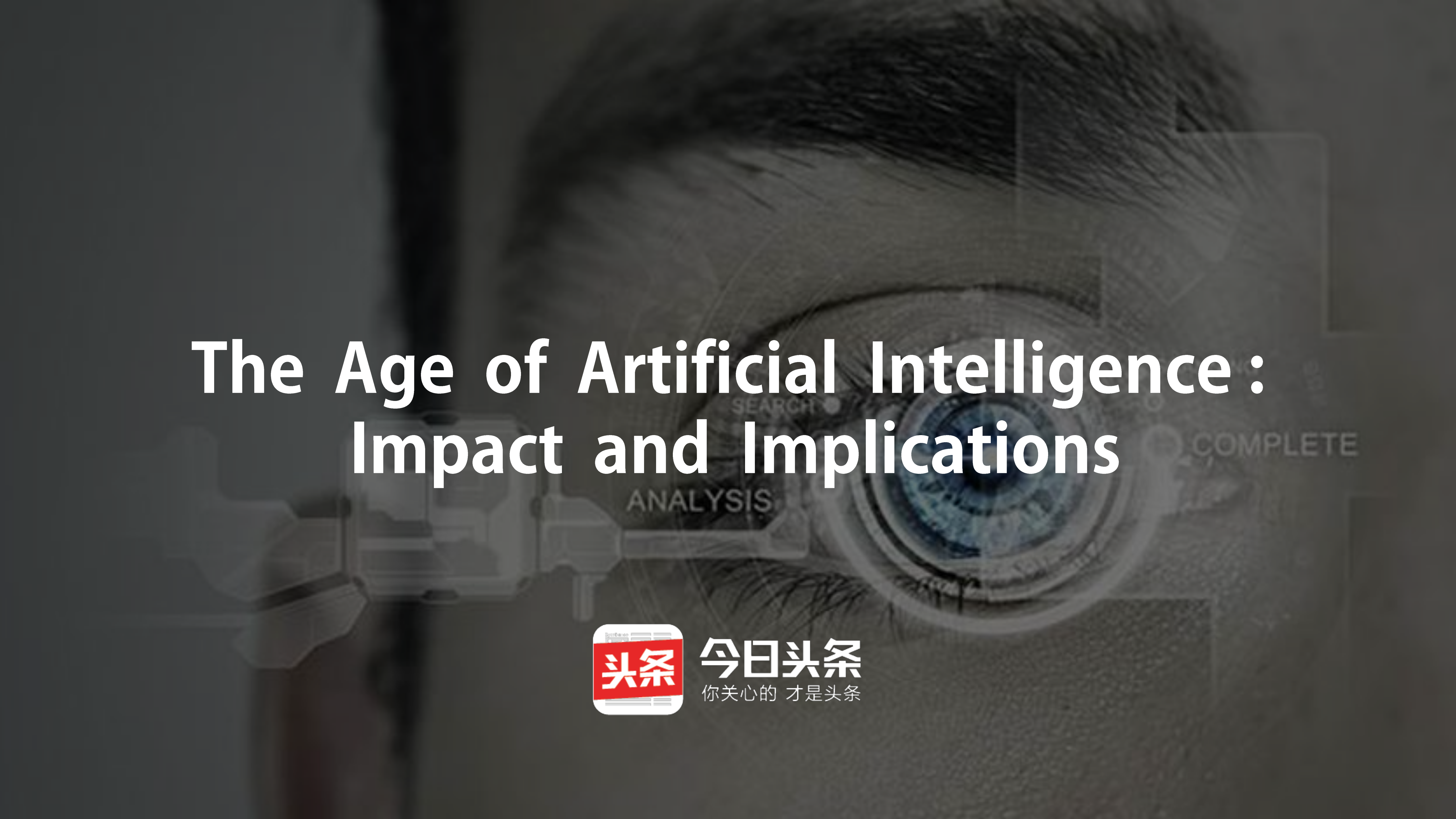
SEARCH
ANALYSIS
COMPLETE

The Age of Artificial Intelligence : Impact and Implications

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Preface

» Since AlphaGo’ s historical victory over humans, Artificial Intelligence (AI) has attracted more and more attention from the public. In fact, AI has become a part of our everyday life and it exists almost everywhere, e.g. when you chat with Siri or read news articles on Toutiao, In a nutshell, AI is an interdisciplinary science based on the integration of computer science, physiology and philosophy. To some extent, all machine behaviors augmenting human to perceive, identify, analyze and make decisions could be regarded as the applications of AI.

» This technology, with a history of over 60 years, recently became a focus again after going through two cycles of ups and downs. As a technology company using AI to reshape the connection between humans and information, Jinri Toutiao has launched this report, The Age of Artificial Intelligence: Impact and Implications, to recognize the most influential companies, technologies and scientists, and to understand and record the fears and expectations of AI in our society today.

Key Findings

- The firms involved in comprehensive AI research are much more influential than those focused on a single field of application
- The open-source platforms developed by leading companies will drive the growth of applications downstream
- Evolving from universal chips to customized chips and then brain-like chips is the path to the future.
- With the further opening of open-source platforms and improvement of algorithms and chips, the key components of AI competition will move to the competition for talents and application scenarios, from competition in technologies today.
- Chinese people’ s AI-Confidence Index stands at 83, which shows an optimistic and rational attitude towards AI.

CONTENTS

- The Knowledge Map of AI
- The Influences of AI Firms and Technologies
- The Influences of AI Brands in Applications Scenarios
- AI-Confidence Index and User Profiles

01/

The Knowledge Map of AI

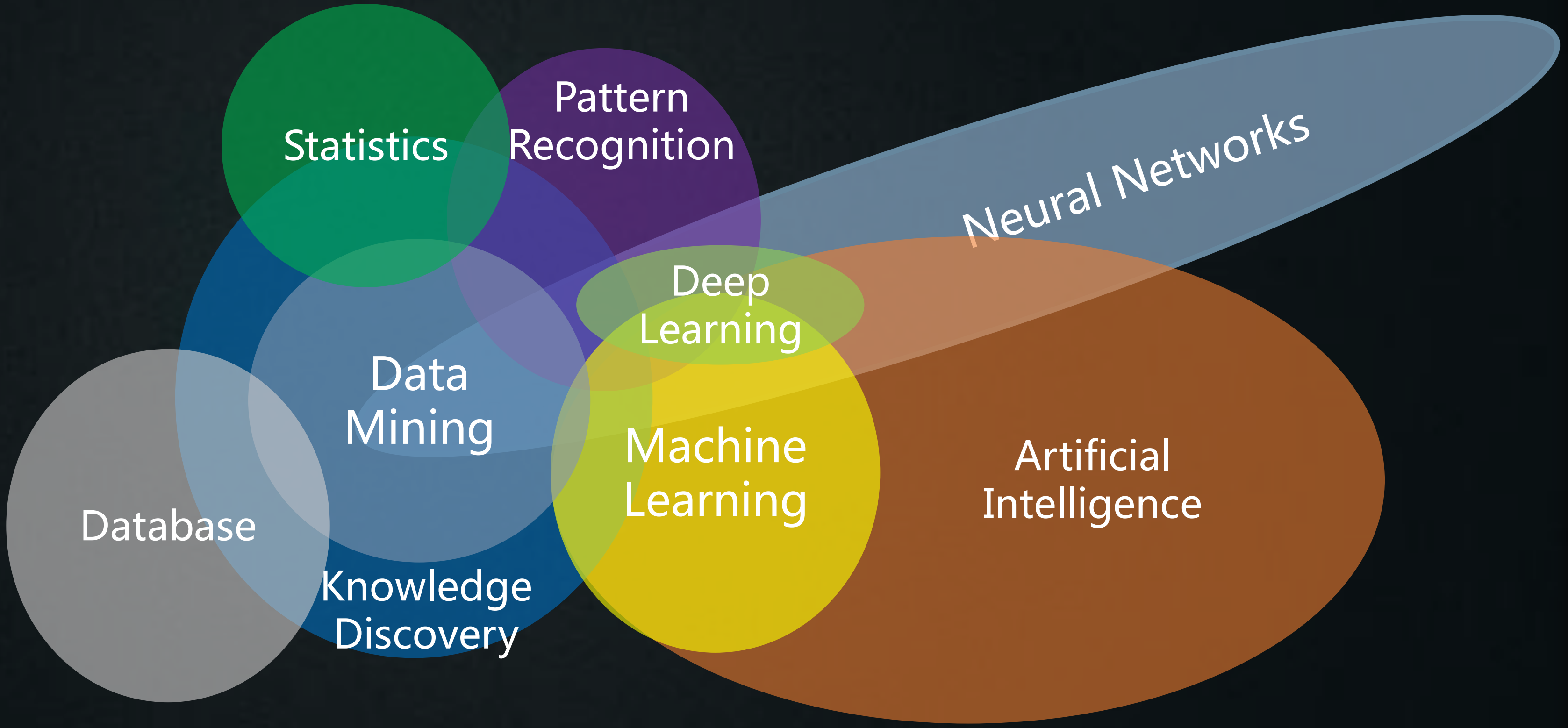
- The Relations among AI-Related Fields and Their Hotness Levels
- The Influences of Basic AI Applications
- The Three Tides of AI Development
- The Three Key Factors for AI Development
- The Value Chain of AI Industry

PART ONE: The Knowledge Map of AI

The Family Tree of AI

- The concepts of 'Artificial Intelligence', 'Machine Learning' and 'Deep Learning' are intertwined with one another but no one is subject to another.
- 'Neural Net Algorithm' and 'Artificial Intelligence' are overlapped, but the former is not simply an application of AI or its subject.

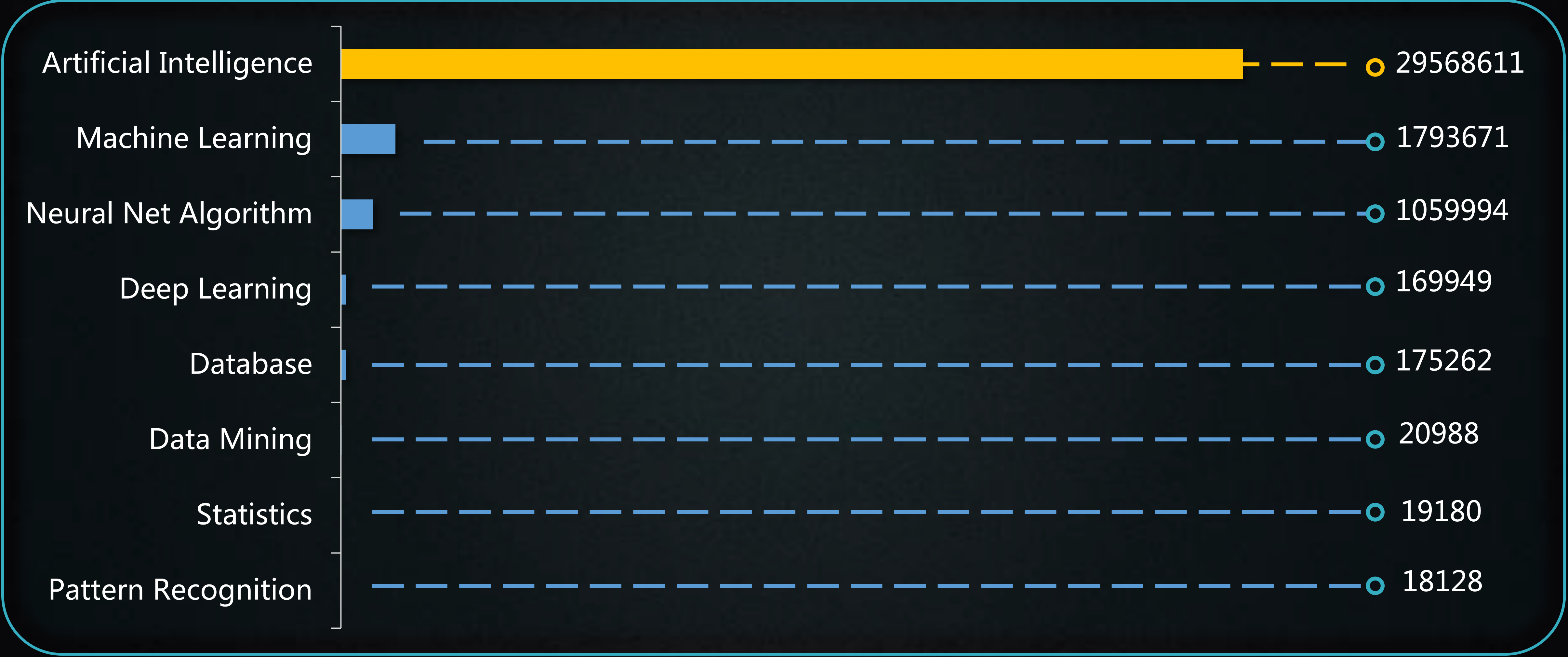
» Connections among the AI-Related Fields


Statistics
Pattern Recognition
Neural Networks
Deep Learning
Data Mining
Machine Learning
Artificial Intelligence
Database
Knowledge Discovery

Data Souces: SAS, 2014 and PwC, 2016

PART ONE: The Knowledge Map of AI

The Influences of AI-Related Fields



» Data Source: Toutiao Index

PART ONE: The Knowledge Map of AI

Overview of AI

1956-1976
The First Tide of AI

In 1956, The Dartmouth Artificial Intelligence Conference came up with the name and vision, and thus marked the birth of AI.

