnetic fields to automatically identify and track items' tags. It requires sellers to stick RFID tags on each product to improve the efficiency of identifying goods.



[Source: Bingo Box, "AI in new retail in China: RFID in unmanned stores"]

Machine Vision

Machine vision uses cameras and computers for facial and behavior recognition. Presently in China's unmanned stores, machine vision performs as a store clerk to recognize and trace customer behavior. However, unmanned stores in China have started experiencing a series of closures, bottlenecking further development. One major obstacle is the difficulty of selling fresh groceries in the store without adding staff. Customers expect to buy processed food when in convenience stores. Some unmanned stores that only carry long-lasting products like drinks and snacks would not attract consumers but only regarded as a big vending machine.

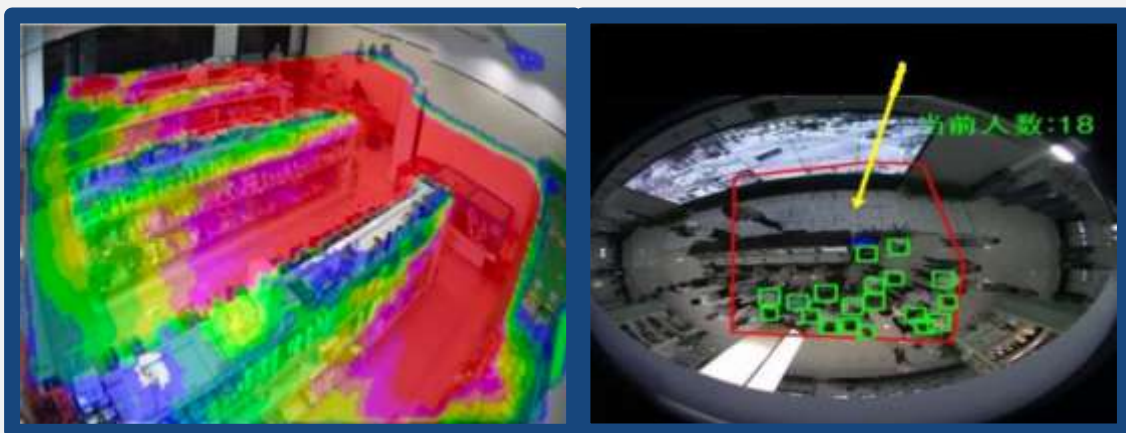
By analyzing Tao Café and Bingo Box, the most recognized unmanned stores in China, it can be seen that they can significantly enhance the convenience of shopping. Customers can enter Tao Café and Bingo Box by scanning QR codes on their apps. The stores are equipped with biometric systems and machine vision technology used for facial and speech recognition. With further upgrades of AI technology in Chinese retail, Tao Café can track target consumers, analyze what the consumer took as they leave the store, and offer speedy payment procedures, effectively removing the need of a check-out system.

From unmanned stores to smart stores, AI applications have changed China's retail landscape

AI is being applied in new ways across the entire new retail product and service cycle, from assembly to customer service interactions. Integrating AI in new retail is helping retailers discover actionable insights with different AI applications. For the perception of the retail process, AI applications in China's new retail can be broken down into the categories listed below:

Customer traffic recognition

The traditional Chinese retail industry lacks effective means to understand consumers' needs and purchasing habits. Customer traffic recognition is one of the solutions of using AI technology in Chinese retail. Tech companies support AI technology in Chinese retail Hikvision and Winner Technology. Customer traffic recognition can identify the flow density of consumers in the store and draw a heat map through real-time monitoring, thereby calculating the most popular goods and services to understand consumer behaviour. Through the results, operation settings of the store can be adjusted timely. In addition, it allows retailers to keep the optimal configuration and realize the balance between people, goods, and places.



[Source: CICC and Hikvision, "AI in China's new retail: customer traffic recognition in smart stores"]

Digitalizing offline retail

Relying on AI robots and other AI technology in Chinese retail empowers offline stores to adopt digital management. Traditional large-scale retail chains need to manage hundreds of stores across the country. By deploying Dahua's smart retail solution, offline-retailing stores can implement precision marketing, find the stores with poor sales, and even identify theft through reviewing business data. Also, the remote patrol function can be used to directly view the status of each store, in terms of its operation, display, health, service, and compare the high and low performing

stores in real-time. The face recognition among AI technology in Chinese retail accurately counts the consumer traffic data and combines the sales data to analyze effectiveness and customer preference.

Supply chain and logistics optimization

Increased use of AI technology in Chinese retail serves to improve overall efficiency and resolve the limitations of traditional retailers, such as inefficient planning, labor-intensive warehousing, and slow response to market changes. Under the complex network and increasingly diversified consumer demands, retailers will need an automated supply chain. AI technology in Chinese supply chain include deep learning, machine learning, and sensor equipment. Product tags like popularity, bestseller, and high margin will be categorized without human intervention. When a product is contributing relatively less compared with its resource, time, revenue, margin, it would be automatically replaced. For a specific example, Cainiao Network has created a logistics information platform that links delivery vendors, warehouses, and merchants. The platform is designed to digitize the logistics management with AI applications in China's new retail. In addition, building on their work in smart logistic robots, Cainiao has developed an agile, automated warehouse solution. The self-charging AGV robots in the warehouse are expected to reduce manual staff labor by an average 50,000 steps per day and improve efficiency by 30%. The promotion of AI in new retail in China is to further accelerate the process of new retail transformation in terms of data, networking, and intelligence. It changes the retailing landscape by creating efficient and accurate user portraits, perfect merchandise, and service, as well as the accurate decisions based on AI-led data.

Using AI to center on customers' needs

China is the first country undergoing a "new retail" reform to focus on customers' needs. Compared to the traditional retail industry, the collection of customers' information is more time-efficient. At the same time, with updated AI applications in China's new retail, retailers are considering how to use customer data to analyze customers' consumption behavior in the store or online in a timely manner. Therefore, China's new retail stores have also launched AI customer support.

Ask an expert

"Chinese consumers are extremely sophisticated and savvy when it comes to digital and assessing brands and products. So, it's about understanding them, understanding what they want, and understanding what are the best channels to engage with them."

Max Peiro, CEO of Re-Hub

Smart product search and recommendations

By integrating AI in new retail, real-time data in many e-commerce channels is used to predict what consumers want. It is based on previous purchases, online browsing, comments, to achieve precise marketing. Take Taobao's AI design system Luban as an example:

Luban system first combines big data and deep learning to decompose the original images, train and learn different designer styles; secondly, according to users' preferences and other data matching to generate digital ads, the system selects the best ads after scoring. The system processes over 8,000 posters per second as demonstrated in the below picture:



[Source: CICC, AI application in China's new retail: the processing flow of Luban's poster design]

Smart customer service (Chatbot)

With the development of the Chinese retail industry, the needs of the online customer service are continuously growing. Because the traditional type of customer service has many weaknesses such as high labor cost, speech recognition is used as one of AI technology in Chinese retail to solve problems effectively based on big data and deep learning. It is expected to gradually replace traditional manual customer service and improve the quality of service.

Ali Xiaomi (阿里小蜜) is an AI-enabled personal shopping assistant and customer service representative used on Alibaba's e-commerce websites. With the use of natural language understanding, Ali Xiaomi stands out from other chatbot services available in China. It is able to understand customers' messages, including texts, voice, and even photos. It will return a list of recommendations that users can

choose by brand, color, and other characteristics. Ali Xiaomi can answer some frequently asked questions and inquiries from consumers.



[Source: Alixiaomi.com, “AI in China’s new retail: smart customer service”]

Pervasive personalization

Merchants selling on mainstream e-commerce platforms presently can personalize their virtual storefronts, offer real-time and tailored product recommendations based on purchase histories, demographics, and geographic locations. It is also an effective approach to center on customers and improves efficiency by integrating AI applications in China’s new retail.

Large new retail platforms using AI

Currently, AI is widely implemented in hypermarkets, supermarkets, and convenience stores. Apart from such retailing stores, other internet companies like Tencent are also the leading buyer and contributor to developing related AI applications. Thanks to the promotion of retail giants, such as Alibaba, JD.com, Suning, etc., AI applications in China’s new retail are on the rise will continue to expand over the next two years.

Hypermarkets: Alibaba & Hema, JD & 7Fresh

Hema and 7Fresh are both highly integrated their online and offline markets. They provide services that connect supermarkets and restaurants. Users add products to their digital cart by scanning QR codes. JD also launched the unmanned shopping cart service, which supported by image recognition. In addition, combined with the no cash payment method, Ali and JD can obtain accurate data of users, in turn, to achieve precise marketing.

The availability of electronic price tags that can be recognized by machine learning applications like RFID, is the key to the efficient operation of hypermarkets. Hence, electronic price tags are a key AI technology in Chinese retail. The use of electronic price tags ensures the same price online and offline sales. Furthermore, with the

mobile handheld identification devices, staff use codes to identify which goods to pick from shelves, then package the products and transport them to the express delivery department. The efficient data transmission chain is also important to support for their delivery commitment, as well as to helping expand the customer base.

AI + big data: Tencent & You Mall smart retail system (优 mall)

Tencent's Mall Smart retail system was released in 2017. It is equipped with Tencent's AI technology called Youtu, and Tencent's Cloud Data. The system includes VIP-to-store reminders, store compasses, line analysis, customer group management, facial recognition payment, etc., covering the various sections of the store. Youtu's facial recognition technology is applied to customer identification; shelves display adjustment, shopping guide, and patrol shop functions. Through the moving trajectory in the mall, shopping paths, and correlations between categories and commodities can be recorded and analyzed to optimize the arrangement of shopping malls. The following chart shows the central values of the AI system in digitalizing customers' information analysis:

In short, AI in China's new retail indeed has great potential for continuous development. Whether in the hypermarket, the smart retail system, or any new forms that may emerge in the future, the fusion of algorithm and experience is an important factor for retailers to consider when deploying AI. That means it is necessary to combine advanced algorithms of AI technology in Chinese retail with customers sentiments from the previous retail experience.

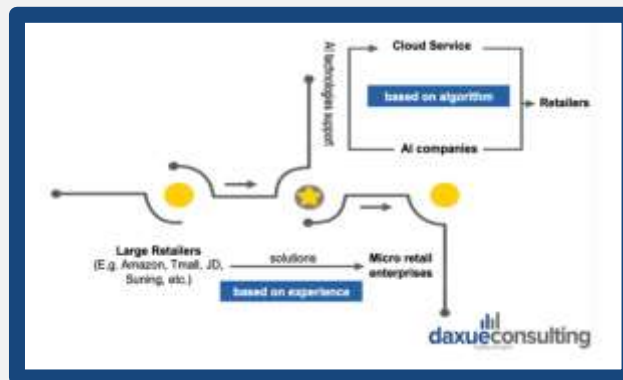
PEOPLE			GOODS	PLACES
ENTER	PATH / STAY	PURCHASE	COMMODITY DISPLAY	AREA OF INTEREST
<ul style="list-style-type: none"> How many people enter the store? Who are they? When are the most people entering the store? 	<ul style="list-style-type: none"> How do customers shop in the store? Where are customers stopped? 	<ul style="list-style-type: none"> Who repurchased? Repurchase rate? 	<ul style="list-style-type: none"> In which area the goods receive the most attention? Which items are picked up more? 	<ul style="list-style-type: none"> Which functional areas are concentrated in the store? Which functional areas have the longest stay time?

[Source: Tencent Research Institute, "Main values of Tencent's You Mall AI+ smart retail system"]

What AI technology in China can bring to your retail shop?

Currently, the main players of AI in new retail in China can be sorted into three categories: cloud services, large retailers with AI uses, and AI companies. Based on their own database, large internet companies can develop or integrate AI technology internally. The represented companies are Alibaba, Tencent, and Baidu. AI companies in China can deliver customized technology that addresses individual store needs. Apart from AI technology, relatively small retailers can also learn from large and mature retailers to find AI solutions.

The structure of leading players of AI in new retail in China:



[Source: iResearch, “the structure of main players of AI in new retail in China”]

Chinese AI companies in retail are mainly focusing on the technology layer. For example, Malong Technologies provides computer vision service. Some other companies like Megvii, Deepglint, Extreme Vision are also offering AI applications to cover the overall retail chain in China. Therefore, **for the foreign retailers who want to launch or further develop their business and integrate AI in China**, cooperating with AI technology companies is considered as an essential and practical approach to target more Chinese consumers. Based on the algorithms, there are two segments of technology that foreign retailers can use to find partners in AI and China’s new retail. Firstly, in the basic level, it is suggested for those retailers with a market share in China to partner with the AI companies which are serving cloud, data, and algorithms technology. They can integrate AI in new retail to form their own consumer group portraits and analyze their preferences and expectations through the data analysis services. Here is the list of companies, which are providing cloud, data, and algorithms services.

On the other hand, China’s AI companies in technology may bring more solutions to the current retail bottleneck. With applications such as computer vision, intelligent speech, and natural language processing, retail companies can directly target the consumers and reduce costs by more intelligent customer services and improved shopping experience. AI companies in China who are developing this type of technology are below:

An innovative retailer should use AI to make accurate forecasts. AI in China's new retail is more expansive than just unmanned stores, as it is reaching into the territory of hypermarkets and supermarkets, and other retail methods that are yet to be invented. In this world of big data, insights from AI will contribute to creating competitive advantages for retailers to improve the efficiency and profitability within the Chinese retail industry.

AI IN MANUFACTURING

How Artificial Intelligence is enhancing the manufacturing industry

AI in China's manufacturing industry is finding its ground with the advancement of smart manufacturing technology. Manufacturers are developing new applications based on AI algorithms designed to help make complex decisions. Many medium and large manufacturers are starting to use data analytics to optimize factory operations, boosting equipment utilization, product quality while reducing energy consumption and production cost. With new supply-network management tools, factory operational managers have a clearer view of raw materials and manufactured parts flowing through a manufacturing network, which can help them schedule factory operations and product deliveries to cut costs and improve efficiency. Through the active use of data mining, engineers and technicians are gaining better understanding of machines, so to improve reliability. Smart, connected products are sending customer experience data to product managers to help them anticipate demand and maintenance needs and design better products.

The application of Artificial Intelligence in Chinese factories includes the manufacturing process, product development, monitoring, logistics, inventory, and environmental safety. The use of Artificial Intelligence in Chinese factories is categorized into two sections: Production research and development, and the Improvement of production process.

Ask an expert

*"AI is extremely relevant when it comes to inventory—**leveraging AI** to be able to make a forecast on inventory allocation, optimization in terms of product assortment of quantities across different geographies across different channels."*

Max Peiro, CEO of Re-Hub

AI has improved the productivity of smart factory technology in China

Since the late 1990s and early 2000, most production companies begin to increase their production vehemently, minimizing their labour cost and maximizing the production capability. It is undeniable that Artificial Intelligence in Chinese factories provides the smartest, safest, and most precise way of achieving optimal productivity. The following are notable AI companies that have taken part in automating manufacturing in China.

MEGVII

MEGVII has core competencies in deep learning founded in Beijing and is a pioneer in applying AI technology and computer vision algorithms to the Internet of Things (IoT) use cases. The company's mission is to use innovative AI technology to deliver the value of AI in China's manufacturing industry and foreign industries as a whole. MEGVII's first commercialized AI product was a facial recognition solution. The Company has developed its proprietary deep learning framework Brain++, which functions as a unified underlying architecture and provides critical support tailored for the Company's algorithm training and model improvement processes.



[Source: MEGVII "Algorithms Engine"]

Leveraging its strong software-hardware integration capabilities, MEGVII has achieved leading positions in several key vertical markets, including personal IoT, city IoT, and supply chain IoT. MEGVII is building an AI infrastructure to connect and power various IoT devices, to solve real-life problems, pain points, and hitches that may hinder the success of AI in China's factories. MEGVII is dedicated to helping customers achieve specific goals such as user authentication and fraud reduction, traffic optimization, and labor efficiency gains.

Changing Precision Technology

Deep learning algorithms applied to manufacturing has reduced production costs in Chinese factories. Changing Precision Technology Co., Ltd. "Changing Precision" is a research and development, production and sales of intelligent terminal, mobile phone components, new energy automotive components, industrial robots, and automation system integration. AI Presently, Changing Precision has approximately 35,000 employees and has a global presence. The compound revenue growth rate of 2010-2017 is over 50%, and the compound profit growth rate of net profit attributable to shareholders of listed companies exceeds 40%. In 2017, the company's operating income exceeded 8.4 billion yuan, and its net profit was 571 million yuan.

Foxconn

As mentioned earlier in the white paper, Foxconn has been a leader in automated factories with fully automated smartphone-component factories, also known as ‘dark factories’. Foxconn Group has fully leveraged its expertise in software and hardware to integrate its unique manufacturing prowess with emerging technology. It has expertise in the areas of cloud computing, mobile devices, IoT, big data, AI, smart networks and robotics/automation.



[Source: Foxconn, “Intelligent Robot Arm”]

Facial Recognition gives Chinese factories a competitive edge

Due to the rapid development of information technology, computer science, and advanced manufacturing technology in China, manufacturing is changing from automated production to digitalized and intelligent production. SenseTime, a company specializing in deep learning and computer vision, is one of the biggest unicorns in China, and a spearhead of these changes. It provided the German automotive car-manufacturing factory (Daimler) with a public face cloud service for face recognition, using authentication technology to help business development. SenseTime will continue making an impact in both smart manufacturing and smart cars, since it signed a five-year cooperation agreement with Daimler, to accelerate the research and development of smart cars.³²

Natural language technology in factories

Xiaoyi is a Chinese artificial intelligence technology company focusing on industrial applications of cognitive intelligence. Xiaoyi has created professional service

³² Sensetime raises US\$620 Million in Series C+ Funding, Jump Start Mag

systems based on natural language processing technology, which is used in industries of finance, medical, education, automobile, electric power, manufacturing, and exhibition. Xiaoyi serves as an example of the current development of natural language processing technology that will be more and more relevant in Chinese factories.

Mor.AI focuses on cognitive computing, natural language understanding, with autonomous voice interactive full-stack technology designed to help people communicate with machines. It is an APP-based dialogue application that uses voice interaction. In the automotive industry, it can provide the vehicle voice assistant, which supports multi-modal interaction, multi-screen interaction, multi-device collaboration, car home interconnection, IMOV car networking overall solution.

Robotics in manufacturing

STEP Electric Corp. Is a small company that provides industrial robots along with control systems and software for industries like welding, packaging, construction, and machining. It has a market cap of about \$870 million.



[Source: Shanghai Step Electric “Industrial Robot”]

SIASUN manufactures sells industrial robots, such as automatic assembly and testing production lines for automobile, motorcycle, engineering machinery, and electronics assembly industries. Besides heavy industry applications, Siasun developed collaborative robots that can work with humans, as underground rescue robot as well as humanoid helpers for interpretation, meal delivery, information sharing, and nursing homes. The company has a partnership with GM Motors, Ford, AGCO Changzhou, Great wall motor, SANDISK, and Geely auto; it currently has a market cap of \$4.23 billion.



[Source: Siasun “Spot and welding System”]

AI applied to distribution

AI in China’s manufacturing industry has recorded an unprecedented success in Logistics and Warehousing. Geek+ leads the technology revolution by applying advanced robotics and AI technology to realize high-flexibility and intelligent logistics automation solution. Geek+ provides leading, reliable, one-stop enterprise-level service with strong technological strength.



[Source: Geek+ “Automated Forklift”]



[Source: Geek+ "Sorting Robot"]

Artificial Intelligence in Chinese Factories is accelerating economic development, and China's global competitiveness. With its biggest tech companies driving momentum for R&D, China is one of the leading hubs of AI development. Its vast population and diverse industry have the potential to generate huge volumes of data that can count on an enormous market. The wide adoption of AI technology in China's factories could be crucial to future economic growth as the nation's population ages, heightening the need to accelerate productivity growth. Some of the required building blocks include a more open data environment and well-trained data science talents.

AI IN TRANSPORTATION

Shaping the future of transportation

Artificial intelligence is redefining the value associated with automobiles. AI technology in transportation connects people, cars, and roads, leading to smart, ecologic driving. AI in the transportation industry is dramatically changing the course of history in the field of transport not only in China but also all over the world. Computational power and high-value data are the core strengths of the multi-dimensional transportation industry. AI uses in the transportation industry, such as self-driving cars, computer vision security at metro stations, and “Urban brain” traffic analysis, leads transportation towards an intelligent era. The negative effects of transportation such as accidents, congestion, pollution, etc. require new technology to make the industry safer, more comfortable, and environmentally friendly.

Applications of AI in China’s transportation industry

Intelligent transportation is the integration of advanced information technology, data communication, transmission technology, electronic sensing technology, control technology, and computer technology into the entire traffic management system. AI in China’s transportation industry goes beyond individual vehicles to include citywide and possibly nation-wide interconnectivity.

Computer vision replaces manual security checks metro stations

Security checks are an important daily part of Chinese subways and trains. However, a human normally has to operate the traditional security check system. The efficiency and accuracy of the check-in are vulnerable to human error.

To maintain constant efficiency and the accuracy, Guangzhou implemented AI in their public transport, “smart security” at three metro stations. After the users register the face scan system through their mobile phone app, they can quickly pass the device security check-in system by scanning their face or the QR code in less than two seconds.

Facial recognition in transportation, ticket-free train station experiments

In Shanghai, the railway station officially launched the real-name verification system supported by AI face recognition technology. Passengers holding the second-generation ID card can scan their face at the train station. When a passenger approaches the machine, it will automatically compare the passengers’ information with the photo on the ID card. Once the information is matched, the gate will open and the passenger is allowed to enter the station. Even when it is barely noticeable, AI in public transport will play a key role in facilitating the daily commute of passengers.

“Urban brain” of traffic analysis

By analyzing the urban traffic data and observing the real-time traffic conditions through the CCTV system, the “Urban brain” could optimize the traffic signal timing. In big cities, the traffic, with millions of people and cars, can become a serious issue for the livelihood of the denizens. Thanks to big data, AI technology in transportation can be much more accurate than human drivers. Currently, Huawei provides a intelligence transportation solution called “TrafficGo” and is leading innovation to improve the efficiency of the traffic in the target area. Huawei has conducted the first pilot project in Bantian, Shenzhen, whose results where described in the company's website as follows: “the delay of cooperative optimization vehicles in multi-junction areas has significantly decreased, surpassing the manual control level”. Another pilot project was conducted in Shangdi and Beijing, and whose results were reported as follows: “the average delay in the main direction of Shangdi’s third street decreased by 25.2%, which led to the average delay of surrounding roads decreased by 10-20%”.³³

AI uses in the transportation industry: Driverless vehicles

Apart from the computer vision security check system, entrance without a ticket, and “urban brain,” one of AI’s most notable applications in transportation is self-driving cars. In October of 2018, the Chinese Minister for Industry and Information Technology, Miao Wei, said at the World Autonomous Vehicles Conference “China is promoting the development of autonomous vehicles. By 2020, the Chinese autonomous vehicles market is expected to reach 100 billion RMB”.

Companies engaged in self-driving cars in China

At present, the autonomous assisted parking technology is relatively mature, and the application of AI technology in transportation is more and more popular. AI technology has entered the transportation industry from different perspectives. Daxue Consulting has conducted extensive research on the major companies in China’s AI transportation industry chain.

Intelligent transportation systems in Chinese cities

Guangzhou, Beijing, Shanghai, and Shenzhen are the first cities to launch self-driving vehicles in China. Municipal Transportation Commission of Guangzhou made it clear that it supports and encourages self-driving vehicles. As one of the first self-driving car companies approved by the Municipal Transportation Commission of Guangzhou, Weide successively picked up more than 3,000 passengers, covering more than 70,000 kilometers.

Smart transportation in China: Driverless vehicles applications

At present, the application of artificial intelligence in the field of autonomous vehicles includes mostly self-driving trucks and self-driving shared vehicles.

³³ TrafficGo description on HuaweiCloud.com

Self-driving vehicles in logistics

In the field of logistics, autonomous vehicle technology is applied to long-distance trucking and in-city delivery trucking. Driverless technology could reduce the number of accidents caused by human and saving overall costs. Suning and Jingdong announced that they had tested their L4-class unmanned heavy trucks in China and Silicon Valley.

The implementation of unmanned trucks mainly reduces risk in blind driving areas, poor maneuverability, and poor stability. These problems could be solved by artificial intelligence multi-sensor on-line calibration, multi-sensor fusion, remote sensing, refined modeling and control, and multi-objective optimization decisions. Once self-driving trucks are commercialized, they would reduce energy consumption, reduce workforce costs, and reduce the error rate caused by human drivers.

Shared self-driving cars in China

Shared self-driving cars in China are among the most useful future applications of AI. For now, private car ownership in China is only 5%, and younger generations prefer sharing cars/taxis. The concept of smart transportation in China grouped self-driving cars is in accordance with the trends. Human driving has many problems, such as the high cost, lack of parking spaces, safety risks, etc. However, shared self-driving cars, users could book through the application, and the nearby vehicle would come. Once the passenger finishes using the vehicle, it could automatically return to the parking lot. Even though current AI technology in transportation is not mature enough, in the near future AI uses in the transportation industry will certainly become more common.

AI IN FOOD AND BEVERAGE

The future of dining is here

The use of AI in the food and beverage industry in China allows players to save time in the production phase in order to focus on more creative solutions and research. Now robots exist in restaurants factories using AI in China, with the aim to make the daily life of Chinese consumers easier.

Restaurants are the next target of AI

According to the China Industry Information Network, China's catering industry reached revenue of 4.27 trillion Yuan (\$628 billion) in 2018, setting a new record. In this dynamic sector, the use of artificial intelligence is becoming more and more widespread. The Chinese e-commerce giants have embarked on the race.