70s

Due to the bottleneck of computer performance, increasing complexity of competing, as well as data insufficiency, a lot of projects were unaccomplished in the 1970s.

1976-2000
The Second Tide of AI

In 1975, Paul Werbos put forward the BP algorithm which made the learning of multi-layer artificial neural networks possible, enabling the rise of two-layer neural networks in 1986 which laid the foundation of the second tide in AI development.

90s

The research of AI encountered the issue of insufficient funds in the 1990s.

2000 to now
The Third Tide of AI Development

In 2012, Geoff Hinton’ s team defeated Google in the ImageNet ILSVRC (Large Scale Visual Recognition Challenge), which was of great significance academically and also triggered a large-scale investment in deep learning in the industry.

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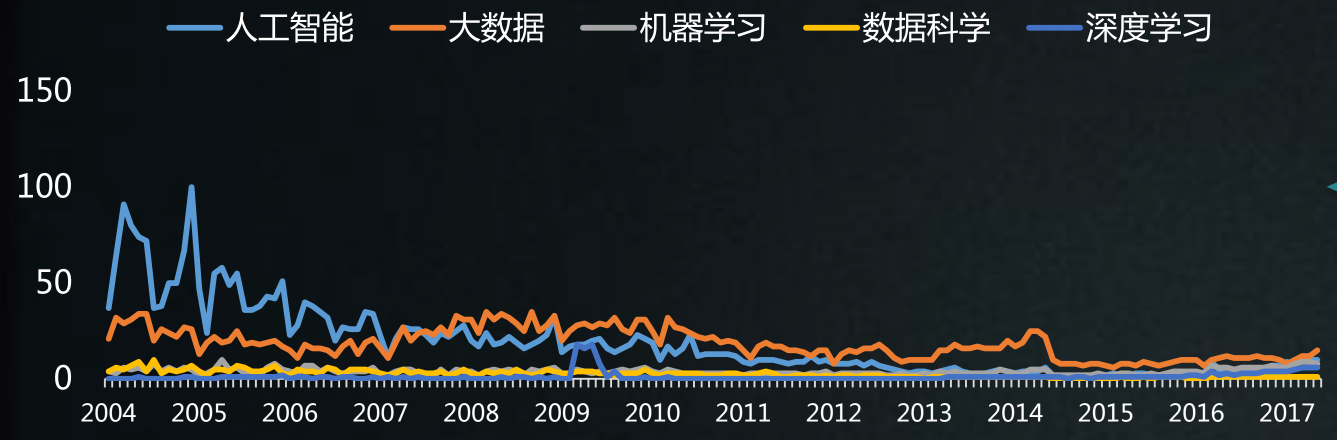
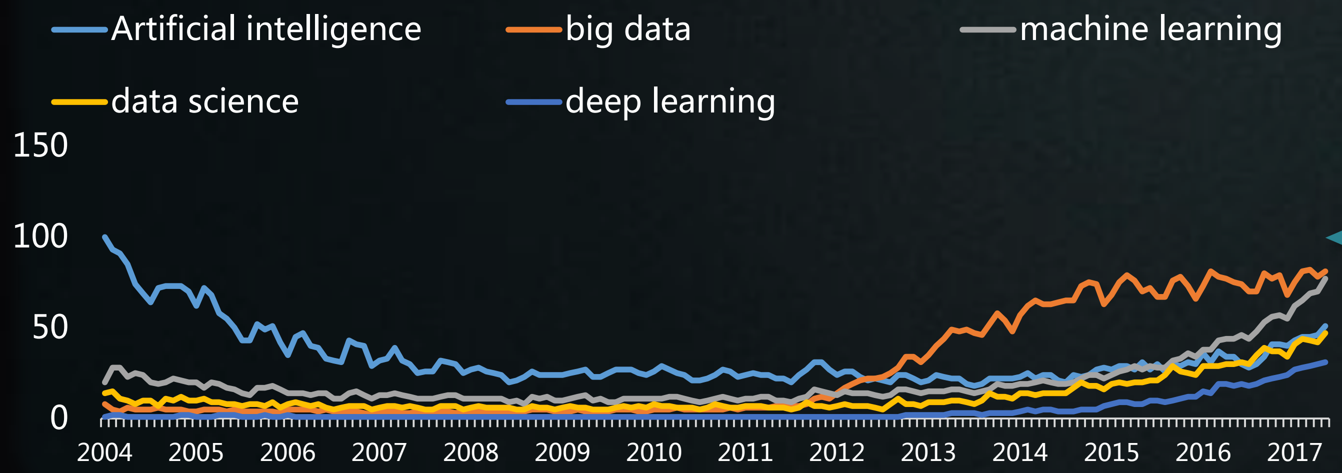
The Rise of The Current Tide



Google Trends (Search with Chinese Names)



Google Trends (Search with English Names)

- Searching key words related to AI in google trends, e.g. ‘Artificial Intelligence’, ‘Big Data’, ‘Machine Learning’ and ‘Deep Learning’, you can see the different focuses and how they evolve.
- To compare the trends of ‘Artificial Intelligence’ and ‘Big Bata’, the former attracted attention in both the English and Chinese contexts as early as 2004. Yet its search volume started to decline in the Chinese context around 2006-2007, with its hotness level outpaced by ‘Big data’ at that time.
- In English language searching, the search volume of ‘Big Data’ only outpaced AI around 2012.
- The hotness level of ‘Deep Learning’ in Chinese searching was almost the same as ‘Artificial Intelligence’ in 2009. However in English searching, public awareness of “Deep Learning” didn't show a significant increase until 2013.

Data Source: Google Trends, 2004-2017

PART ONE: The Knowledge Map of AI

The Three Key Factors for AI Development

- The increase of data scale, improvement of computing capability and the birth of deep learning algorithm significantly changed the AI industry and moved it forward.

Algorithm

The engine of AI

Big Data

Provides the fuel for AI

Computing Capability

Reflects on the improvement of chips and cloud computing capability

PART ONE: The Knowledge Map of AI

Structure of the AI Industry

Application Level	Products	self-driving cars intellectual assistant robot journalists intellectual investment consultants • • •
	Industry Solution	financing transportation retail agriculture manufacturing • • •
Technology Level	General Technology	voice recognition natural language processing computer vision knowledge map deep learning • • •
	Algorithm Model	CNN clustering decision tree SVM • • •
	Framework	TensorFlow Caffe2 PyTorth Torchnet • • •
Base Level	Big Data	accumulation of underlying data
	Computing Capability	chips cloud computing

02/

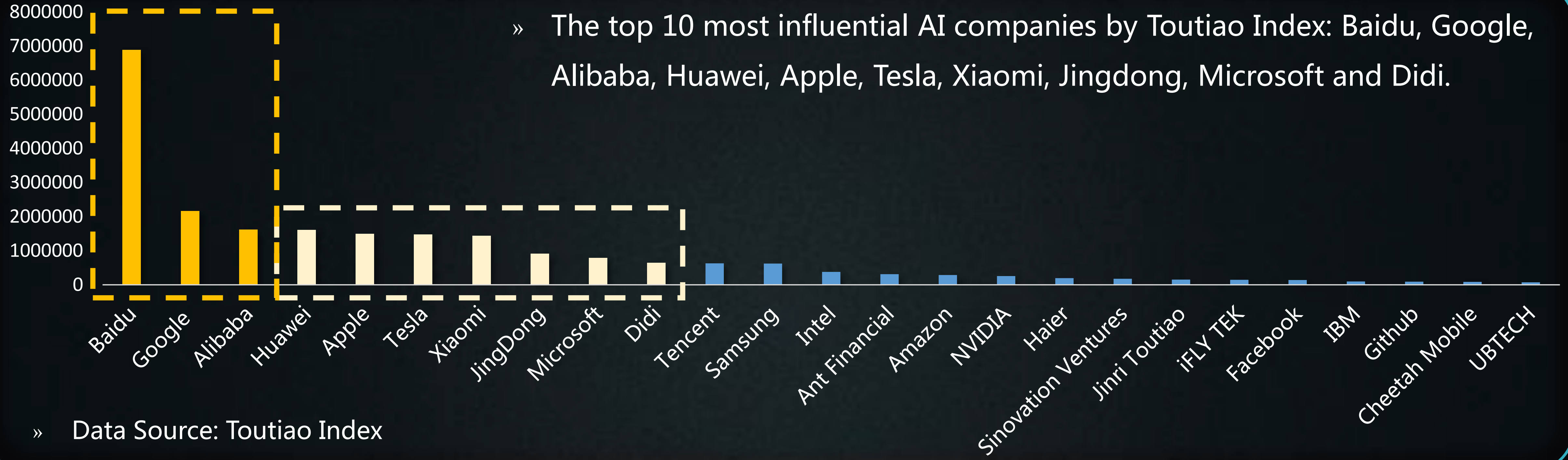
AI Companies and Technologies

- Top 10 Most Influential AI Companies
- Most Influential AI Open-Source Platforms
- Top 10 Most Influential AI Chips

PART TWO: AI Firms' Influences

Top 25 Most Influential AI Companies

- The top 10 most influential AI companies by Toutiao Index: Baidu, Google, Alibaba, Huawei, Apple, Tesla, Xiaomi, Jingdong, Microsoft and Didi.