Robots in restaurants in China

The most visible application of AI in food and beverage is the use of robots in restaurants in China. Chinese e-commerce giant JD.com plans to open 1,000 restaurants by 2020 where food will be prepared and served by robots.

Chinese robot chefs

A leader AI in the food and beverage industry is Xcafé, a restaurant opened by JD.com in Tianjin at the end of 2018. This 400 square meter restaurant can welcome up to 100 people ready to enjoy the dishes prepared by the robot chefs. The process is simple: one person supervises approximately five robots that are in charge of all the preparation steps. Receiving orders, choosing products, assembling, cooking and plating up, everything is done using artificial intelligence.



[Source: Jd.com/Xcafe – Smart restaurants in China]

However, the example of Xcafé shows us that robots are not yet managing restaurants alone. On the other hand, they can also still represent a big advantage; smart restaurants in China are becoming a real tourist attraction. Having cooks or robot bartenders is still something new around the world and a lot of chains are

promoting it to attract customers who are keen on high tech. In Shanghai, the Ratio recently opened its doors with an attractive concept: the bartender is a state-of-the-art robot that modeled after the arm and hand of a real bartender. Customers order on a Wechat mini-program and can see the robot prepare their orders in front of them. Of course, as far as human interaction is concerned, human managers are still there to answer customers' questions.



[Source: Ratio Café – AI in the food and Beverage industry in China]

Chinese robot waiters

The kitchen is not the only place you can find robots in restaurants in China. They are also in the dining room, interacting directly with customers to take orders and serve meals. Haidilao, one of the largest hotpot chains in China (the only Chinese food company with a revenue of over 10 billion) opened the world's first artificial intelligence technology restaurant in Beijing in 2018. A fully mechanized service with intelligent robots as waiters and a panoramic screen to order everything to enjoy your private custom-made hotpot experience.

"Our next goal is to be the most intelligent restaurant in Beijing, we are already conducting technical discussions. I believe that in 10 or 20 years, there will be no more people in hotpot restaurants, only two engineers who can take charge of everything"

- Zhang Yong (CEO of Haidilao)

In the dining room, humanoid robots navigate the tables to serve customers their orders taken on iPads. However, the restaurant is so big that there are still human waiters to take care of the 93 tables. In this case, it appears robots do not entirely replace restaurant staff, but rather serve as a novelty to attract customers.



[Source: SCMP – Robots in restaurants in China]



[Source: AFP – Robot.he smart restaurant in China]

Alibaba has also hopped on board with AI in the Food and Beverage industry in China with Robot.He. Following its New Retail project, the restaurant, located in the Shanghai suburb of Nanxiang is part of a Hema's store. In alignment with Hema's Retailtainment strategy, waiters are small robots that bring you dishes prepared by cooks.

Leverage big data to understand customer expectations

AI in the Chinese catering industry also makes it possible to predict customers' expectations and tastes in order to offer them an ultra-personalized experience. This is what the Chinese pizzeria chain *La Cesar* has set up.

By analyzing the data collected on Baidu, marketers can see what the current food trends are. The analysis of social networks or other applications such as Dazhong Dianping via web robots can also be very relevant. The idea is to analyze trends to create appropriate recipes and menus. Therefore, the restaurant is constantly changing its menu. This reminds us of the business model of major international clothing chains such as Zara, which relies on the continuous renewal of its collections.

Ask an expert

*“Nowadays there are **massive amounts of data** and **brains** can leverage this amount of data to understand what is the **potential** in these market segments, **understand** who are their target customers there, and then be able to **target them**.”*

Max Peiro, CEO of Re-Hub

Thus, the intelligent software combines searches, comments, and photos to create a list of the most frequently used keywords to produce a monthly report that serves as a basis for managers to create new recipes. This is how the cranberry smoothie became a success after a 2017 analysis showing the trend of sour flavors and cranberries during the summer. Another example is the durian pizza, which is the brand's best-seller.

In China, KFC also uses data to predict customer choices. Thanks to intelligent software that assembles the customers' faces and their previous choices, KFC is able to offer a choice adapted to each customer. The facial recognition technology was developed in partnership with Baidu.



[Source: The Guardian – AI in China's F&B]

AI used to ensure safety and hygiene

Beyond purely marketing applications, AI in China's F&B also can ensure kitchen hygiene. It has become a very sensitive subject in China since the 2008's melamine-tainted infant formula scandal. The relatively high frequency of such incidents takes a great toll on consumer trust. Artificial intelligence can be a solution. A camera-based system is currently being piloted in the Zhejiang city of Shaoxing to recognize poor sanitation habits of cooks. A camera system installed in kitchens is able to recognize 18 different types of health risks such as smoking, using your phone, not washing your hands or touching your hair. An alert is then sent to managers via a mobile app. The system also recognizes good sanitary habits such as disinfecting surfaces, using gloves, checking the temperature of refrigerators. This system based on motion and facial recognition can encourage employees to maintain good habits that would be financially rewarded. January 2019, approximately 1,700 cameras have been installed in more than 800 restaurants in Minhang district, Shanghai.³⁴ The food safety project is led by the Market Supervision and Management Bureau of Minhang, which will also receive alerts when cameras spot poor hygiene behaviours.

The advantages of AI in the Chinese catering industry:

- Rapid service, the average robots in restaurants are capable of processing up to 8,000 dishes each day
- Robots have more endurance than human staff
- Fun, attractive and novel
- No room for human error, protocols are respected bringing transparency for everyone
- An increasingly important database for marketers and the beginning of the era of extreme personalization

However, currently the price of a robot remains too high for AI in the Chinese catering industry to become mainstream. For a restaurant to employ a robot worker, it must pay about 50,000RMB for each robot and then several hundred RMB each month for its upkeep. To compare, a waiter in Shanghai would cost between 3,000 to 10,000 RMB per month. While facial and speech recognition systems can be profitable, robot restaurant managers are not yet ready.

AI in food delivery in China

Delivery drones in China

A famous application of AI in the food and beverage industry in China are delivery drones. These are supposed to facilitate the process of meal transport to the country where food delivery apps have an estimated 355 million users³⁵. However, the

³⁴ Minhang District Market Supervision and Management Bureau, EFE.com

³⁵ China food delivery market analysis, iiMedia Research

introduction of drones requires the creation of air routes over cities. A trend that is still being tested today and which causes a real problem of competition between the different brands. Ele.me, China's largest delivery application with 260 million users and 53.4% market share was the first to receive government approval to work on the first air routes for delivery drones. Thus, 17 roads have been approved over Shanghai, in the Shanghai Jinshan Industrial Park. This should benefit more than 100 restaurants in the area. The Ele.me drones used during this test phase are capable of carrying up to 6 kilos and flying at a maximum speed of 65km/hour. The trend is gaining momentum with China's e-commerce platform JD.com also entering China's drone delivery market with a license to experiment with delivery drones in Shaanxi Province last year.



[Source: Pandaily – AI in food delivery in China]

How automated food delivery is breaking records

While drones can become the solution, for the time being, other AI-based software and systems are being used. That is how Meituan Waimai, commonly known as Meituan, which controls 40% of China's food delivery market, developed its AI-powered Super Brain, a system to automatize food delivery in China. The system aims to ensure the best delivery times at any time of the day or night and under any weather conditions. Everything is based on data: artificial intelligence analyses data before, during and after delivery to always improve. The aim is also to offer customers a very accurate estimate of delivery time in real-time. This is how Meituan Waimai promised to break all delivery records in China.

Controlling the food supply chain

It all starts in the fields

Artificial intelligence has also made its entry into the world of agriculture in China. Thanks to cloud-based agricultural intelligence, farmers are now able to improve their yield and the quality of their product. Alibaba recently launched its "ET Agricultural

Brain" in Shanghai, a powerful intelligent software based on big data that will change the lives of Chinese farmers. The AI is able to record all the production details to regulate the full life-cycle of production. Vegetable and pig farmers have already started using the program. This is the case of Tequ Group, a pig breeding company based in Sichuan that has been using Alibaba's technology for several months to raise its pigs. So each pig has an identifier that allows them to set metrics, to see which pig is sick, which pig is fertile, reducing mortality rates.

How robots perform quality assurance

The second step of the process is the establishment of AI in factories in China. This is primarily used to improve machine performance and ensure quality. For example, the AI modules from EZ Robot Inc. have improved production efficiency, inventory turnover, and equipment utilization across China. However, more recently, a new type of robot has appeared in factories using AI in China: Taste-testing robots. Powered by artificial intelligence, they aim at guaranteeing the quality of some mass-produced Chinese food such as pork belly, black rice vinegar, fine dried noodles, etc. Humans previously performed this job and the process was slow. Thanks to robotic tasters, the assessment will not vary from one person to another. According to the report of the China National Light Industry Council, the Chinese food manufacturers that have taken part in the government-funded AI-tasting program have received positive feedback. The robots can also check that all the food has the same color, smell, and taste. Finally, AI in factories in China can also sort ingredients. Food sorting is indeed a very time-consuming step in factories because human hands carry it out. However, with artificial intelligence and especially image and motion recognition systems, factories using AI in China can accelerate this production phase. Products can be sorted by size, color, and freshness.

Ensuring transparency for the customer

If AI in the food and beverage industry in China can directly serve the interests of customers, it is in the tracking of the supply chain. Mengniu Dairy, China's second-largest dairy company is embarking on an effort to bring the centuries-old industry up to date using AI in China's F&B. In the dairy industry, in particular, the whole process is very delicate and the temperature at each stage of production must remain the same. Mengniu is now collaborating with Alibaba to use AI to analyze the supply chain, to gain information such as where to manufacture products and where to collect milk, as well as how products can be transferred to customers with maximum efficiency. Alibaba has indeed big plans to integrate food-tracking blockchain technology into the supply chain in its stores. The company undertook a traceability test conducted last year to track the origins of a package of mangoes thanks to AI. It took only 2.2 seconds compared to 6 days and 18 hours using traditional methods.

Companies that use AI in China's food and beverage industry

ZhongAn Technology

ZhongAn Technology, the tech subsidiary of Chinese Insurtech giant ZhongAn Online, is a FinTech company focusing on the research and development of technology in blockchain, AI, big data and cloud computing. ZhongAn Technology has already worked on a technology relying on blockchain farming to provide a more transparent food supply chain. They applied blockchain in raising free-range chicken in rural areas. Their project called "Go go Chicken" is already working in more than 200 farms in Anhui, Henan, Guizhou, Shaanxi, Gansu, Hainan, and other provinces. By 2020, it will land in around 2,500 farms in China.

EZ Robot Inc

EZ Robot is not only specialized in AI in China's F&B but in high-performance robots more generally. They are known for their robots in education and how they are able to interact with children but their robots can also be used in the catering industry. Indeed their robots are controlled remotely and adjusted by Wi-Fi and can have vision tracking, speech recognition, artificial intelligence, 3D printing, etc.

Hongbo Zhicheng Technology

Hongbo Zhicheng Technology is a Chinese start-up based in Shenzhen that creates "stir-frying robots", i.e. a kind of equipment that automates cooking, such as automatic woks. They are the AI partners in China of some of the biggest names in the F&B industry such as Haidilao or the Japanese fast-food franchise Ajisen Ramen. If you need their robotic solutions for canteens, schools or other facilities, they can also be a good solution. In addition to their machines, Hongbi Zhicheng Technology is developing a research lab in Chinese cuisine to see how robots can improve in Chinese techniques. They have also developed a digital database of recipes for several hundred Chinese dishes.

Infinite Food

Created in 2015, Infinite Food combines food and robotics. The company's core product is a vending machine that prepares and distributes meals on-demand. The strong point is that robots are able to work correctly with fresh products. Today, the company is still looking for ways to improve its product and considers it a "restaurant in a box". It is possible to rent or buy this product.

Despite all these innovations, many people remain doubtful about the use of AI in the food and beverage industry in China. It raises the question of the standardization of Chinese food and the end of creativity in cooking. This calls into question the culinary arts and the profession of chef and waiter. Do robots in restaurants in China mark the end of conviviality? In any case, they undoubtedly help to bring a little transparency into the production process, from the farm and factory to the consumer's plate.

AI IN VIDEO GAMES

Taking 'computer player' to a whole new level

Over the past decade, artificial intelligence has proven to be the driving force behind the next phase of the evolution of video games. China recently officially recognized gaming as a profession, has not hidden its intentions to become one of the leaders of this industry. So, how do big names use artificial intelligence in China's video games?

The use of AI in China's video game industry

Of course, the first application of artificial intelligence in China's video games aims at improving the gaming experience. For example, Tencent, NetEase, and Changyou, who are the leaders in the Chinese video game industry in 2019, have all used a speech recognition system to improve gaming immersion. This allows players to convert their voices into texts or instructions in the game and keep their hands free. As far as mobile games are concerned, the advances in artificial intelligence are rather the same, and fortunately given the size of the mobile game market in China. According to the iResearch Institute, the size of the Chinese mobile gaming market was more than 100 billion RMB in 2018.

One example of an AI mobile game is Caihua Xiaoge (猜画小歌) which employs image recognition technology. The challenge for players is drawing pictures accurately so the games image recognition algorithm can recognize what the picture is. If the computer can correctly identify your drawing, then you move onto the next stage.



[Source: Sixthtone – Caihua Xiaoge, AI in China's video games]

Intelligent recognition can also enforce regulations in the video game industry. Tencent announced last year that it would use facial recognition to manage the hours players spent in front of the screens, especially for young players. This artificial intelligence system aims to limit the playing time of children under 12 to two hours

per day. Tencent thus records the players' faces and thanks to national data, blurs the game screen or blocks the connection. This system has been implemented on the multiplayer online battle game Honor of Kings, one of the most popular video games in China. After several trial phases where Tencent realized that thousands of Chinese children were trying to divert the limit, the company decided to apply this age restriction system to 10 of its most popular games.

AI in esports

Artificial intelligence is also used in China's esports industry. In 2018, China's eSports industry was worth more than \$13.8 billion, an 18% increase over the previous year. According to the Chinese Gamma Data Institute, the total number of players has also exceeded 400 million. Indeed, AI in esports in China can help to improve the playing tactics of professional gamers. This is the case of the artificial intelligence designed by Tencent's AI team to beat the professional players of Starcraft II. Starcraft is a very popular game in China (星际争霸) and has four teams of well-known professional players who participate in international tournaments representing the country. Thus, the defeat of the professional players TLO and MaNa (German and Polish) against artificial intelligence shocked the gaming community in China. It also means that today, artificial intelligence in China's video games has advantages for the professional industry: it is a new way to train players.

AI in video games creation

In China, artificial intelligence is also used to accelerate or improve the video game creation process. First, when it comes to working on NPCs (nonplayer characters). Artificial intelligence in China's video games, therefore, makes it possible to make the behavior of these fake characters more natural and reactive to the players' actions. NPCs can either have simple reactions based on a predefined sequence by the computer or react differently to each player's action.

However, we know that today's great adventure video games, even with a large budget, do not always use this type of AI. The risk is that artificial intelligence makes NPCs too unpredictable and that it ruins the game's history written by creators. Thus, until creators have found a middle ground for the use of artificial intelligence in China's video games, NPCs that are smarter than players are yet in store for tomorrow. For the moment, artificial intelligence is mainly used to make the graphics and movements of characters as realistic as possible, like in the Tencent video game, Ring of Elysium, known and loved for its very high-quality graphics. In addition, the use of AI in video games can reduce some production or testing costs.

Evaluating artificial intelligence with video games

Not only can AI help develop video games, but video games can also help program AI. Researchers around the world are working with video games to help machines develop. The aim is to use the virtual schematics of video games to test the skills of intelligence systems when it comes to, reacting to the environment and learning from their mistakes. One example is using a virtual driving game to test autonomous cars. Tournaments between gamers and artificial intelligence also test the power of an

artificial brain against a real human brain. In China, in 2016, Google's AlphaGo algorithm faced one of the best players in the world's Go game, Ke Jie.



[Source: Wu Hong/EPA – Testing AI in China]

The victory of this artificial intelligence is proof that games and video games are an excellent way to test, because they provide structure, repetition, and reinforcement. Therefore, video games have been used for decades in China as a means of testing and evaluating the power and performance of artificial intelligence systems in situations that mimic reality.

The success of VR games in China

A large market expected to reach 45.09 billion USD

Of course, artificial intelligence is at the heart of the latest success of the video game industry in China: VR games. According to Grand View Research, the virtual reality game market size in China is expected to reach USD 45.09 billion by 2025. An 'immersive' game experience where players put on a VR headset and use controllers to maneuver around the virtual world. Horror, adventure, strategy, dance, and even flight or travel simulations are available. The success of VR games in China is so big that everything is a pretext to use virtual reality. Recently, a VR game in China went viral on Weibo. A game that allows Shanghai residents to practice sorting waste just before the new law on waste sorting is implemented in July 2019. The principle of the game is probably one of the simplest in the world. However, it was a great success; some people even made long queues to play.

VR facilities on the rise

Despite the success of VR games in China, the purchase of personal headsets is too expensive for most Chinese people who are not big gamers. People who want to try VR games in China must find places where it is possible to play at a lower cost. This can be in shopping malls where more and more activities are offered in VR, in cafés or even in cinemas. Amusement parks are also an excellent place to test VR activities,

as highlighted in the HTC Vive report, which showed that 70% of respondents were interested in attractions with VR in amusement parks. This success has also resulted in the opening of VR facilities, spaces dedicated to VR activities and VR games in China. According to a recent report by the iFanr Institute, in 2018 there were 50,000 VR arcades in China. Among them, there are two big names which have made their fortune thanks to this VR arcade concept: Seekers VR, which is based in Wenzhou and owns a franchised chain of 200 arcades in more than 70 cities across the country and Xigua which has nearly 100 "Player No. 1" VR arcades across China.

In Shanghai, players have many options of VR facilities, so competition is becoming tense, and the criteria are often price-oriented. Here is a list of the best competitors, with an idea of the price for each:

- MacHouse: A sizeable bright space which looks like an old bowling alley from the 1980s, equipped with the HTC Vive. Price: 388RMB for two people for an hour
- Mofamen: Friendly atmosphere, equipped with the HTC Vive Pro, in bonus the green background to animate the player into the game. Price: 119RMB per person for an hour
- Joy's VR: Large choice of VR games and VR headsets, HTC Vive Pro, Oculus and PlayStation VR. Price: 170RMB per person for an hour
- VR+: An arcade with rooms adapted to the game you want to play (example playing a horror game in a bloody fake prison). Equipped with the Oculus Rift. Price: 48RMB for a 20-minute game
- Star Trek: A VR facility around the StarTrek theme. Price: 98RMB for an hour
- Chuangyi Zhigu VR: An arcade built in a large apartment with a wide choice of VR systems. Price: between 98RMB and 128 RMB for an hour
- VR Better: A VR facility on the theme of science fiction in an apartment where you can also drink and eat. Price: between 100RMB and 128RMB for an hour
- Qingxing Mengjing VR: A place at the forefront of the latest VR innovations in a more natural environment. Price: between 87RMB and 138RMB for an hour.

Top VR headsets in the video games industry in China in 2019

However, the VR headsets market is still growing and unfolding many opportunities. In its Global Entertainment and Media Outlook 2017-2021, PwC found that China's demand for VR headsets would reach 85.9 million within five years, overtaking the US's projected 68 million. When asking Chinese gamers which criteria are the most important when it comes to VR headsets, comfort comes in first place with 46%, then following screen resolution with 44%, convenience 40%, good content 40% and precise control 40%. Thus many international players are fighting to win the hearts of Chinese consumers, including HTC, Oculus, and Sony. For example, the best-selling headset in China is the HTC brand, which alone takes 33.1% of the market share of the Chinese VR headsets market. However, major international brands such as Oculus and Sony are finding it more difficult to penetrate the Chinese

market. Oculus only launched its VR headset in China in January 2018. After HTC, domestic players dominate the market.



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[Source: HTC Vive website – HTC headset to play VR games in China]

The second and third most popular VR headset providers in China are Pico and DPVR with 28.5% and 13.3% of VR market share, respectively. More recently, the Chinese video platform iQiyi also released a new VR headset called Qiyu 2S.

AI companies in China's gaming industry

Companies in gear

ANTVR

ANTVR is a Chinese company dedicated to VR and AR systems. After a round of investment, thanks to Sequoia Capital, the company founded in 2014 has sold more than 1 million VR products worldwide. Several collaborations with brands such as Lenovo, One Plus, and Motorola make it an excellent AI partner in China. One of its flagship products is its technology made for VR game in China called ANTVR Cyclop, which features the latest technological innovations and is compatible with Steam. In addition, ANTVR open sources its hardware for developers to create games for the kit.

DPVR

DPVR is today considered the world-leading VR technology company. Based in Shanghai, its products have been sold across more than 100 countries. Since its foundation, the company has received investments from many listed companies and investment institutions such as Xun Lei technology, Kai Ying technology, and Ao Fei which proves its potential as an AI partner in China. Through research and

innovation, DPVR aims to build user-friendly VR Products and solutions for everybody to easily enjoy the VR gaming experience.

The company develops headsets for video games, movies, and music but also complete kits dedicated to playing VR games in China such as the E3 Polaris:

According to the research institute Canalys, with 24% market share, DPVR accounted for the largest market share among the mainland China VR brands. So it is also a very good choice if you want to partner with an AI company in China.

Pico

Pico develops innovative VR products which enable users to experience VR easily. Founded in 2015, Pico is now huge all over the world (US, Europe, China, Japan) with over 300 team members. The company has developed its own platform called the Pico Digital Platform, which features games, apps, and videos from a variety of developers and publishers. They have around 150 apps and games available and can work directly with developers who want to create a game or app for Pico devices, convenient for an AI partner in China. One of their best products is the Pico, which is an all-in-one VR headset which offers real freedom in the gaming experience. It enables movements in all directions, which is perfect for games with total immersive VR experience without wires or phones.

Companies in technical savoir-faire

Dgene

Dgene, founded in May 2016, is a VR solution provider based in Shanghai. The company has worked in different industries such as real estate, education, tourism, healthcare, and of course, digital entertainment.

Dgene develops VR solutions with light-field technology to provide 360 3D reconstructions. It's an imaging technology which would be very useful as an AI partner in China to work on ultra-realistic reproduction of real-world for video games. The company won 100 million RMB funds from IDG Capital in 2018 and also received 1 billion-dollar fund, from Alibaba (co-investors: Safran Fund; GSR Ventures Venture) and angel funds of 45 million RMB from Shanghai United Investment. It means that today Dgene has a lot of plans to develop and invest: they plan to expand the 3D reconstruction technology into our mobile phones via the camera.

Realis

Realis offers an optical camera tracking system for virtual reality. It works like a target tracking software which can be based on multiple cameras to obtain the right two-dimensional data and real-time calculation. Their system uses cameras to capture the data to identify the trajectory of tracking objects. They can be a beneficial AI partner in China because their cases include gaming, and they offer installation as well as packaged equipment rental program. With years of research and development overseas, their team is able to develop independently low-latency and high-accuracy VR solutions. As a potential AI partner in China, Realis has previously

worked in the video games industry in China producing PVP games with multiple players at the same scene. They are now working on the future of VR games in China: offsite online VR gaming. Players in different cities will be able to play together in the same VR battle.

The use of artificial intelligence in China's video is expanding rapidly. Its interest is that it can be used for many different things, whether to improve the gaming experience and game creation or to help machines learn and grow. Gamers in China still see AI in video games as something very innovative and therefore attractive. Additionally, the recent wide-scale adoption of 5G networks is expected to further boost the VR development. This promises to be a great time for VR video games and AI applications in the Chinese ludic industry.

AI USAGE BY PUBLIC INSTITUTIONS

Modern tools for managing humanity

"The dividend of government policies is a key factor behind China's AI development."

- Robin Li, Baidu co-founder and CEO

One of the Chinese government's greatest ambitions, with the Communist Party at the forefront, is to make China the world leader in artificial intelligence and the world's first innovation center by 2030. The Chinese government established the Next Generation Artificial Intelligence Development Plan (AIDP) in 2017. The financial resources dedicated to this new plan are equal to China's ambition: \$22 million per year, a sum that contributes to a budget that should reach \$59 million by 2025. China's AI development plan prioritizes research and innovation in applications of AI in the Chinese military and defense industry, as well as insecurity and surveillance. The aim is to become the world's first innovation center by 2030.

Champions at the forefront of innovation

In 2018, the Chinese government took a major step forward in China's AI development plan by announcing that China's technology giants Baidu, Alibaba and Tencent (BAT) along with leading facial recognition companies Flytek and SenseTime, officially became China's "AI Champions." This new position benefits technology companies by ensuring them a position at the forefront of the innovation race, freeing them of the competitive threat of state-owned enterprises. However, collaboration with the government on national security and military applications of AI in China is the price to pay for this strategic position. The Chinese government has specifically entrusted certain tasks to the local technology giants to achieve its Development Plan. Alibaba Cloud must dedicate its research in AI for Smart Cities, Baidu in the sector of autonomous vehicles, Tencent in medical imaging, and iFlytek in voice recognition. The Chinese government has also set up a Strategic Advisory Committee made up of leading technology universities, the top AI experts in Chinese technology start-ups and "AI Champions." The "Made in China 2025" plan is another essential plan, which aims to increase China's autonomy in AI, and reveals how it has become a national priority for the Chinese government.