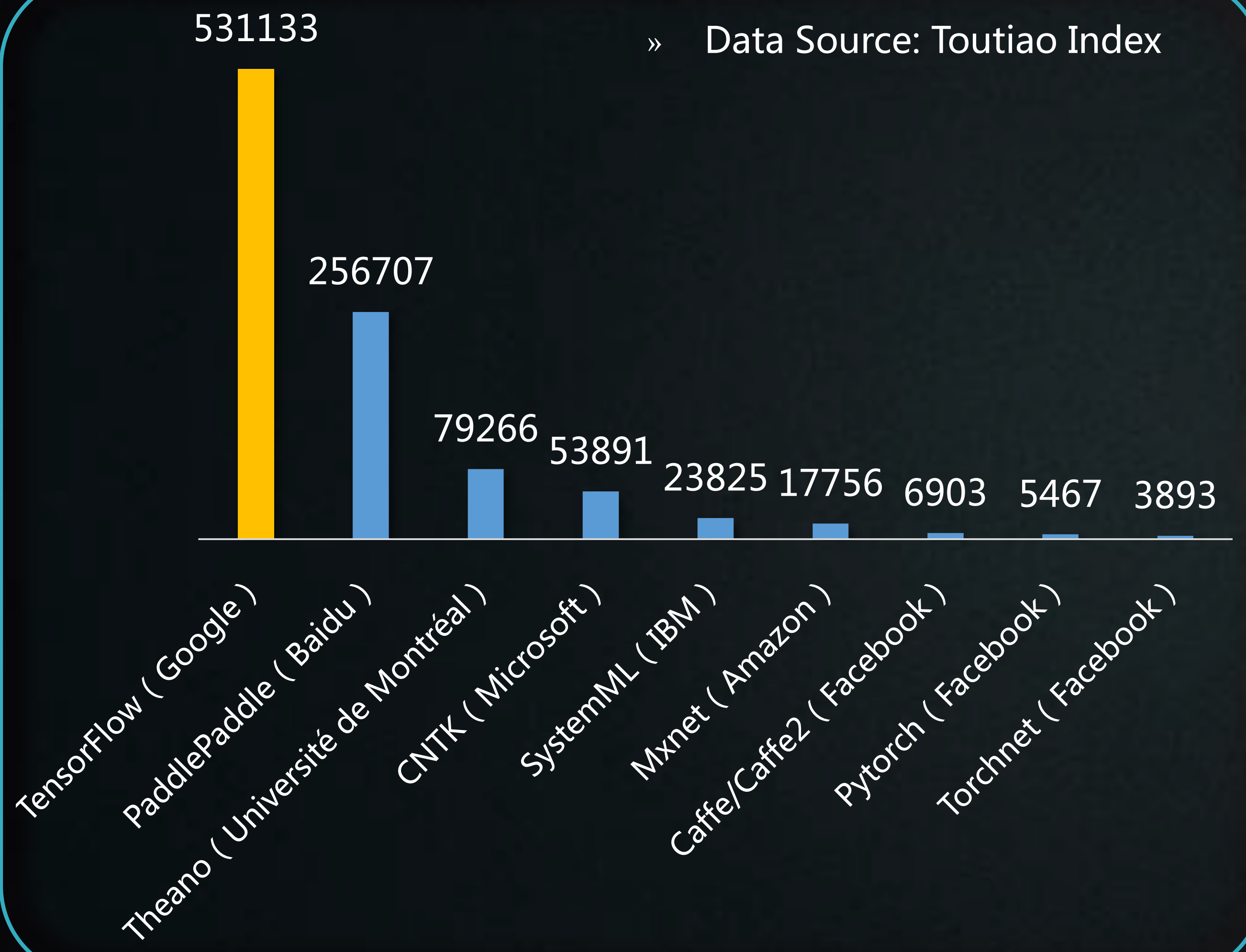


- Data Source: Toutiao Index

- The hotness level of Baidu exceeds Google in the Chinese searching.
- However, the hotness level doesn't translate directly into the competitiveness. Many outstanding AI companies are not listed above.
- Examples: NVIDIA (focused on AI hardware), Jinri Toutiao (focused on intellectual information distribution), and Facebook (focused on open-source AI).
- The list also reveals that the companies involved in comprehensive AI research are much more influential than those focused on a single field.

PART TWO: AI Firms' Influences

Most Influential AI Open-Source Platforms/Frames

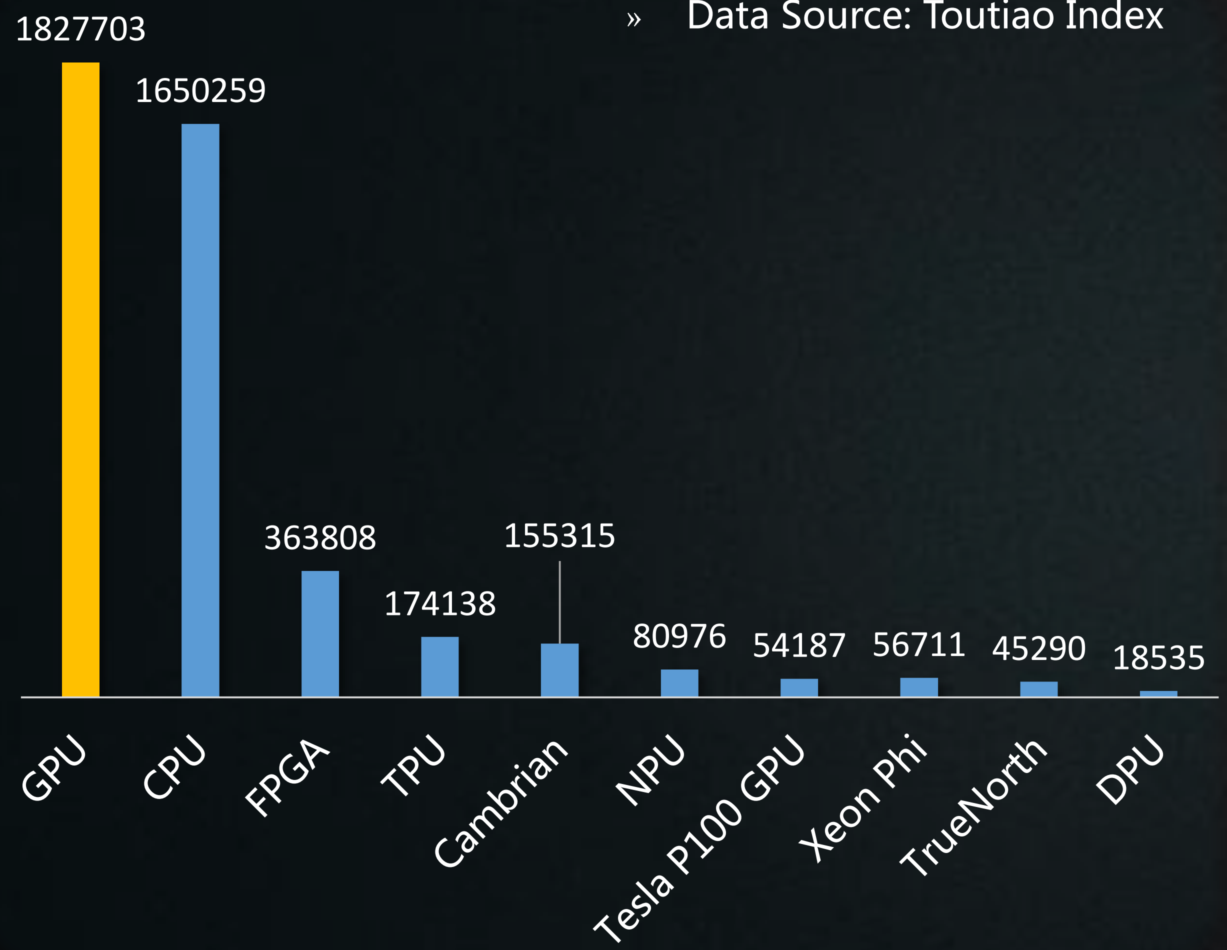


» Data Source: Toutiao Index

- AI’ s rapid development requires the advancement of open-source platforms, to enable more middle and small-sized enterprises/developers to get involved in the research of AI.
- In this regard, the AI giants embarks on developing open-source platforms. In terms of the power of influence, Google’ s TensorFlow shows an overwhelming advantage. Meanwhile, Facebook has accelerated in this aspect these years and launched several outstanding platforms like Caffe, PyTorth and Torchnet which win wide-range recognition, though its impact is limited in the Chinese context.
- As the only platform launched by Chinese company, Baidu’ s Paddle Paddle is the product developed during Andrew Ng’ s tenure.
- By developing open-source platforms, the AI giants aim to mobilize more talented scientists and engineers to participate in AI’ s development together. Moreover, the open-source platforms would drive up the development of the downstream of AI industry.

PART TWO: AI Firms' Influences

Top 10 Most Popular Chips

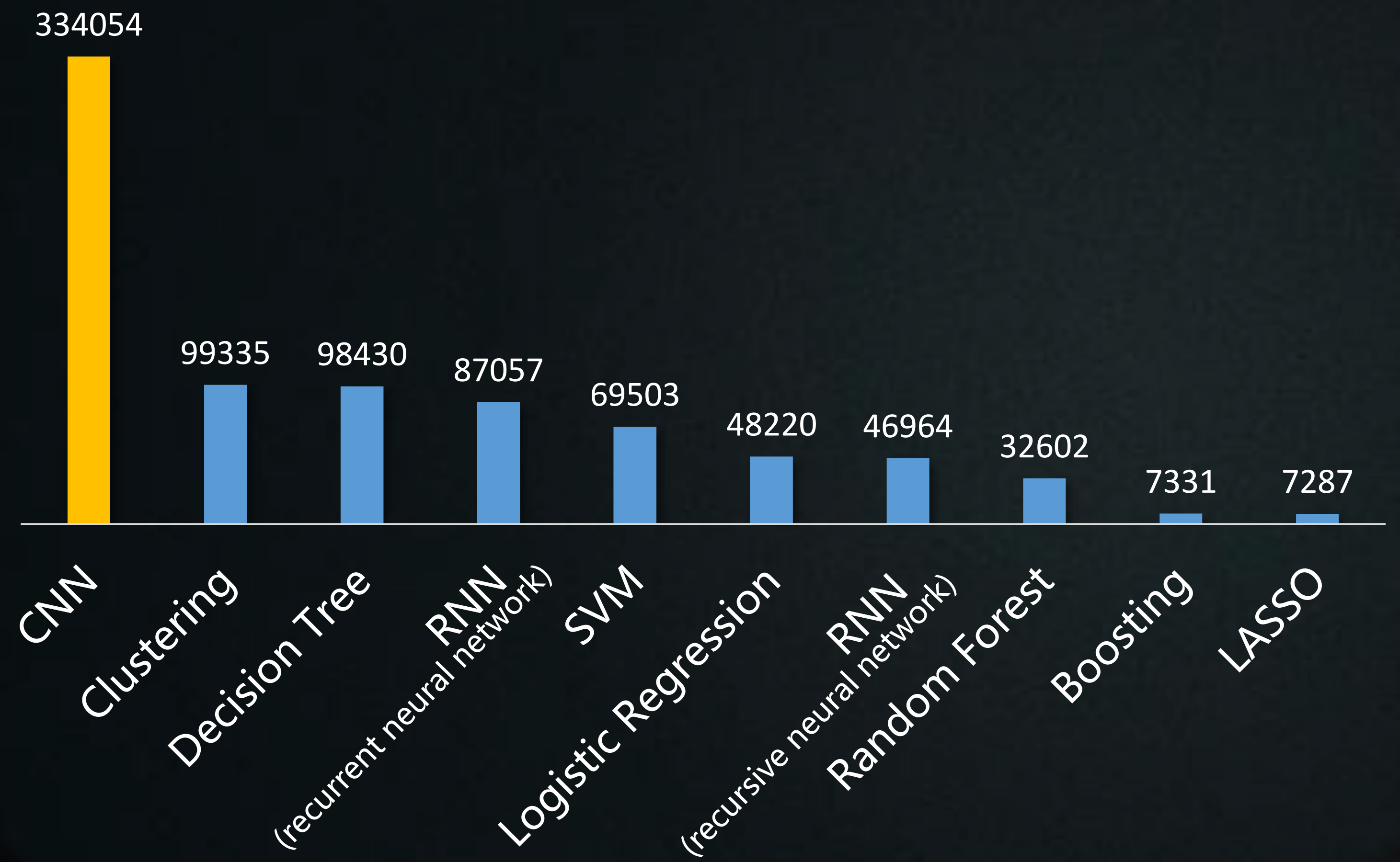


» Data Source: Toutiao Index

- At present, the universal chips that are suitable for operating parallel computing such as GPU and FPGA are generally adopted to meet the new computing demands represented by deep learning.
- Their importance for AI also gets confirmed in the list, and their advantages are clear: avoiding the high investment and risks in custom chip’ s development. Yet their inborn bottlenecks in the performance and energy consumption are also distinct since it is not specialized for deep learning. As the AI application scope continues to expand, the problems would become increasingly apparent.
- The new computing demands in the AI age will promote the development of the new specialized computing chips: the custom chips (e.g.TPU, Cambrian and Tesla P100 GPU) and the brain-like chips (e.g.TrueNorth). It could be expected that evolving from universal chips to customized chips and then brain-like chips is the path to the future.

PART TWO: AI Firms' Influences

Top 10 AI Algorithms



» Data Source: Toutiao Index

» Algorithm is the core technology for AI.

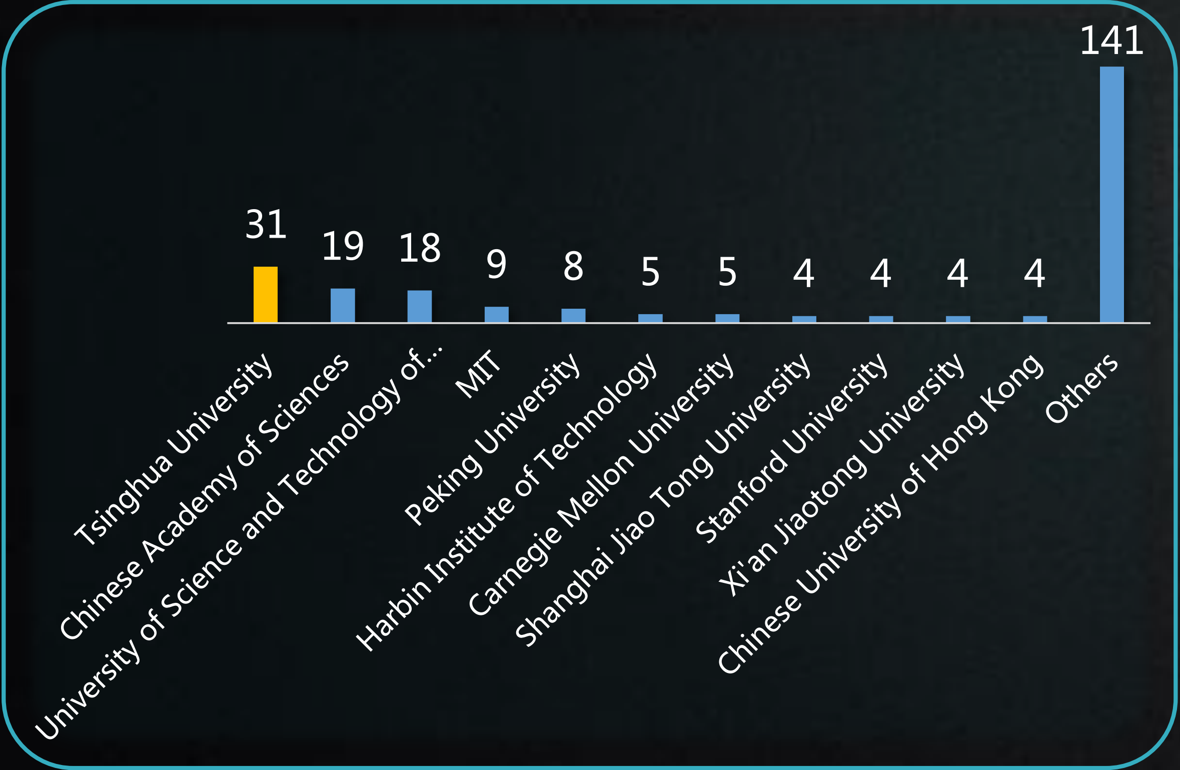
» CNN (Convolutional Neural Network) is ranked No. 1, which is a powerful digital-image processing model making the input images into abstraction on its convolution layer.

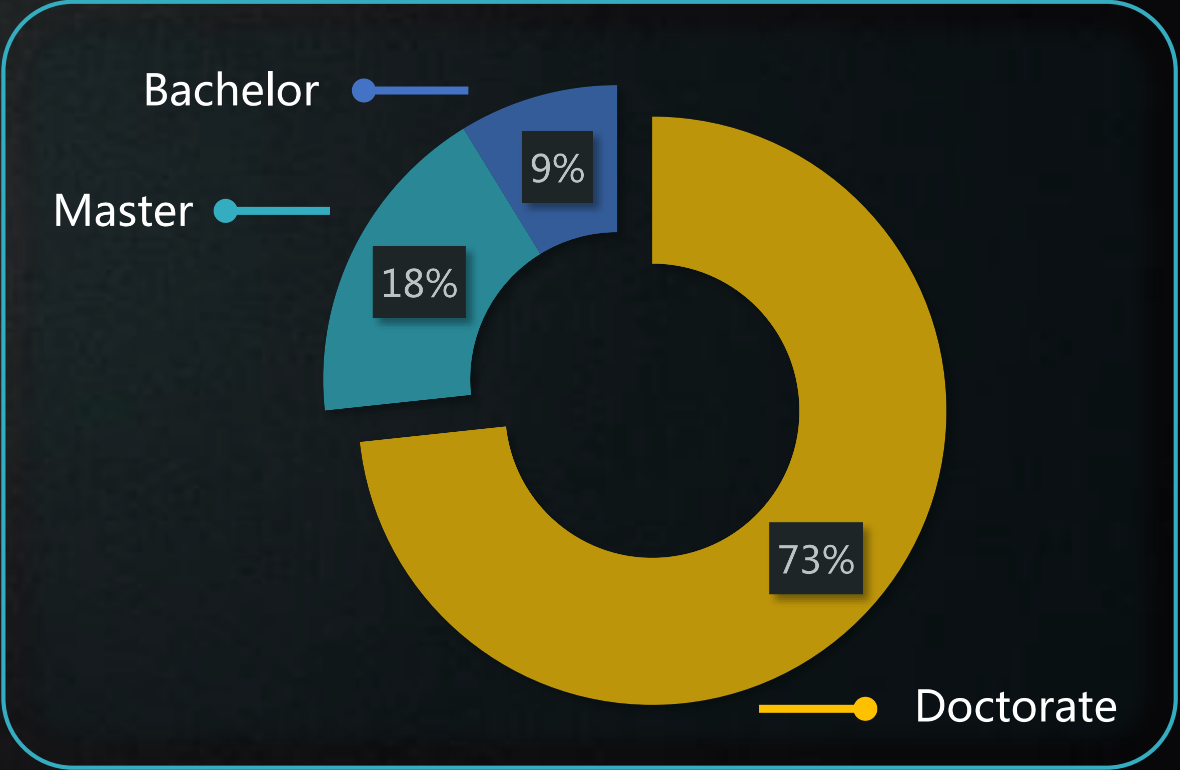
» The algorithm won a good reputation for its application in the AlphaGo-Li Shishi contest. The victory of Alpha-Go demonstrates the power and versatility of CNN.

PART TWO: AI Firms' Influences

The Distribution on AI Talents (Graduate School and Graduate Degree)

- The AI talents largely come from Tsinghua University, Chinese Academy of Sciences, University of Science and Technology of China, Massachusetts Institute of Technology, and Peking University.
- It is a very well-educated group: 68% of them hold doctorate degrees.





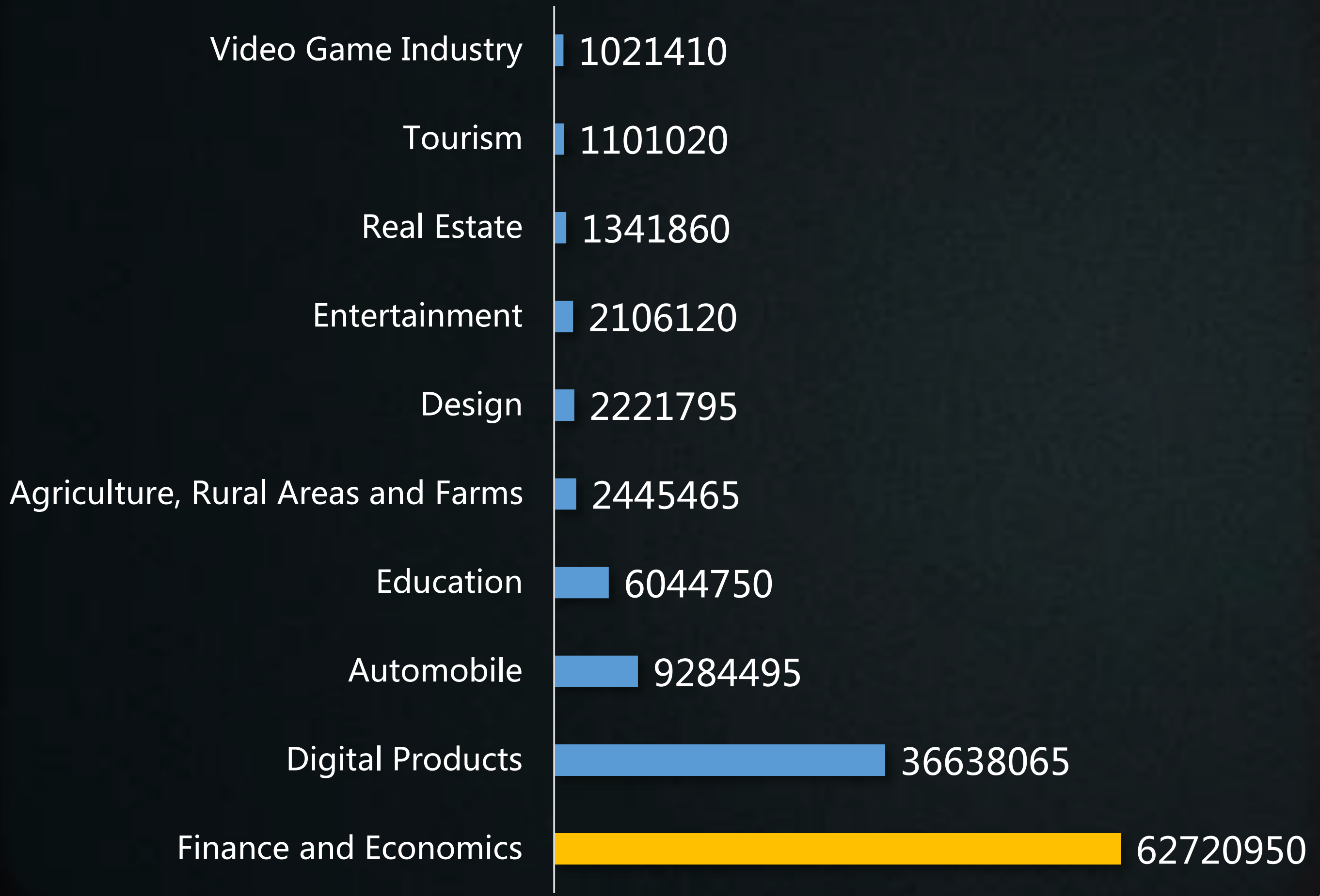
Data Sources: *The List of AI Talents* from IYIOU.com

03/ AI’s Influence in Applications Scenarios

- Top 10 Application Fields of AI
- Star AI Products for Consumers
- Star Robot Journalists
- Star Intellectual Assistants
- Star Self-driving cars / Unmanned Pilot