Public and private: Dual use of AI technology in China

The use of AI in China essentially implies a dual-use factor: both actors from the public - the Chinese government- and private sector benefit from the synergies of the interdependence relation. For example, the same technology that powers autonomous vehicles can be used in commercial vehicles in the same way as in military AI-enabled drones in China. On the other hand, the company that specializes in natural language analysis and automatic translation, YaTrans, collaborates with the Chinese government on counter-espionage by making its NiuTrans system available to the Ministry of State Security. Similarly, computer vision is widely used in facial recognition in China for commercial purposes and is also used for military applications, including automated image analysis. There is then a military-civil fusion approach elevated to the level of "national strategy" that allows China to transfer

dual-use technological advances. The government promotes resource sharing and institutionalizes links between the People's Liberation Army, the defense industry, the private sector, and universities.

AI innovation in China needs for data

In addition, AI technology works based on an enormous amount of data. China is the country with the most potential for AI development, mainly because of its wealth of data to train AI systems. China is on track to have 20% of the world's data by 2020 and 30% by 2030³⁶. With fewer obstacles to data collection and dissemination, China is accumulating an unprecedented database. With increasingly powerful computers, new algorithms, and an extensive database, China becomes the country with the most advantages to lead the development in machine intelligence. The 800 million Chinese Internet users and 700 million smartphone users are the keys to China's AI development.

AI security systems in China allowing the government access to data

To obtain such amounts of data from the Chinese population, in 2017 the Chinese government enacted a law on personal data and cybersecurity requiring all companies, both domestic and foreign, to make all data collected from users available to the government.

Data allows the Chinese authorities to know and track the population: location, customs, political opinions, affinities, sociability. Similarly, it feeds the AI algorithms that will be able to refine their precision in facial and voice recognition, and in identifying suspicious behavior. In turn, as AI technology is largely owned by private companies, commercializing it in the market is always an option, or at least is what the authorities say. Article 7 of China's National Intelligence Law gives the Chinese government the authority to obtain any assistance and cooperation from tech companies to Chinese military and security services. The Chinese government is increasing the pressure on technology companies, subjecting them to intense scrutiny. According to press reports, companies have noticed a growing pressure to fall in line with Beijing's mandates during 2018. Likewise, public and private sectors are united in a close relationship of dependence: the needs of the Chinese government in security and military direct the R&D investment in tech companies. The latter can develop AI devices thanks to the entry of vast amounts of data, partly made available by the Chinese state.

³⁶ Battlefield Singularity: Artificial Intelligence, Military Revolution and China's Future Military Power, Elsa Kania, Center for New American Security, 2017

MILITARY APPLICATIONS OF AI IN CHINA: THE ADVENT OF UNMANNED WARS

Development of AI in the Chinese military is a state priority

The Chinese government's AI development plan (AIDP) strategy states that the country will promote all kinds of research to lead innovation in national defense. The Chinese People's Liberation Army (PLA) sees the transformation of today's informative ways of warfare into future intelligentized warfare a source of national advantage for China. AI in the Chinese is a priority, and this strategic vision makes it easier for the PLA to achieve its desired capabilities by using breakthrough AI technology from the private sector. China's state-owned enterprises dominate its defense industrial base, which Jane's - a journal specialized on global defense industry- rates as the most advanced in the Asia-Pacific region. According to the official PLA, dictionary defines an "artificial intelligence weapon" as: "a weapon that uses artificial intelligence to automatically pursue, distinguish and destroy enemy targets; it is often composed of information gathering and management systems, knowledge base systems, assistance to decision-making systems, mission implementation systems, etc.". Today, the PLA funds a wide variety of AI projects, and the Chinese defense industry collaborates with many private tech companies in an extensive R&D program. Among other military applications, the PLA hopes to improve its future capabilities by leveraging AI to create intelligent and autonomous unmanned systems, intelligent support in command decision-making, data fusion, and information processing. Without wishing to establish an exhaustive list, the following are an example of military applications of AI in China.

Autonomous weapons in China: Unmanned Aerial Vehicles (UAVs)

Unmanned aerial vehicles (UAVs), also known as drones, are intelligent autonomous weapons with AI-integration. The intelligent drones in China are mainly used by the military, as it is supposedly forbidden for commercial use. Thanks to the speed and accuracy of identifying potential threats and transmitting information to military bases, the use of UAVs reinforces military efficiency. No need for pilots, drones can attack remotely by pressing a single button from the operation center. During the 12th China International Aviation and Aerospace Exhibition in November 2018, China presented its latest stealth combat drone model. Conceived by a state-owned company, the CH-7 is a UAV the length of a tennis court with a 22-meter (72-foot) wingspan. In addition, also shown at the exhibition was the TYW-1 is a high-altitude, high-strength UAV used by PLA Navy (PLAN) and PLA Air Force (PLAAF) primarily for reconnaissance. The Chinese defense industry is beginning to incorporate higher levels of autonomy into its UAVs: it can operate with a high degree of automation, taking off and landing independently and involving minimal human intervention in tracking and attacking targets thanks to the weapons incorporated.



[Source: Phys.org “The Blowfish: a UAV with AI technology in China. AI used by the Chinese government”]

Unmanned Surface Vessel (USV)

In 2018, the state-owned China Shipbuilding Industry Company (CSIC) launched the Marine Lizard, which is not a UAV, but an autonomous amphibious landing vehicle, a type of USV. The vehicle can be used for protection in an amphibious assault force, providing anti-aircraft support with armaments and avoiding an obstacle, and its weapons are controlled remotely.

Military Command decision-making in China

Another field where the PLA is expanding military intelligence in China is on military command decision-making that takes advantage of the potential of AI, as well as big data, cloud computing, and machine learning. Leveraging AI in improving military capabilities in command decision-making introduces a uniqueness on the battlefield, where human cognition will no longer be able to keep pace with AI in future wars. AI technology supports commanders' decision-making on the battlefield through advanced prediction, option, and impact assessment capabilities. The PLA is leveraging AI technology to “enhance” decision-making of fighter pilots or commanders of submarines.

AI and Cybersecurity in China

Military computer systems are vulnerable to cyberattacks, which can result in the loss of classified military information and damage to military capabilities. However, AI-equipped systems can autonomously protect networks, computers, programs, and data from unauthorized access. In addition, these AI security systems in China can anticipate cyberattacks by logging patterns, allowing counter-attack tools to be developed to deal with them.

Current research of military applications of AI in China

The PLA is working in partnership with many academic institutions and AI expert companies for the support of the dual-use of AI in China and military research. Hoover Institution makes an extended description of current research projects in AI in the Chinese military:

- Using AI-enabled image processing and target recognition technology to detect ships in satellite imagery.
- Using machine and deep learning for the analysis of underwater acoustic signals.
- Implementing an AI decision-support system on nuclear submarines.

AI used by the Chinese government in surveillance and security

Video surveillance AI-technology in China

Hikvision, owned by the China Electronics Technology Group Corporation's (CETC) 52nd Research Institute, has pursued collaboration with the PLA to provide its AI-enabled video surveillance technology for national defense and security purposes in China.

Facial recognition in China: tech companies working for the state

Face++, Megvii's powerful AI-enabled devices

Technology start-up Megvii was founded by the Chinese government to collaborate with the police and law enforcement. Its Face++ facial recognition device is designed to find criminals, detecting faces by analyzing data with facial points, and confirming the identity of the person with extreme precision. The system is powered by data provided by the government: China has a pervasive surveillance network with 170 million security cameras in its Skynet system and 400 million more in the pipeline. Moreover, Face++ is an open platform where any developer can create their own app, contributing to data sharing. Face++ becomes the most extensive facial recognition platform in the world, with more than 300 thousand developers from 150 countries using it.



[Source: NYT "Skynet, the government's powerful surveillance system in China"]

Isvision

China is building the world's most powerful facial recognition system, ambitioning to identify any of its 1.3 billion inhabitants in less than three seconds. The system Isvision has been developing the system since 2015, a Shanghai security company, in collaboration with the Chinese Ministry of Public Security. The system connects to the police and their database of suspicious citizens, allowing them to be recognized and tracked. Isvision AI-powered facial recognition devices have already been installed in some areas in Beijing, and in Xinjiang and Tibet, where conflicts persist.

SenseNets

SenseNets was established by video surveillance company NetPosa Technologies and AI start-up SenseTime in 2015. SenseNets is also part of the government's Skynet project, the national system for fighting crime and preventing potential disasters in China. It specializes in three types of systems: **facial recognition**, to identify potential suspects and fight terrorism; **crowd analysis** that facilitates and accelerates decision-making; and **human verification** to compare facial images with ID card identity photos.

LL-vision

In March 2018, local police in Beijing tested a new surveillance device: smart glasses with facial recognition and car plate identification, that then match the data in real-time with a suspects' database, or a "blacklist," according to Reuters. The AI-powered glasses are manufactured by the AI start-up LLVision, that collaborates with the government on security matters, or as LLVision CEO Wu Fei says, in "noble causes" (Reuters).

China's success in artificial intelligence brings economic growth to the country through investment and talent as well as the development of economies of scale. There is a boom in the number of AI companies and start-ups in China, innovating

relentlessly, and widely selling its technology across many industries (Know more about the AI landscape in China in Daxue Consulting). While most of the AI companies in China collaborate with the government within the dual-use strategy, some of them are selling military and security technology abroad. For example, DJI, the Chinese company world leader in consumer drones, was selected as the sole drone provider to the New York Police Department. Moreover, China has become the primary exporter of UAVs with clients in the Middle East, such as Egypt, Iraq, Saudi Arabia, and the UAE. Ziyang UAV's attack helicopter drone Blowfish A2 is gaining increasing interest in the Middle East. China does not seem to want to slow down the development of lethal autonomous weapons. However, there have been concerns from within the Chinese government to avoid an AI arms race, and Alibaba's chairperson said that new technology such as artificial intelligence could lead to World War III. Despite these concerns, the Chinese leadership continues pursuing global AI primacy and its use in the military and surveillance.

AI IN ADVERTISEMENT

AI is changing the future of advertising

In 2016, the Chinese government committed its Three-Year Guidance for Internet Plus Artificial Intelligence Plan (2016-2018) focusing on economic improvement. 2016 was the first year of AI in China's advertising industry. Before this, advertising in China gradually completed the intelligence evolution of value war. The evolution consisted of three steps: In the 1.0 era, advertisers competed in the number of advertising resources and resource coverage; then, the focus of advertising in the 2.0 era shifted to the form and clarity of the display; finally entered the 3.0 era of big data applications.

By 2018, the impact of AI on advertising in China is impressive. The size of the mobile advertising market in China had exceeded 400 billion Yuan, with a growth rate of nearly 50%³⁷. With the landing of AI in the Chinese advertising market, the realization efficiency of mobile advertising is effectively improved, leading to further growth of the advertising market.

Ask an expert

*"I'm happy to say that I see in at least the past year, that there are much **less fake ads** in China. There's more safety in programmatic advertising in China for media buying in China. There are so many companies doing verification, viewability, and advertisers can feel much **safer** in the programmatic world today."*

Shimi Azar, General Manager of Spotad

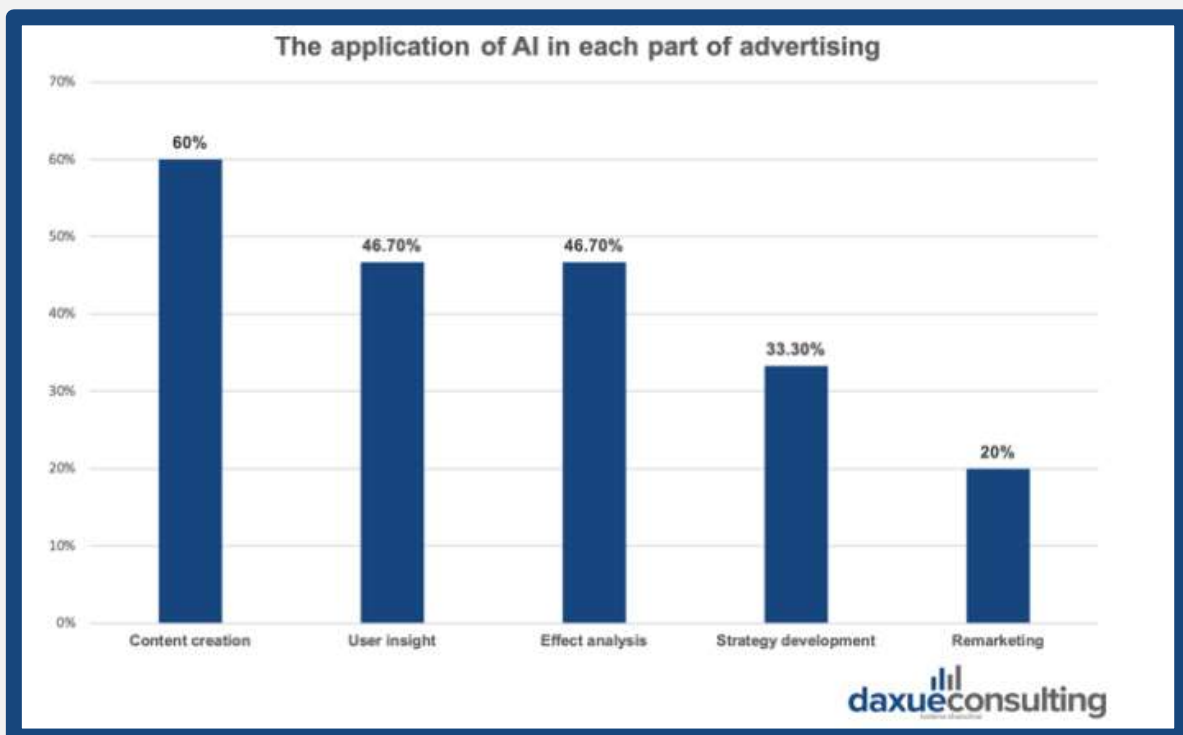
Changes in China's advertising industry – AI and Big data as new focuses

With the continuous development of the marketing industry, the traditional advertising model is no longer adapted to this environment. Under the premise of fragmented user time, problems such as unsatisfactory advertising ROI, and unclear target users are constantly magnified. At the same time, the viral delivery mode and single content form will inevitably cause users to have fatigue, which will reduce the interest in advertising. Additionally, the efficiency of media resources and traffic management urgently needs to be improved. To improve the effect of customer collection, and transformation, AI advertising in China combines technology with marketing to provide more creative content based on substantial user characteristics. AI advertising in China is at the frontlines in AI adoption and innovation. The application of AI in China's advertising industry can bring richer user labels, more

³⁷ 2018 China's AI in Marketing Industry Status and Development Trends and Predictions, China's Industry Information, chyxx.com

advanced crowd expansion technology and optimized click transformation of the target population. This effectively improves the advertising experience for both the advertisers and the target market by reducing unwanted ads and unwanted targeted audience members.