PART THREE: AI’ s Influence in Applications Scenarios

Top 10 Application Fields of AI

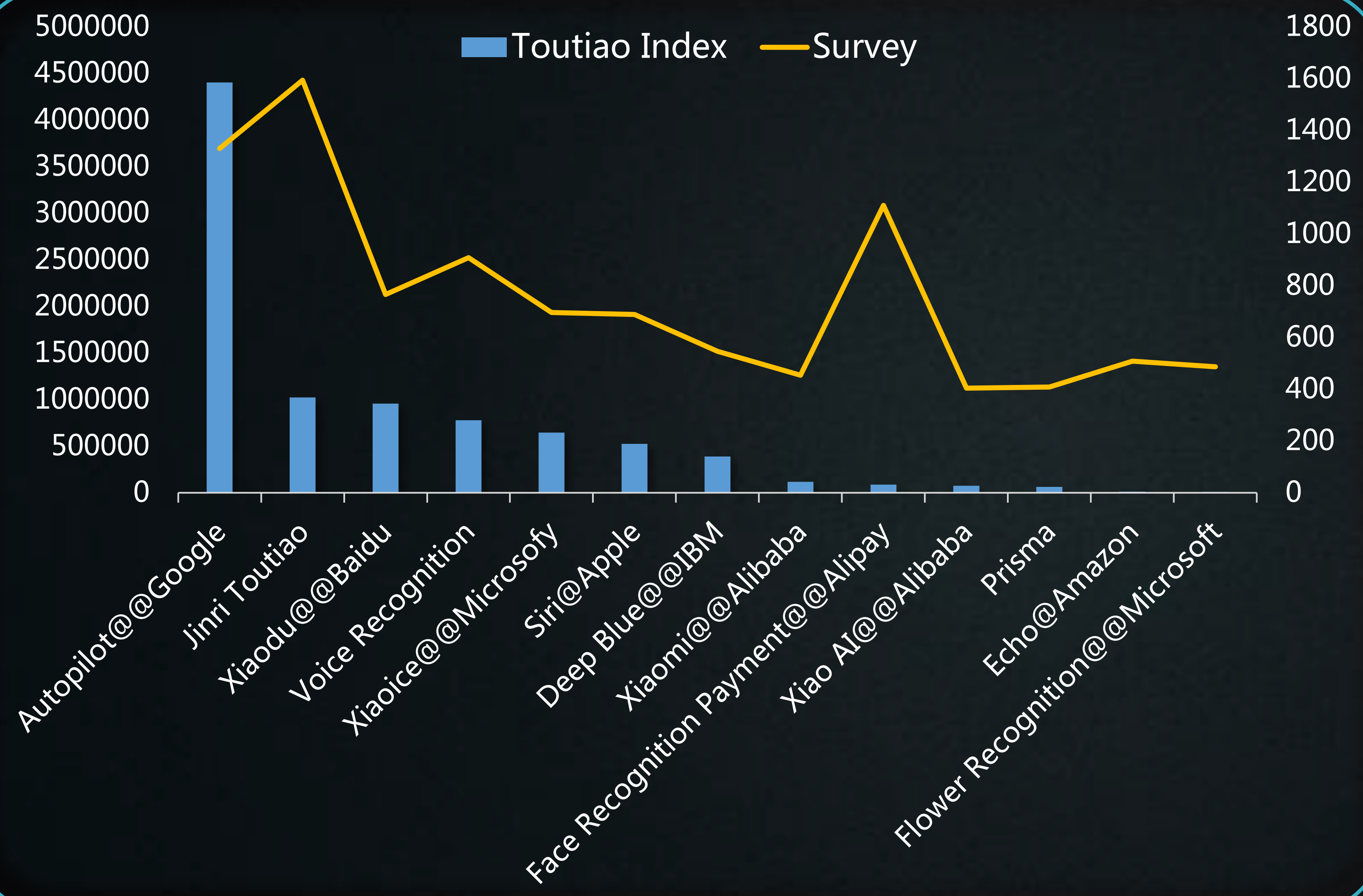


» Data Source: Toutiao Index

- AI as an computer technology, no matter in which scenarios and fields it is applies, its nature is making technology to serve us better.
- There are many successful cases in some fields like finance, digital products and automobile, but the application of AI in traditional industries like agriculture, real estate and tourism still needs to be improved.
- A survey by McKinsey indicates that more than 40% of companies in China’ s traditional industries have not viewed AI as their strategic priority. Only when AI gets wisely applied in these industries, rather than serving only the technology giants, its potential economic value could be maximized.

PART THREE: AI’ s Influence in Applications Scenarios

The Influence of AI Products

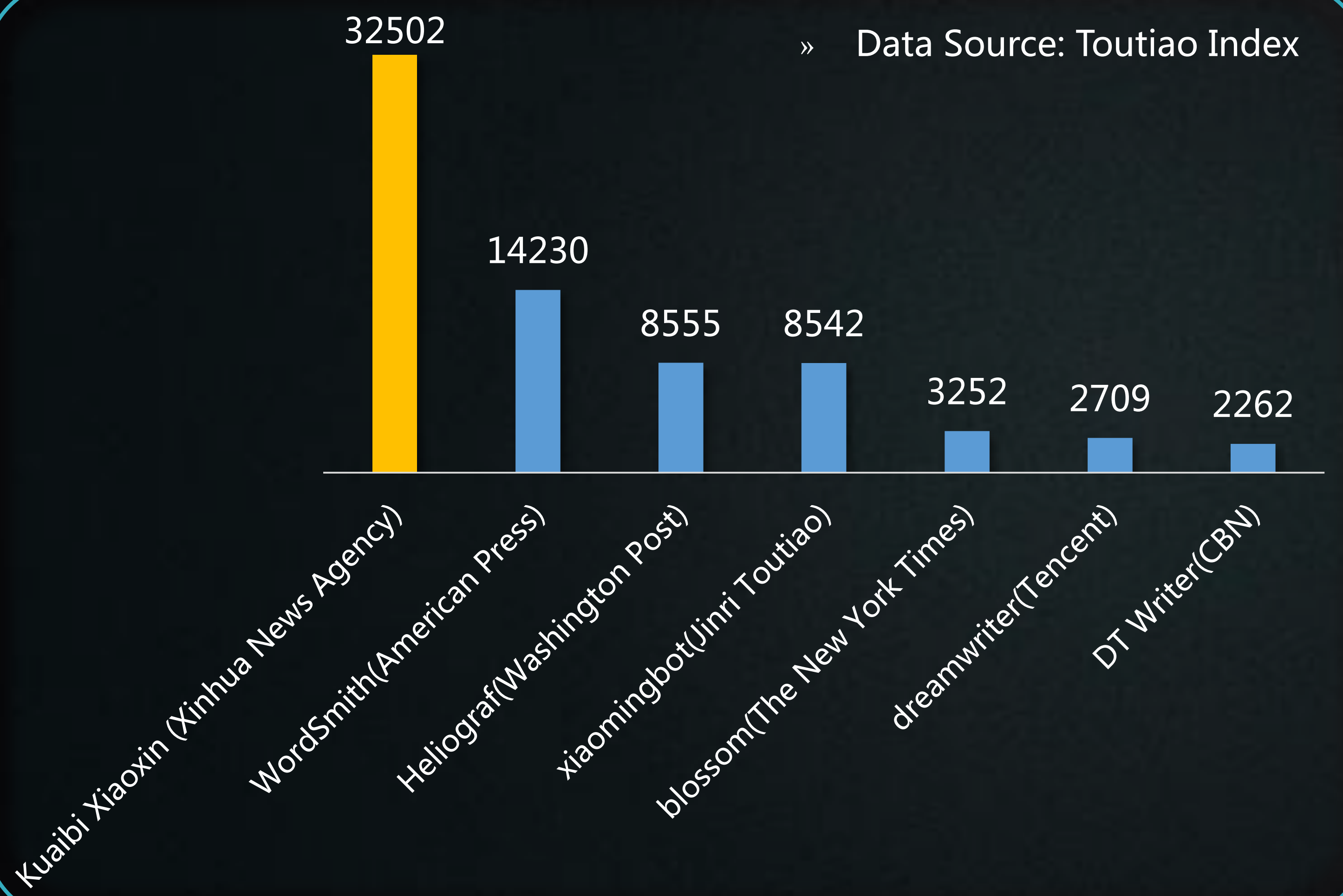


- The true value of high-end technology can only be realized when it is applied to improve the lives of people. From this perspective, simple application scenarios are exactly the best opportunities for the practices of machine learning.
- Though most of the recent AI products are developed for business users, those used widely by consumers have obviously gained a higher level of recognition and better reputation and influence.
- For example, Google’ s autopilot is ranked No.1 recongnized by Toutiao Hotness Index, while Jinri Toutiao and Alipay are most recognized by the public in the questionnaire survey

Data Source: Toutiao User Survey

PART THREE: AI’ s Influence in Applications Scenarios

The Influence of Robot Journalists

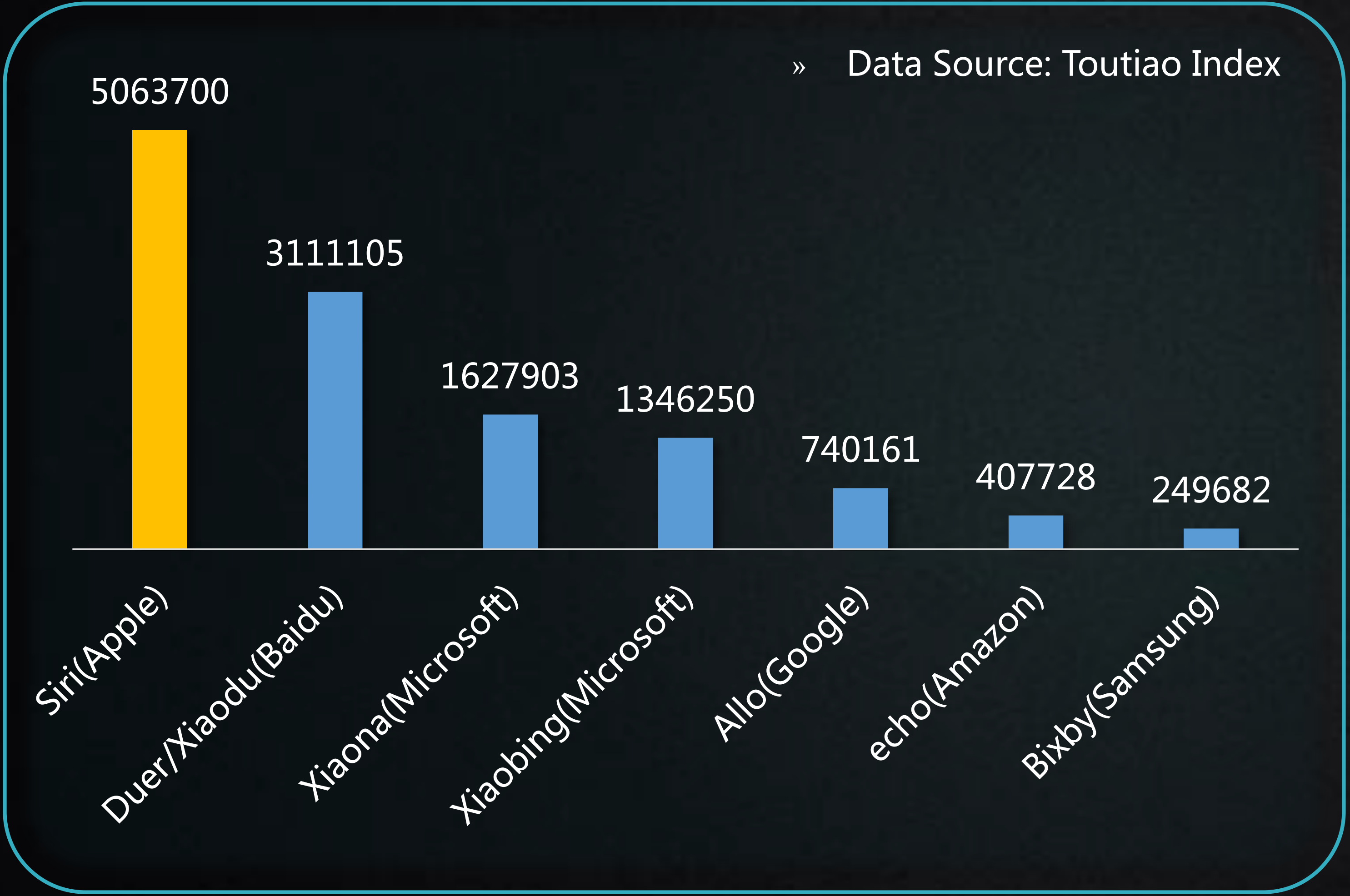


» Data Source: Toutiao Index

- Robot journalist is an AI computer program used in specific fields of media reporting. As a mature programming framework has not been developed, robot journalists cannot yet cover all industries. Today robot journalists are used with a high frequency in the sports and finance channels to produce quick reports.
- Jinri Toutiao, Tencent and Alibaba are the leading companies in China in terms of robot-journalist technology.
- But ’ Kuaibi Xiaoxin’ — developed by the Xinhua News Agency in 2016 — is the most well-known robot journalist to the public.

PART THREE: AI’ s Influence in Applications Scenarios

The Influence of Intellectual Assistant

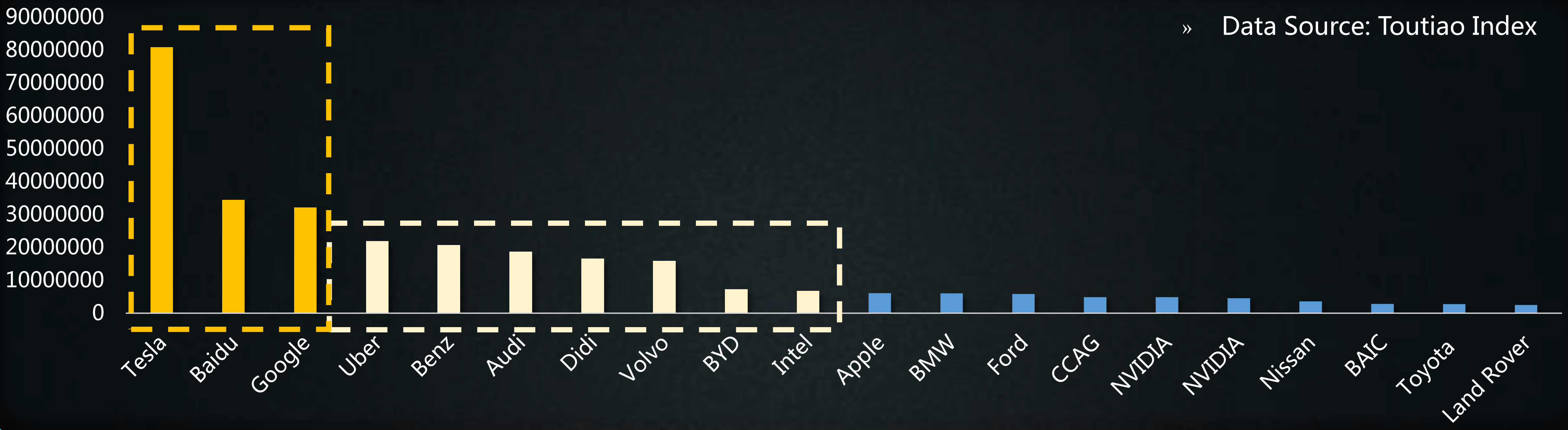


» Data Source: Toutiao Index

- Intellectual assistants, which used to exist only in science fictions, have arrived in our daily life and become well-known to the general public, just like Siri. By studying user behavior, such products are expected to improve the efficiency of cellphones and other similar devices.
- Apple’ s Siri is the most commonly known intellectual assistant in China, followed by Baidu’ s Xiaodu (thanks to the popular TV show Super Brain) and Microsoft’ s Xiaona and Xiaoice.

PART THREE: AI' s Influence in Applications Scenarios

The Influence of the Firms in Autopilot / Unmanned Pilot



» Data Source: Toutiao Index

- Autopilot (or unmanned pilot) is wisely considered as one of the most promising applications of AI, and also the most competitive one. The competitors include technology giants like Google and Apple, new automakers like Tesla and NEXTEV, traditional car manufacturers like Benz and Audi, and even NVIDIA — a chip manufacturer.
- It is notable that many Chinese companies appear on the Top 20 list, including Baidu, Didi and BYD.

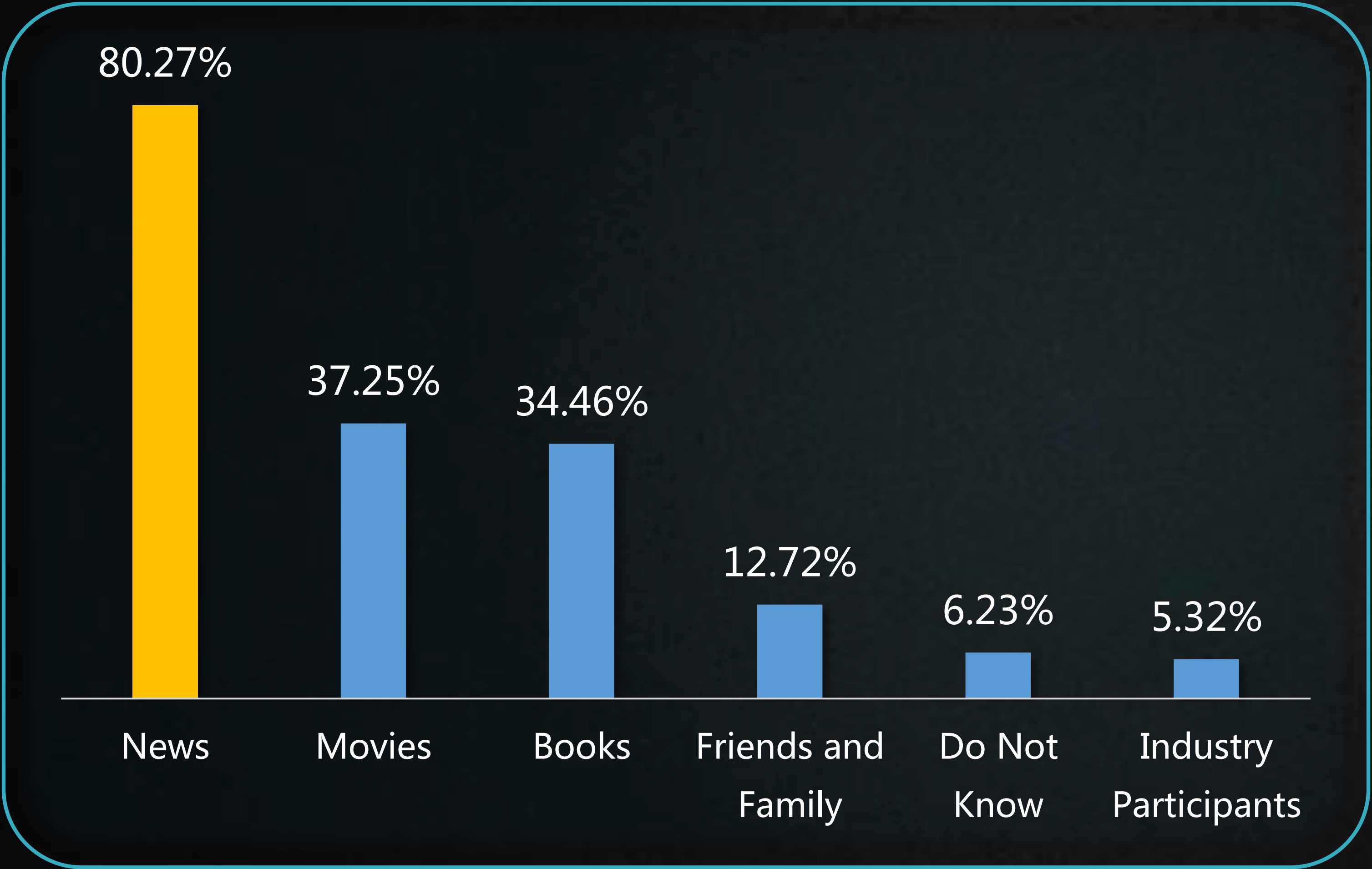
04/

Public Perception of AI

- AI-Confidence Index
- The Public Perception of AI
- Ten Questions about AI
- AI-User Profiles

PART FOUR: Public Perception of AI

Channels to Learn about AI



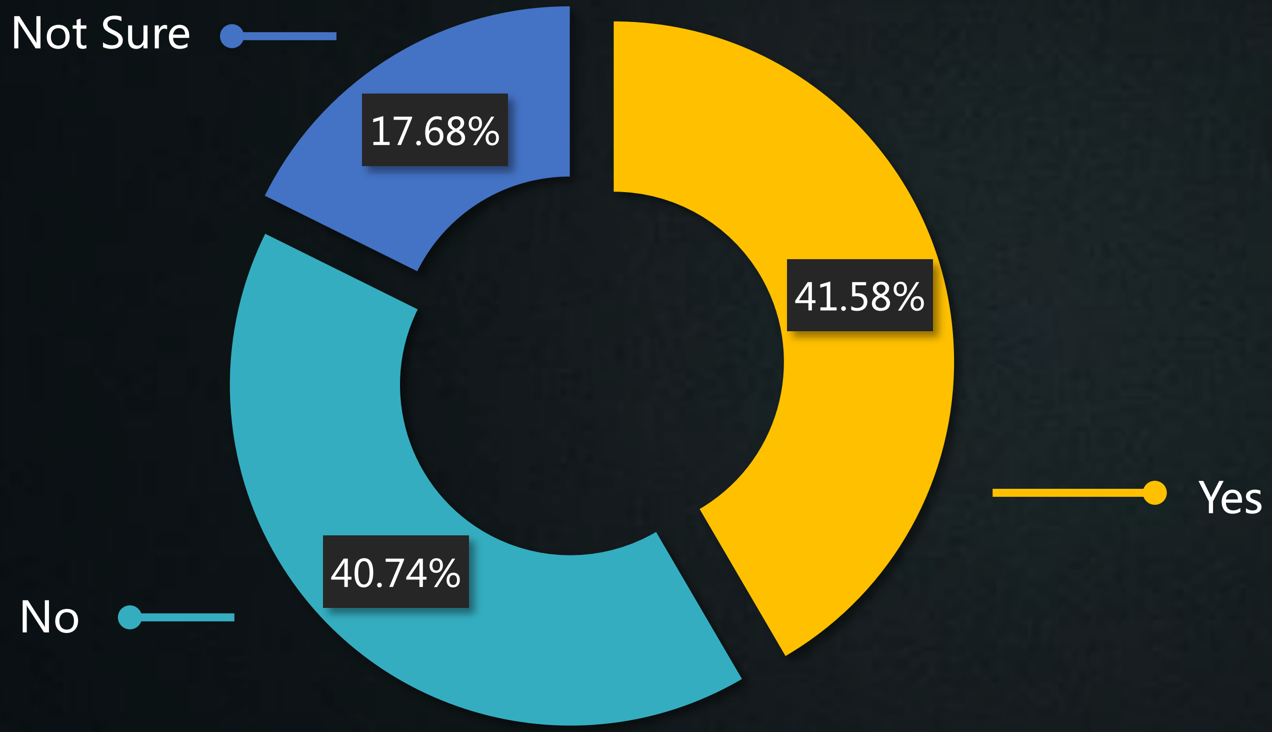
» News reports and movies are two main channels,accounting for 80.27% and 37.25%, respectively.

» Only 6.23% of respondents said they had no ideas about AI.

Data Source: Toutiao User Survey

PART FOUR: Public Perception of AI

AI Products and Services in China



Data Source: Toutiao User Survey

- AI has become an integrated part of our lives, but not everyone has realized its existence.Despite the high public awareness of AI, only

  41.58% of the respondents realized

  that they had used AI products, while 40.74% of them thought that they had never used them. 17.68% of the respondents said they were not sure what AI products were like.

- In the respondents from Hong Kong, Beijing, Tianjin, Shanghai, Fujian, Shandong, Heilongjiang, Inner Mongolia and overseas, over 46% of them had used AI products or services, exceeding the average.

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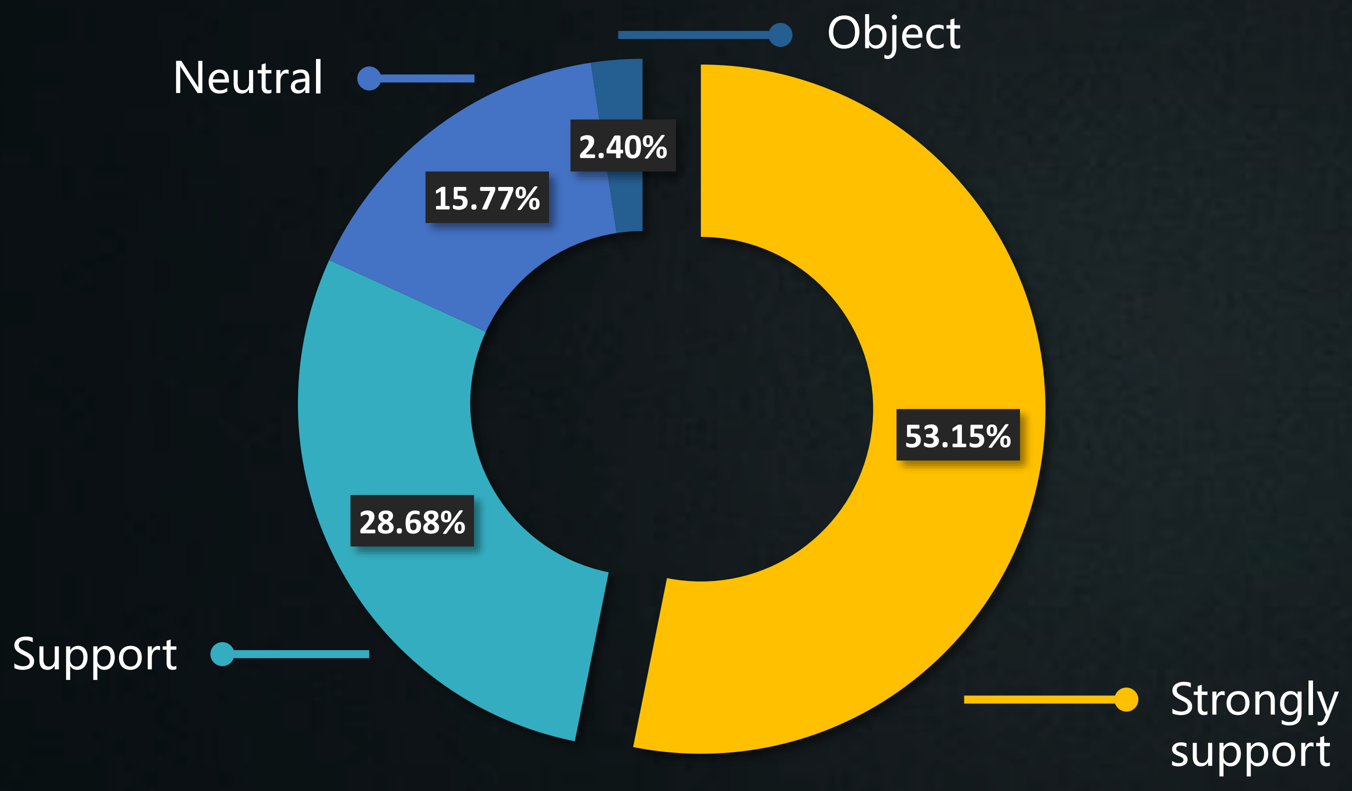
PART FOUR: Public Perception of AI

Chinese People's Expectation of the Future of AI



53.15% » Strongly support. These respondents believe that the development of AI should move forward at full speed, considering its various benefits. The respondents in Xinjiang, Shaanxi, Guizhou, Anhui and Shandong showed the highest supports, where the support rates all exceed 60%.