Several marketing pain points of China's traditional advertising industry are the balance between the amount of ads and the user experience; user engagement; user retention; product differentiation in the Internet media. Therefore, advertisers are focusing on the role of data and technology to solve the pain points in digital marketing. Currently, the majority of advertising spend is digital, and AI advertising in China thrives on massive data sets available in China.



AI exists throughout the whole marketing process

According to a survey about AI in China's advertising industry by ibaogao, 60% of advertisers have used AI for content creation. Besides, the proportion of 'user insight' and 'effect analysis' both equal to 46.7%. Meanwhile, other application landings that the main attempted have been "strategy development" and "remarketing."

Thus, three stages of advertising with applications of AI in China's Advertising Industry can be highlighted: the ad creation stage, the ad serving stage, and the ad detection stage. These three advertising phases also correspond to three dimensions content management, traffic management, and data management, respectively.

AI in Ad creation

The stage of ad creation includes hot topic matching, creative mass production, creative screening tests, and material integration and adaptation. With the application of AI in Ad creation, advertisers can realize the standardized production of primary creative ideas and quickly enter the release process: realize the automatic

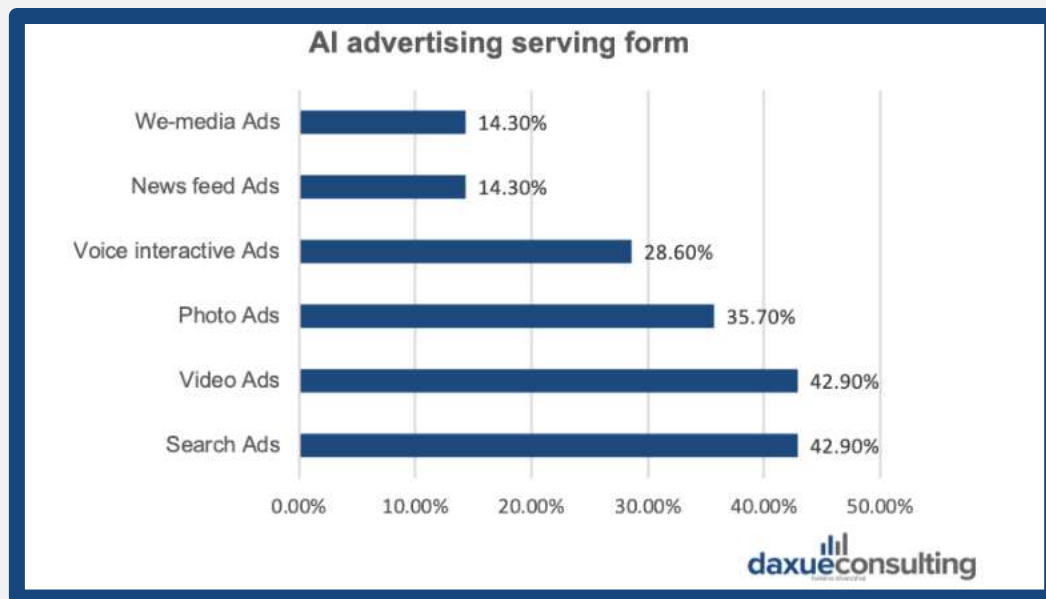
output of AI for standardized copywriting, design elements, graphics, text, etc. An AI-powered system can create ads for advertisers. The function has appeared on some social media platforms. Based on the links you promoted, those platforms apply intelligent automation features to suggest which ads you should run. An AI-powered system exists in some third-party tools that use smart algorithms to write ad copy for advertisers. These systems use two AI techniques: Natural Language Processing (NLP) and Natural Language Generation (NLG), to write ad copy in seconds.

Alimama is a Chinese data-powered marketing technology platform of Alibaba group. Based on the core business data and super media matrix of Ali Group, it empowers brands to provide products and marketing platforms with AI in Ad creation. In 2018, Alimama launched an AI copywriting product at Cannes international creative festival. It combined Taobao and Tmall's massive amount of content with a natural language algorithm. Alimama has achieved three core competence-simulating human-written proposals, real-time online sample learning, and high writing quality. The production capacity of this AI product has reached an impressive 20,000 pieces per second.

AI in Ad serving

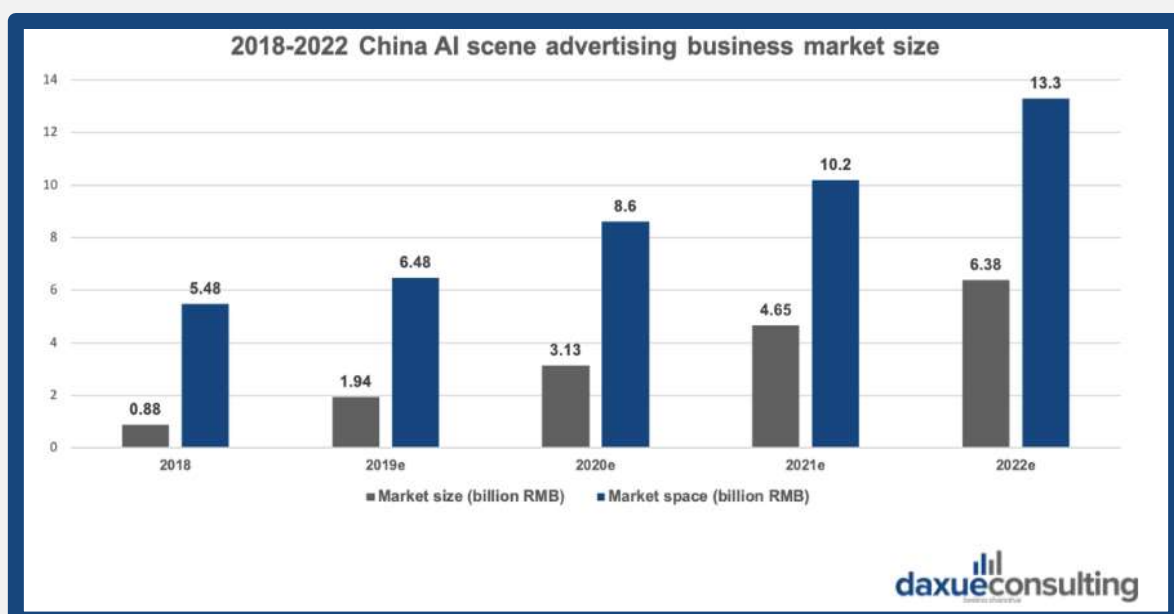
Ad serving is the process of advertisements disseminated to the audience. AI can help provide accurate communication and improve return on investment. AI in ad serving has three functions, namely scene identification, user identification and understanding, and advertiser identification. Firstly, AI in Ad serving provides scene-marketing power. This can be achieved by access more diverse data and modules, then providing richer user portraits for AI, to improve the accuracy of delivery and reduce budget waste. Additionally, anti-cheating technology can identify false traffic, thereby improving the transparency and authenticity of the delivery.

There are many combinations of AI in Ad serving forms. Among them, search ads and video ads are the most popular forms, 42.9% of advertisers choose them as the form of advertising. Nowadays, video is the most popular ad carrier in China. Two mainstream video delivery methods include Big IP and DSP (Demand Side Platform). Big IP is now the core of brand advertising in the video field, such as TV series advertising. Big IP creates a lot of traffic, but the cost of sponsorship is extremely high. The other method is DSP, also known as the precision crowd. It sends ads directly to the audience who want to see them. DSP has a relatively high-cost performance for the accuracy of the crowd. However, it only has the dimension of the user label, so it cannot accurately locate the placement of ads.



Context marketing in China uses AI to achieve effective advertising

Context marketing refers to the marketing behavior of consumers' psychological state or demand in a specific, realistic scene, to effectively achieve the goal of companies. A new form with AI advertising in China is called ASMP (AI Scene Marketing Platform) system launched by Video++. The system uses AI technology to structure the accumulated video content. It can complete brand exposure, product introduction, and one-click purchase functions in videos. In specific video scenarios, users' emotional resonance will be stimulated to maximize the effective improvement of conversion rate and expand the income of advertisers. Compared to traditional online video advertisements, AI scene advertisements can add about 40% of advertising space resources and an average increase of click rate of 2.5 times. It is estimated that the future AI scene advertisements can bring 31% value enhancement to the online video advertising industry.



Buying services while watching videos are provided by the short video platform. The charging model includes charging commissions for e-commerce platforms, clicks, and collection of payments for the implementation of the project. AI advertising in China first took effect on short video platforms and live e-commerce broadcasts. However, applications and business models in the long video platform, OTT and other fields have yet to mature. Brands can set different advertising forms to be embedded in video content according to their own communication needs. Applying AI to provide high-quality solutions for video content marketing and truly complete the seamless connection between brand and content. The ASMP system links the user's emotion with content relevance. It enables the audience to have emotional resonance after seeing the advertisement, which makes the advertisement more meaningful and effective. This is the best-case scenario for advertisers.

AI in Ad detection

The main task of Ad detection is to test the advertising effects. AI in Ad detection can help to manage data and traffic. Three aspects of AI advertising in China can be applied: online public opinion detection and analysis, automatic analysis of we-media data, and filtering of malicious and false traffic. One example is the process of advertising review on websites. Poorly targeted advertisements often appear in search engines along with malicious behaviors that collect user information, leak user privacy and threaten user security. AI in Ad detection can not only realize efficient information screening at the entrance but also automatic verification and process all links of advertising promotion by aiming at the illegal words and the constantly changing argumentation words.

At present, Baidu has used Baidu brain to build a machine recognition model by extracting text and image information from the page. Through the treatment of variant words simulation, trademark knowledge base, and risk word mining, it severely cracked down on non-industry medical promotions and other violations.

AI+ in advertising

The core of advertising effectiveness is user understanding. Therefore, data becomes a basic competitive barrier in AI+ Ad marketing, as it is the foundation of AI advertising in China to help gain consumers insight and analysis. In terms of companies engaged in AI in the Chinese advertising market, B2C content or service platforms have a natural advantage in user data. On the other hand, B2B's AI companies and advertising companies need to enhance customer data access capabilities and rely on accumulated data to optimize delivery capabilities.

The impact of AI on advertising in China

Because of the impact of AI on advertising in China, Chinese mainstream Internet companies and advertising companies have long been deployed in AI+ marketing. They have used AI technology to enrich media assets and optimize delivery effects in

the original development advantages. On the other hand, it is open to customers and empowers its capabilities directly to clients in the platform ecosystem:

Most SMEs adopt the ‘production + sales’ model, and the demand for marketing is relatively simple and flexible, such as in e-commerce operations, SEO, social media promotion, H5 production, offline event planning. In addition, with the impact of AI on advertising in China, many startups are keen to create new consumer experiences that will use new technology such as AR, VR, and face recognition. Large B2B companies in the Chinese advertising market generally have higher advertising and marketing budgets, and their demand is concentrated on promotional videos, offline meetings, and offline advertising. Such companies generally choose stable, high-quality suppliers, and production companies to collaborate.