28.68% » Support. These respondents believe that we should continue to promote the development of AI technology, but focused on low-risk projects.

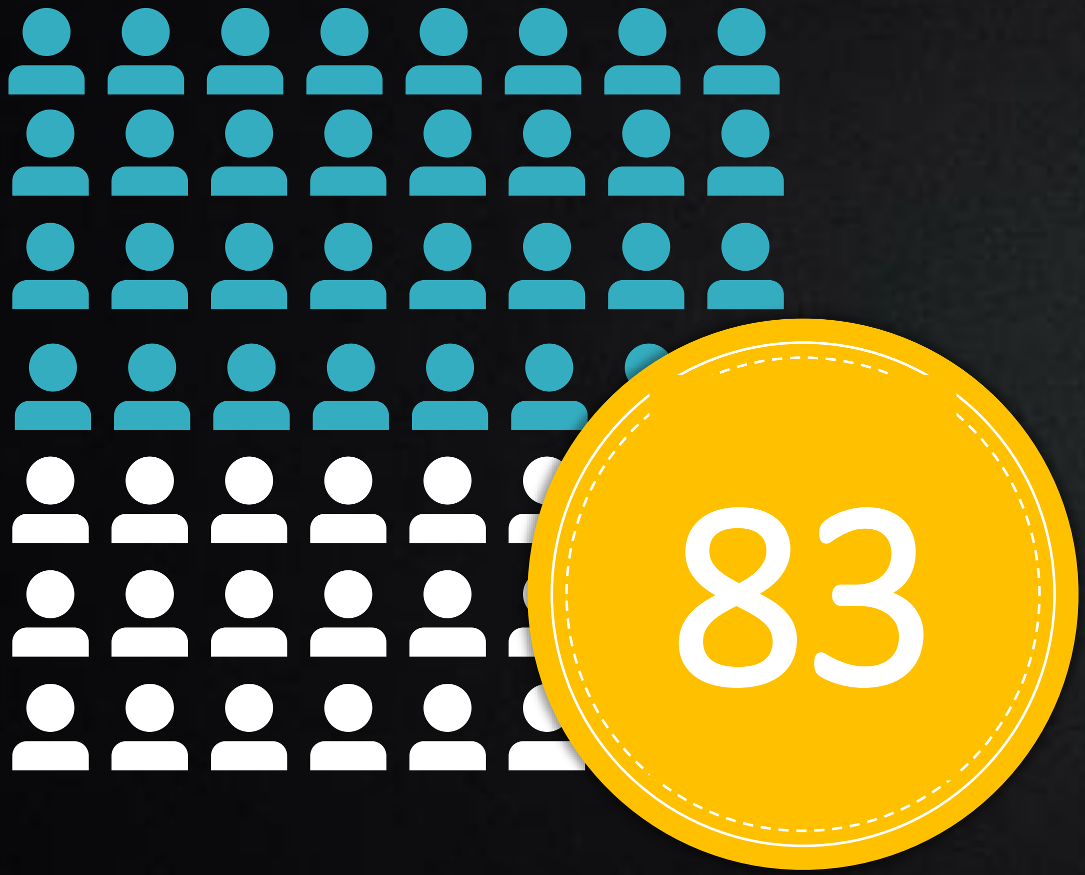
15.77% » Neutral. AI development should slow down and we need to invest in projects that set up safeguards for AI applications.

2.4% » Object. AI development should be stopped.

Data Source: Toutiao User Survey

PART FOUR: Public Perception of AI

AI-Confidence Index



93.77 » Public Awareness of AI: How much we know about AI

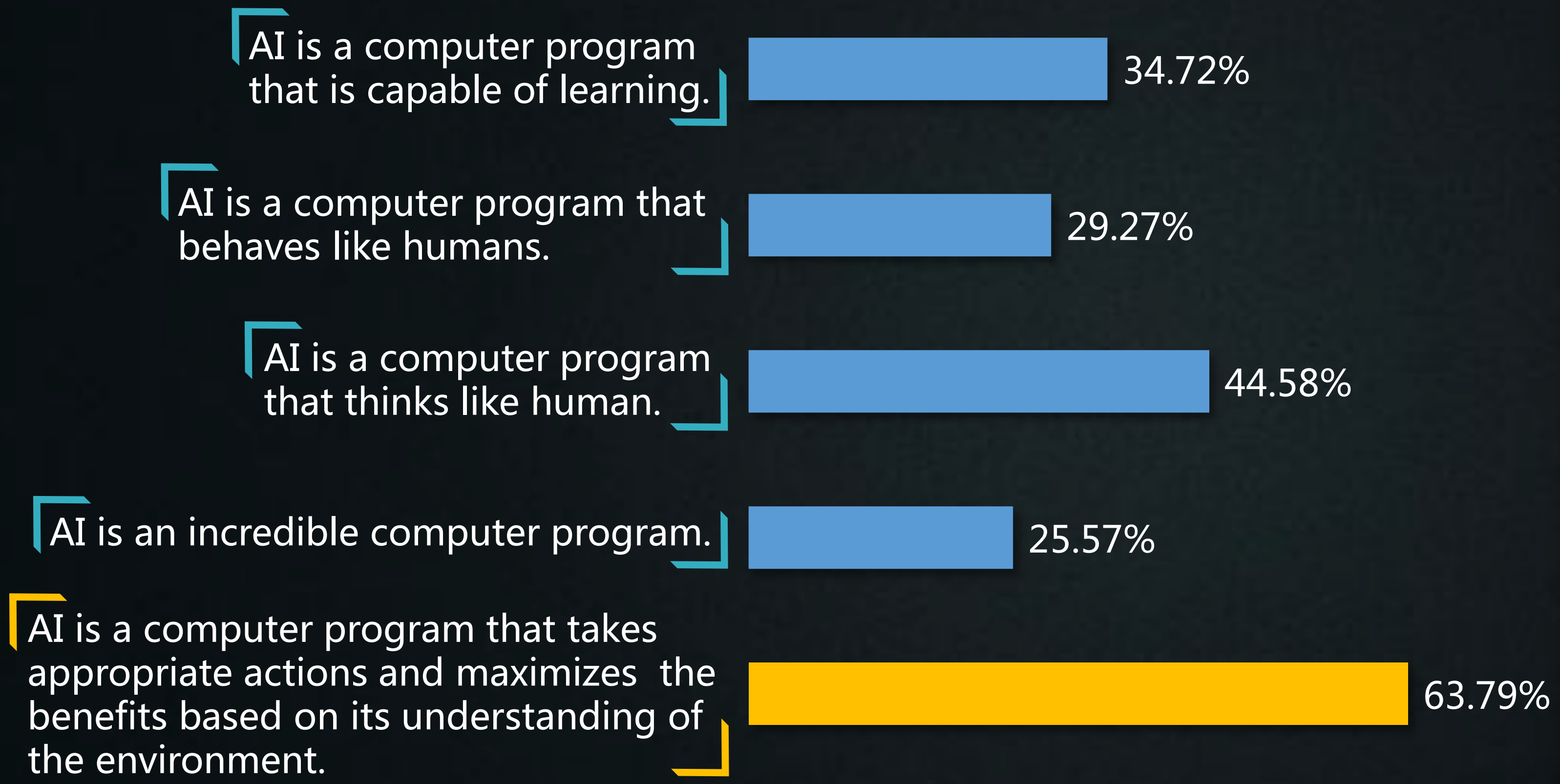
41.58 » The Usage of AI Products and Services

81.83 » Our Expectation of AI: Chinese People's Attitudes towards AI Development

83.22 » AI-Confidence Index = 2* (ln(a)*2+ln(b)*4+ln(c)*4)

PART FOUR: Public Perception of AI

What is AI in the Public' s Eyes?

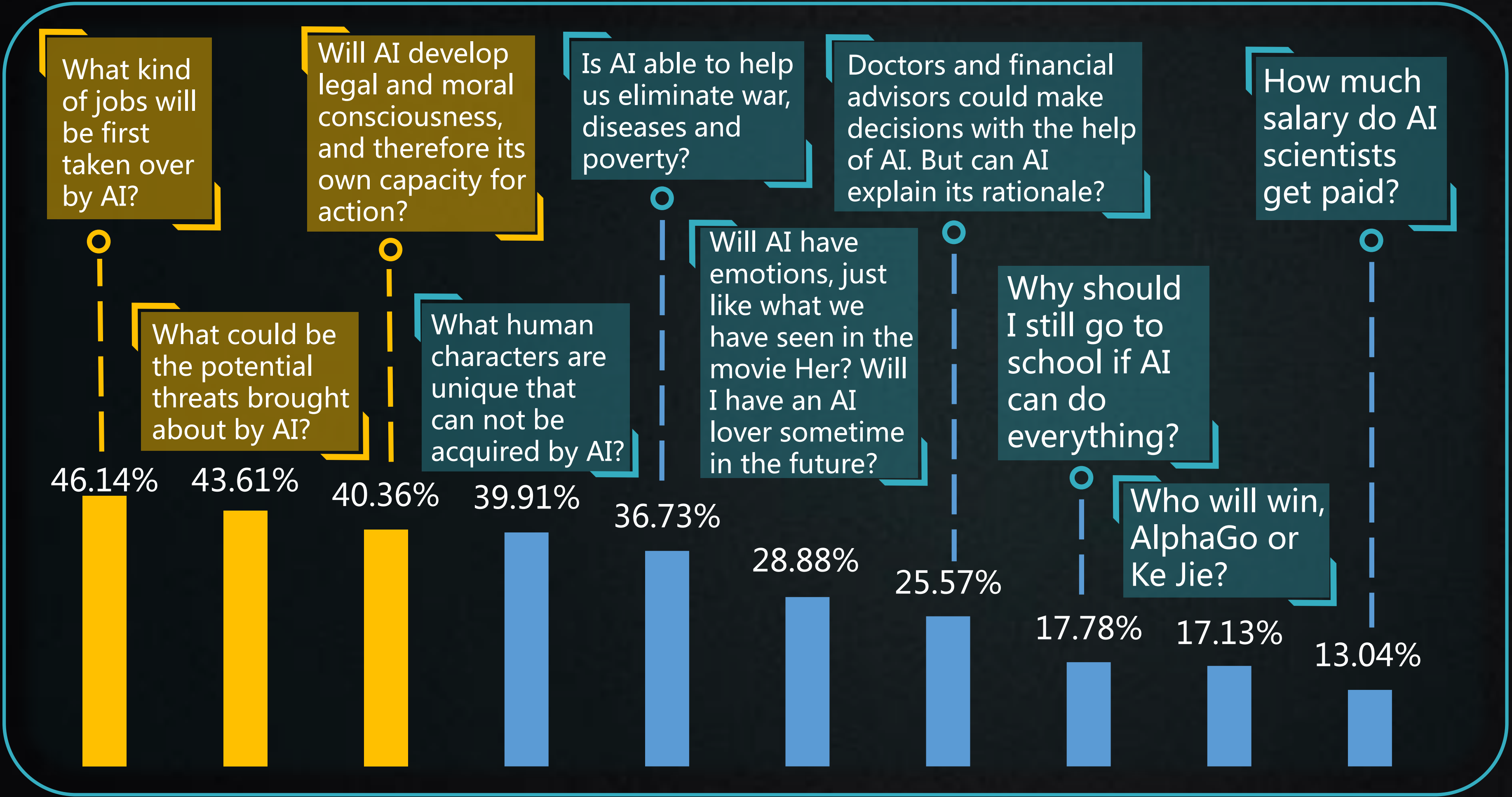


- There are various opinions and definitions about AI. Li Kaifu defined AI with five characters in the book Artificial Intelligence, on which the respondents shared their different degree of approvals on each point:63.79% of them think that Ai is a computer program that can take appropriate actions and maximizes the benefits based on its understanding of the environment.