Large B2C companies using AI in Chinese advertising are high-quality customers competing for advertising agencies and traditional media. The advertising budget is sufficient, and the creative, production and distribution channels are biased towards the high-end. With the rise of Internet media, a significant portion of the budget for such companies has moved online, while the need for user portraits, data, strategies, and real-time monitoring has increased. Their partners are generally 4A, local interactive marketing companies, media distribution tools developed by major technology companies and advertising technology companies, big data-based AI strategy providers, etc.

Ask an expert

*“E-commerce in China is very strong. The infrastructure of E-commerce in China grew significantly. It’s no more only Alibaba and JD. There are other places, Xiaohongshu and NetEase Kaola, even fresh vegetables and fruits, apps that are becoming huge and have budgets to stand on media buying. We see a lot of **advertising clients** from E-commerce in China.*

Shimi Azar, General Manager of Spotad

Leading AI companies in China's advertising industry

Service	Company	Purpose
Search engine+ Newsfeed Ads	Baidu	Establish an 'Omni Marketing' platform
Social Ads	Tencent	Intelligent marketing product
Newsfeed Ads	TouTiao	Open 'marketing API' to the public
Advertising space bidding	Alibaba	Release Intelligent marketing engine OCP 'X'
Online videos	YOUKU	E-commerce integrated into a video
Online videos	Bilibili	E-commerce integrated into video
Online videos	iQIYI	AI predicts program performance
Ad serving	BlueFocus	BlueMC, iDataBot, etc.
AI technology company	Moviebook	Product and video placement marketing

Ask an expert

*"On the ad exchanges like **Tencent** they're very strict. Put all laws aside; even if the creative doesn't display the brand's name that the user can see very clear, it can also be disqualified. They're very strict. They want all the online advertising displayed on their apps to be very nice, clear, and good. They don't want bad content. This is how they control it.*

***Baidu**, on the other side, is much more flexible. If you are a well-known advertiser, you will be on their white list and will be approved automatically, which means that all the creatives will be approved automatically and you can start the campaign in one minute. If it's not on their white list, they will ask for documentation.*

*In order to advertise on **Douyin**, you will have to contact **ByteDance** ad department and negotiate deals on displaying ads. Similar to Facebook and Google; they have their own in-house ad exchange that you can log into to buy ads. ByteDance is definitely the biggest player coming up in Chinese advertising."*

Shimi Azar, General Manager of Spotad

AI IN HOSPITALITY

Are robots taking over the hotel industry?

Artificial Intelligence has managed to alter the shape of many industries in the world. The appearance of automated hotels in China, such as Alibaba's Future hotel, a robotized hotel, is redefining the future of the hotel industry. The use of AI in hospitality in China is creating high-tech hotels that lower management costs and improve efficiency, replacing manual work with systems and robots. Facial recognition check-in in hotels is becoming a reality in China, and the use of AI-powered computers that mine data provide tailored customer experiences.

How has artificial intelligence been utilized in the hotel industry in China? How do technology-driven consumers perceive high-tech hotels in China? How can AI improve the guest's experience in the Chinese market? What AI companies are developing technology that will be used in future smart hotels in China?

How AI disrupts guests' experience, in a good way

Alibaba's Future hotel FlyZoo, a unique robotized hotel in China

Alibaba, known mainly for being the e-commerce and technology giant in China, opened its first robotized hotel in December 2018, the FlyZoo Hotel. The Alibaba Future Hotel in Hangzhou was built by Fliggy, Alibaba's online travel platform, along with other business units such as Alibaba A.I. Labs and Alibaba Cloud.

The main objective of this high-tech hotel is to demonstrate that artificial intelligence is already transforming China's Hospitality Industry and that it will inspire the tourism and hotel industry in China and around the world to embrace innovation.

Wang Qun, CEO of FlyZoo Hotel, repeatedly said in many interviews that they would continue to create 'smart brains' for automated hotels in China, as well as more customized experiences for guests.

Four AI digital innovations in FlyZoo Hotel

Facial recognition

FlyZoo is equipt with a facial recognition check-in system. On the way to the room, the elevator recognizes the customer and identifies the floor of their room. The room door opens without the use of magnetic cards or keys. All this, thanks to facial recognition technology. As China's largest R&D spender, Alibaba is the largest single investor in SenseTime; an AI start-up known for its facial recognition technology.



[Source: China Daily “Alibaba robotized hotel in China”]

The vocal assistance of Tmall Genie

At the Alibaba Future Hotel, the 290 rooms are equipped with the vocal assistant Tmall Genie, who obeys all the guest’s orders by voice, whether it is to dim the lights, change the temperature, open or close the curtains, turn on the television or even order food.

Robot concierge

The one-meter high robot activated by Tmall acts as a concierge, accompanying the guests to their room, providing room service, doing laundry, and even acting as a waiter in the hotel restaurant. At the bar, the bartender is a robotic arm that can produce more than 20 different cocktail mixes.

Buy and pay with a click

Customers begin their adventure at the Alibaba Future Hotel by booking exclusively online through Alibaba’s Fliggy App (Alibaba’s online travel agency). When booking the room, travelers can also choose all the features that allow them to customize their trip as much as possible: the type of room, its location in the hotel, the orientation, and direction of sunlight.

Like all Alibaba products, the Hotel of the Future also offers the possibility to shop online. Guests can buy anything they see in the hotel, such as the decorative products, using the FlyZoo purchase application. The check-out and all payments are made with a simple click on Alipay.

Tech giants Alibaba and Baidu take part in China's AI hotels

Marriott International

International hotel chains are also transforming into high-tech hotels in China. For instance, introducing Figgy's facial recognition check-ins the application powered by Alibaba in the Hangzhou and Sanya locations of the Marriott International Group. Alibaba plays an important role in the implementation of AI technology in the hotel industry in China, this time partnering with international hotel brands. Founded in August 2017, the joint venture of Marriott International and Alibaba Group is an innovative digital travel service and consulting company that aims to launch AI technology in the hospitality industry. Alibaba's goal is to revolutionize the hotel experience selling high-tech solutions, thus leading China's hospitality industry into the future.



[Source: Hotel News Resource "Marriott uses facial recognition in the check-in"]

This initiative appears to be successful, as joining Alibaba means also benefiting from its capacity to engage customers and create networks. From the news section on Marriott International's official website, "along with digital enhancements, Marriott International has also witnessed a significant growth of over two million loyalty members as of June 2018. Enabled by the joint venture, members can now link their Marriott Rewards and Fliggy memberships through status matching, earn points, and enjoy benefits from both programs".

InterContinental Hotel & Resorts

Similarly, the InterContinental Hotel & Resorts Group (IHG) has teamed up with Alibaba's competitor Baidu to enter the high-tech hotel generation and pioneer the introduction of AI in hospitality in China. By developing "Smart rooms" with artificial intelligence in its Beijing and Guangzhou hotels, the aim is to redefine the customer experience in China's hospitality industry.

The Baidu DuerOs platform integrates AI technology into the Smart Rooms through voice control devices. For example, guests can choose the ambiance of their rooms between work or leisure mode. By offering an increasingly personalized experience, based on customers' choices, the circulating information allows the management system to fine-tune guests' tastes and expectations.

In addition to the use of robots to automate service and concierge tasks, AI in Chinese hotels has also been introduced by the dissemination of data allowing to automatically define the profile of the consumer and thus offer customized and personalized experiences. Artificial intelligence brings the service or product closer to the consumer, in a country of millions of inhabitants where the possibilities of consumption are infinite. Using the preferences of the clients, stored during previous trips, AI technology automatically offers prepares hotel room for the client anticipating their preferences, offer a higher output quality than when relying only on human effort.

Are consumers receptive to automated in China's hotels?

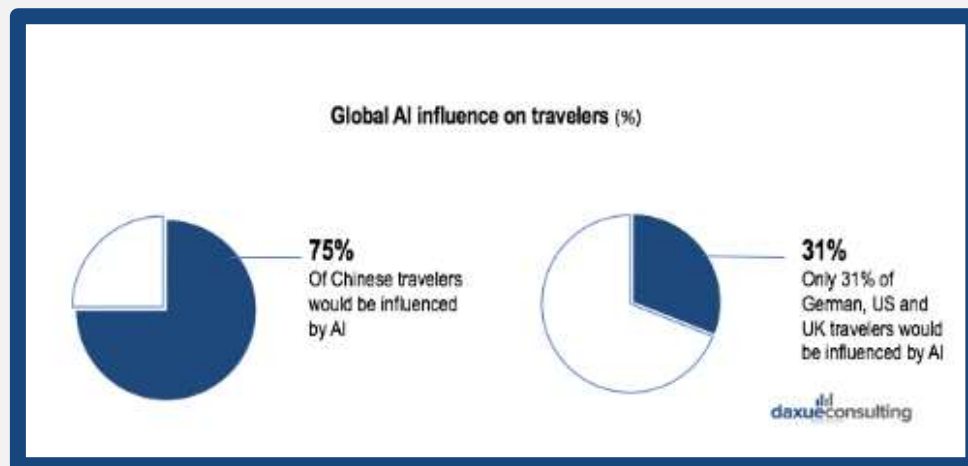
China, where data sharing and facial recognition are well integrated

AI in automated hotels in China offers a high-quality personalized service to its guests, and it is possible thanks to the circulation of data that refines the profiles and preferences of clientele. The dependence on smartphones makes it possible to store deep reserves of consumer data that hotels use to study and access the needs of potential customers.

In China, there is a massive data network that circulates between companies and state institutions to locate and watch the country's inhabitants' lives, among other uses. Chinese upper-class leisure travelers are favorable to the diffusion of their data and accept more easily to share information on their hobbies, their profile on social media, photos, job, and geolocation. On a survey realized by Mazars, 97% of Chinese travelers were willing to share at least one piece of personal information against 80% of Western travelers. The integration of AI in the tourism and travel industry in China is easier than elsewhere.

Facial recognition check-in in hotels in China is just another example of the spread of AI-technology across Chinese industries: facial recognition is used by banks, financial institutions, airports, restaurants, many Chinese start-ups, mobile apps, and the government. On a Washington Post' report in 2018, an inhabitant from Chong Qing stated that the facial recognition camera that allows access to her apartment is a useful convenience: "If I am carrying shopping bags in both hands, I just have to look ahead and the door swings open," she said. "And my 5-year-old daughter can just look up at the camera and get in. It's good for kids because they often lose their keys." Personalized services driven by AI technology have become a priority for Chinese travelers.

A fascination with AI and modern technology



[Source: Mazars “Which travelers are accepting of AI?”³⁸]

Chinese consumers, especially from young generations and, increasingly, the growing middle class of Tier 3 and Tier 4 cities, are attracted to virtually everything tech-related. The notion of artificial intelligence is much more deeply rooted in the Chinese mindset compared to the west..

Exposure to futuristic products or experiences is a real pleasure for today’s Chinese population. High-tech hotels in China represent not only a step forward in comfort and modernity, but also an attraction. With growth in China’s smart home appliances, guests would look for the same level of comfort and automatio during their stay in hotels than at home.

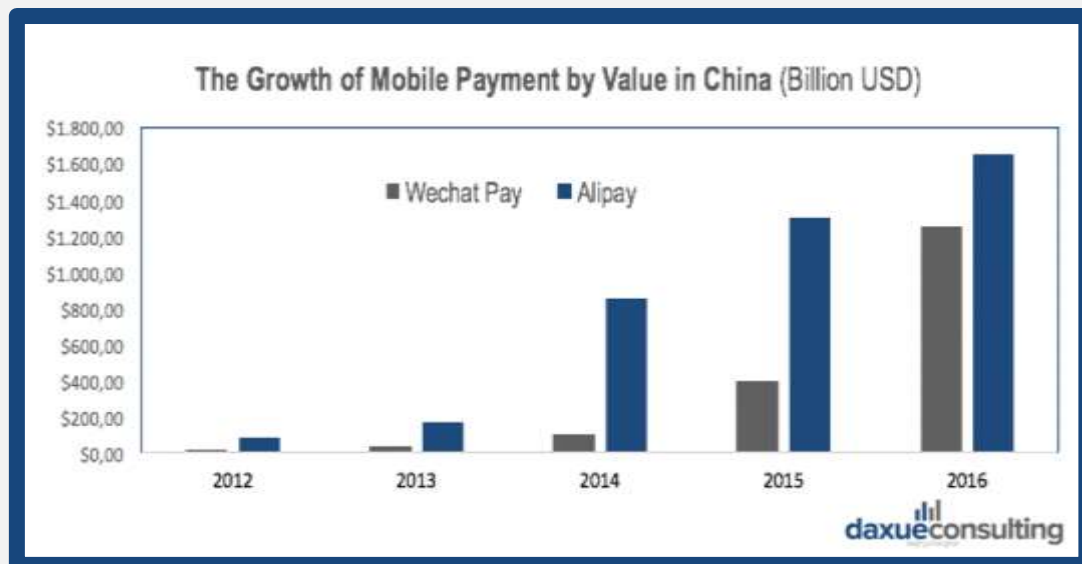
Chinese consumers also prefer interacting less with humans, as technology improves. The FlyZoo Hotel is robotized in all the tasks facing the public, but not in those behind such as the kitchen and cleaning services. The robots are part of Alibaba’s devices to combine high-tech with reduced personnel costs, eliminating the need for guests to interact with other people.

Consumer comfort levels with mobile payment in China

Another attractive feature of implementing AI in hospitality in China is online payment and purchasing. With 583 million people using mobile payment transactions in China in 2018 and still growing, online checkout and payment in hotels are bound to be the first innovation in hotels that have not implemented it yet. Some hotels in the US and Europe, such as the Landmark in London are already launching WeChat Pay and Alipay systems.

China is a mobile-first market, which greatly contributes to the success of online payment. Another reason is that mobile payments are powered by the strongest technology players in China: Alipay, the main payment method belongs to Alibaba Group. On the other hand, WeChat Pay belongs to Tencent, and the almost 1 billion users of WeChat in China prove its popularity.

³⁸ Data Source: Artificial Intelligence, a Game Changer in the Hospitality Industry, Mazars



[Source: Better than Cash Alliance “The growth of Mobile Payment in China”³⁹]

Could high-tech in hotels in China affect human resources?

In a study conducted by PwC, 21% existing jobs in China’s service sector could be displaced over the next 20 years. However, it is estimated that there could be a 50% growth in jobs created by AI and related technology over the next 20 years.

With AI solutions in the hotel industry in China, it is possible to cover consumer assistance throughout the booking process, and problem solving during the guests’ stay, therefore reducing the human labor factor. Most guest requests can be handled automatically by AI-enabled response technology in hotels, resulting in savings in time and costs, and an increase in guests’ engagement with the brand.

In the official Marriott International website, Mr. Henry Lee, Managing Director of Marriott International Greater China states “with technology, our hotel associates can work more efficiently to do what they do best – delivering personalized service to our guests.”

Therefore, in China’s robotized hotels, both basic and repetitive functions, as well as complex problem solving for involving customer interactions, can be carried out without the need for human contact. Still, even Alibaba’s FlyZoo Hotel, the most robotized hotel in China, has a human guest service workers, who are free from mechanical and tedious tasks and can focus on the human side of service.

AI in the hospitality industry in China: Artificial Intelligence meets tourism trends to deliver the best guest experience

A new Chinese tourist profile

China’s tourism sector continues to grow. In 2018, travel and tourism contribution to China’s GDP had amounted to 1,509 billion USD with spending mostly coming from domestic consumers; leisure travel accounted for of 81.4% of total versus business

³⁹ Data Source: Social Networks, e-Commerce Platforms, and the Growth of Digital Payment Ecosystems in China: What It Means for Other Countries, Better Than Cash Alliance

travel accounting for 18.6%. Chinese consumers travel mainly for leisure and with a motivation to reaffirm their status, vis-à-vis others by publishing their travel experience on social networks.⁴⁰

With the rise of the traveling middle class, new profiles of Chinese tourists are defined, and the hotel industry will not stop growing. Travelers increasingly demand standards, finer things. Thus, a new kind of traveler arises: the free independent travelers (FIT).

The FIT travelers

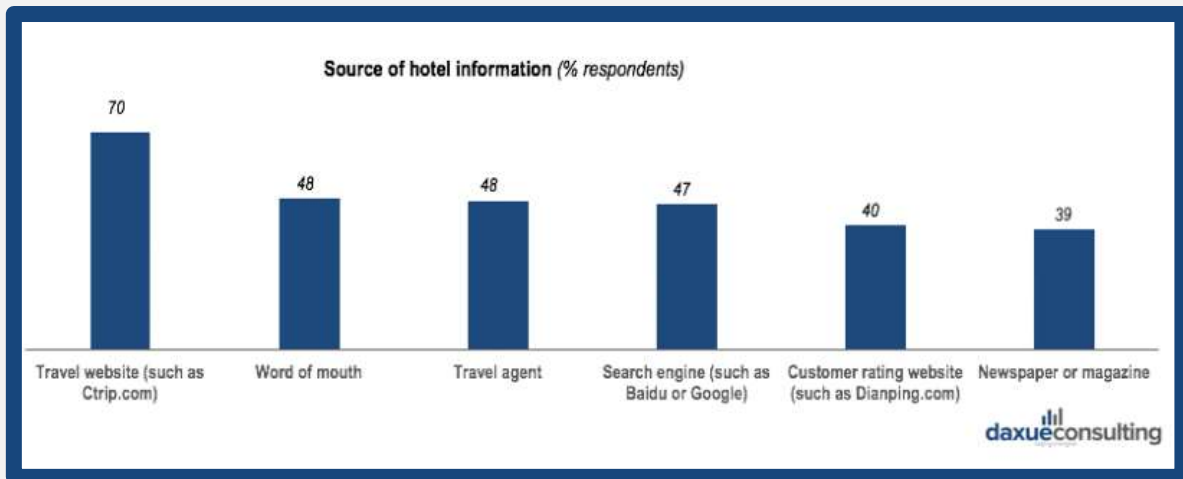
Free Independent travelers are young, well-educated, and relatively affluent. The FIT use all types of electronic devices that will allow them to travel more comfortably. Smartphones are the FIT's travel planner, tourist guide, means of payment, and communication with their peers. FIT are tech-savvy consumers that drive growth for most technology innovations and make a potential guest of high-tech hotels in China. By using AI and intelligent devices in the hotel, valuable personal data is also collected from the traveler. On a survey conducted by Mazars Consulting and YouGov, some of the results imply that "Chinese travelers are indeed looking for comfort and convenience more than other countries surveyed. Armed with this data, AI algorithms can determine the clients' habits, either to lure them back by offering a tailor-made experience or to sell them additional products".

Increasingly connected Chinese travelers

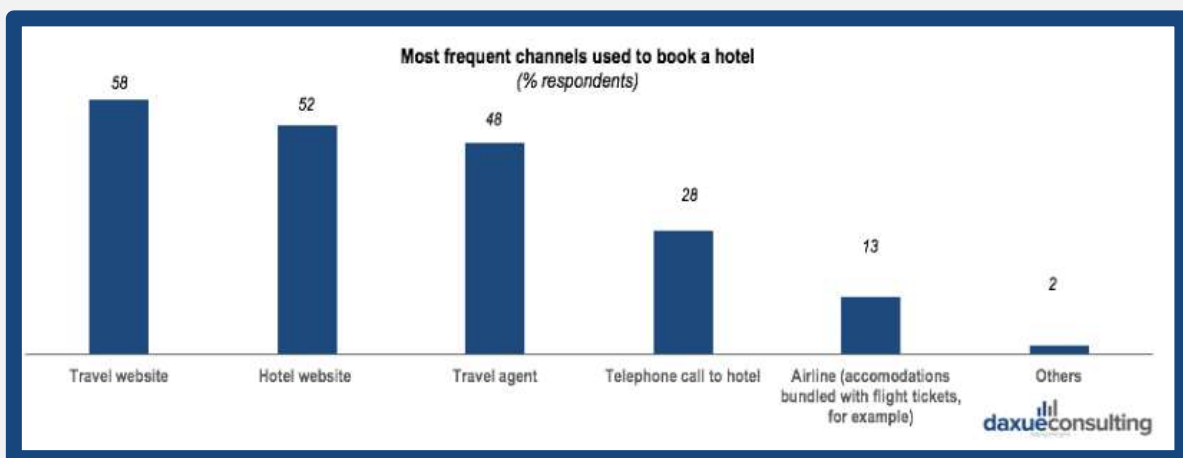
Independent travelers are willing to spend more but at the same time, are more demanding. The new generation of Chinese travelers, especially Y generation and millennials, are known for thoroughly planning their trips ahead of time, to find the option that best suits their expectations. Millennials' spending accounts for 65% of total consumption growth, becoming a group of people with the power of reshaping China and the world. The vast majority use social networks and travel agencies to assess their alternatives, in addition to relying heavily on references from other customers.

AT Kearny's consumer study on the segmentation of the Chinese tourism market observes that 70% of travelers use online travel sites for gathering information, with 58% booking accommodation on sites such as Ctrip or Qunar. Online tour operators rely heavily on content gathered on user experience.

⁴⁰ Travel and Tourism Economic Impact 2019 World Report, World Travel and Tourism Council



[Source: ATKearny “Source of hotel information”]



[Source: ATKearny “Channels used to book a hotel”⁴¹]

In addition, travelers do exclusively use websites dedicated only to travel. It is increasingly common to find travel products on China’s giant e-commerce platforms such as Taobao, and social networks such as WeChat. Through Wechat, hotels can create brand awareness and communicate their services. Similarly, in addition to chat messaging, WeChat also has chatbots and mini-programs, where hotels can add e-commerce and booking functions.

Applications of data mining technology in hospitality

Personalized services are a reality in the hotel industry in China. Travelers are looking for tailor-made experiences, services tailored to their expectations and tastes. Some hotel brands are using technology and social media to get as close to the consumer as possible. The collection of personal and behavioral data during the hotel stay are extremely useful when defining the consumer’s profile and presenting offers related to the hotel industry or offers to buy products.

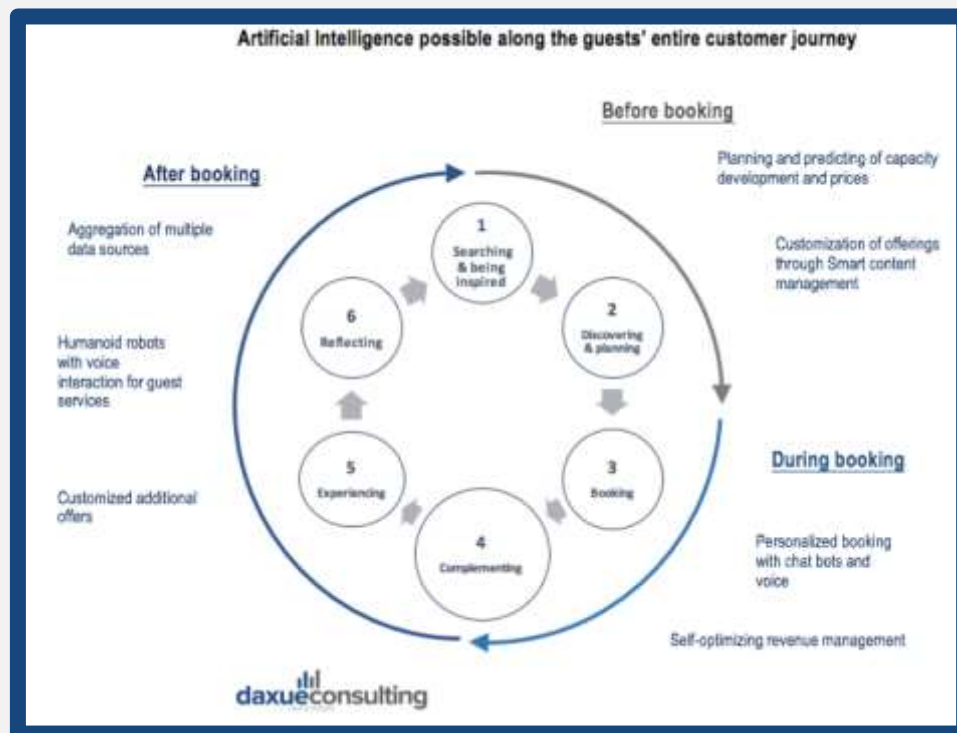
Technology giants Baidu, Alibaba, and Tencent are investing millions in AI, developing powerful databases that bring the offer closer to the consumer in an

⁴¹ Data Source: China’s Hospitality Growth Industry – Rooms for Growth, ATKearny

increasingly accurate manner. Tencent, Baidu, and Alibaba have access to an infinite amount of information that allows data mining to define consumer demand. By launching AI technology in hotels in China, the technology giants can easily approach the traveler and meet his/her expectations and desires, changing the hotel industry dynamics. Demanding travelers would spend less time looking for the perfect fit, and almost tailored-made offers would be presented to them.

AI during the guest's journey

Artificial intelligence technology can be introduced into almost every phase of the traveler's consumer experience. The match of relevant consumer data with personalized and automated service thanks to high-tech devices in hotels in China lead to excellent customization, which, in return, allow guest excitement and satisfaction. Hotel companies who understand the importance of AI in hospitality in China first would acquire a significant competitive advantage.



[Source: Roland Berger "AI applications along the guest's customer journey"]

Companies in the hotel industry in China should embrace innovation through the implementation of AI-enabled technology, and collaborating with the best AI companies. Alibaba, Baidu, and Tencent, as well as Huawei, are amalgamated AI companies, but there are also plenty of SME AI companies in China that are developing AI technology as well. Implementing AI such as facial recognition, or machine learning devices that power data mining is a source of competitive advantage. The AI Smart room, for example, is undoubtedly attractive for Chinese travelers and is laying the foundations for a new degree of modernization and customer satisfaction. Hotel companies can also partner with AI companies in China that work separately by basis, technology, or just application.



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