Data Source: Toutiao User Survey

PART FOUR: Public Perception of AI

Ten Questions about AI

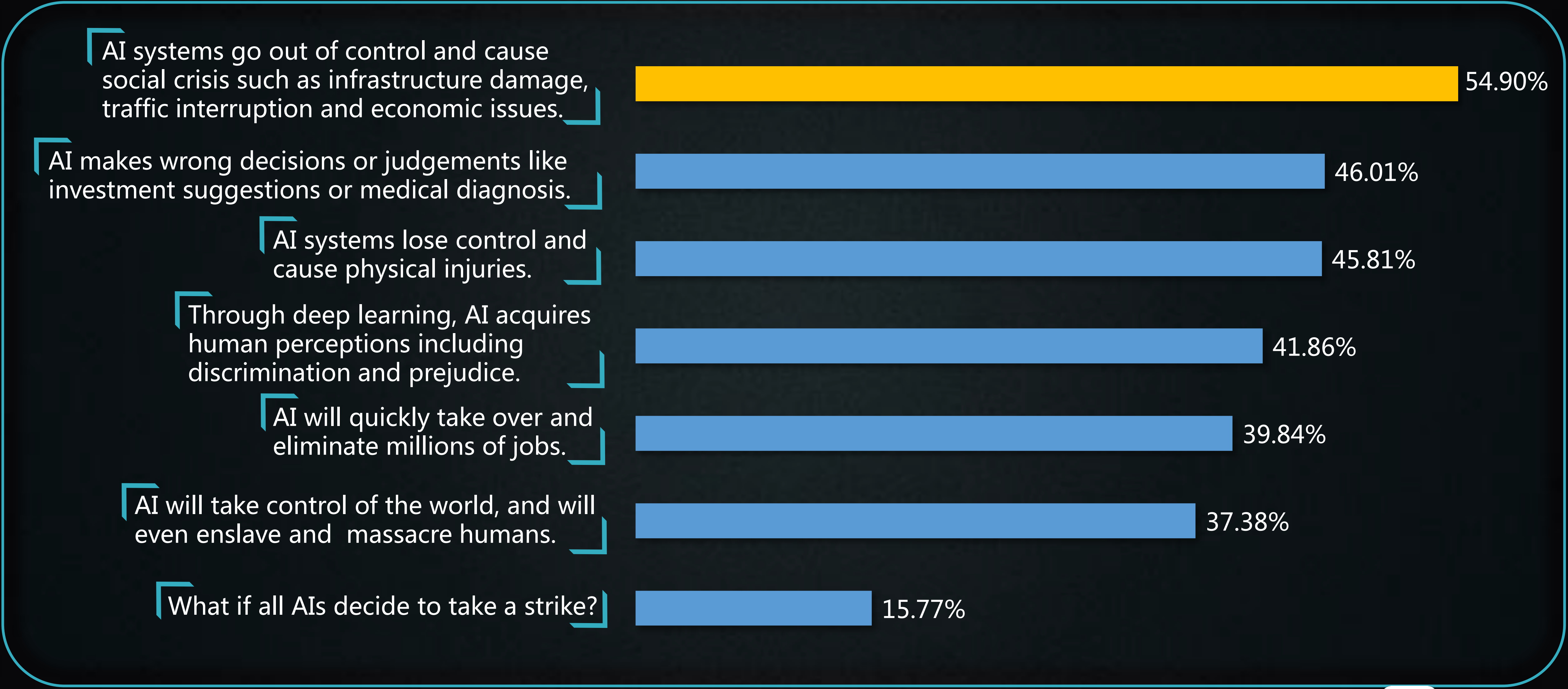


» In the 10 important questions, people are most concerned about those that could have a direct impact on their interests: what jobs will be taken away, potential threats against humans, as well as legal and moral risks associated with the development of AI. These top three questions indicate doubt and some negative thinking about the future of AI. It shows people's desire to have a better understanding of the risks of AI, even though many are supportive of its development. As for the game between AlphaGo and Ke Jie, who will win, they don't really care.

Data Source: Toutiao User Survey

PART FOUR: Public Perception of AI

What are your fears about AI?

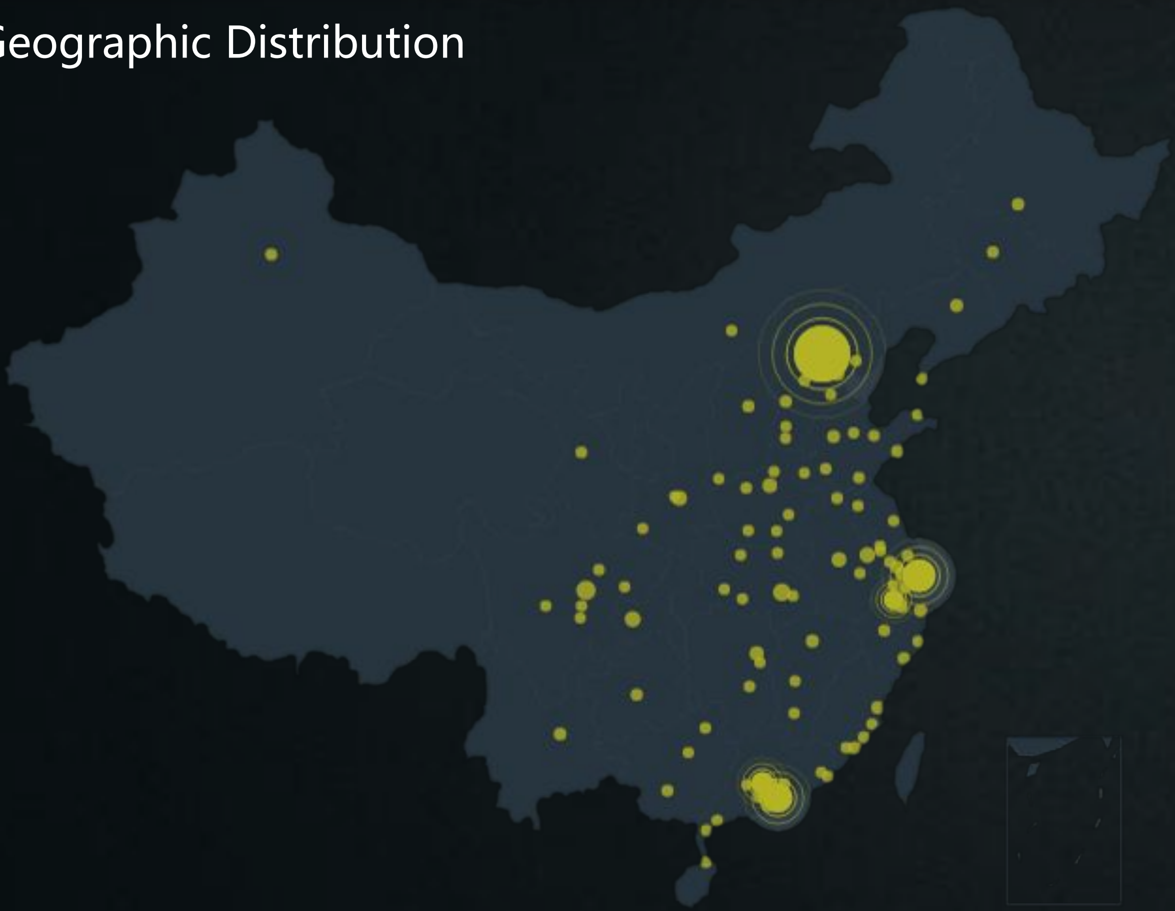


Data Source: Toutiao User Survey

PART FOUR: Public Perception of AI

AI-User Profiles

Geographic Distribution



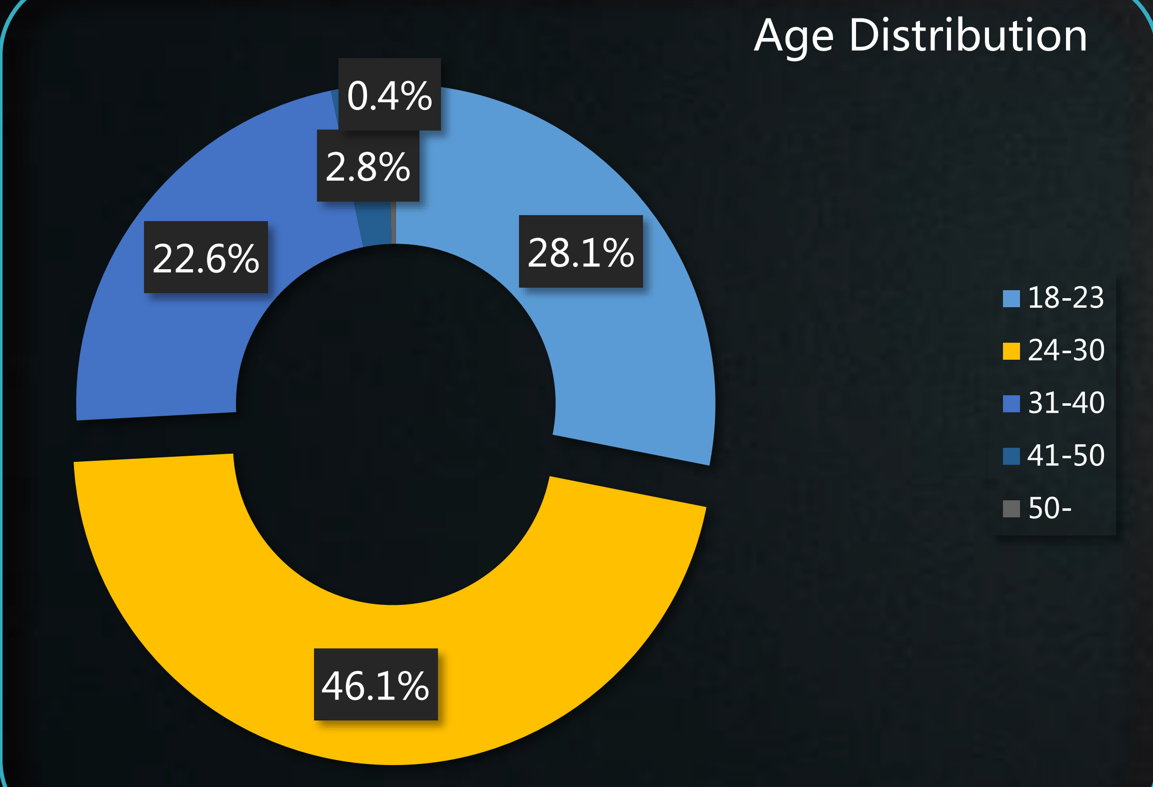
- The majority of users who show an interest in AI are from Tier-1 Chinese cities, Beijing, Shanghai, Shenzhen, Guangzhou, Hangzhou, Chengdu and Wuhan.
- AI is a typical knowledge-intensive industry, so Beijing enjoys an obvious competitive advantage, with its big pools of talents, technology, industries and capitals, serving as the core area of AI development in China.

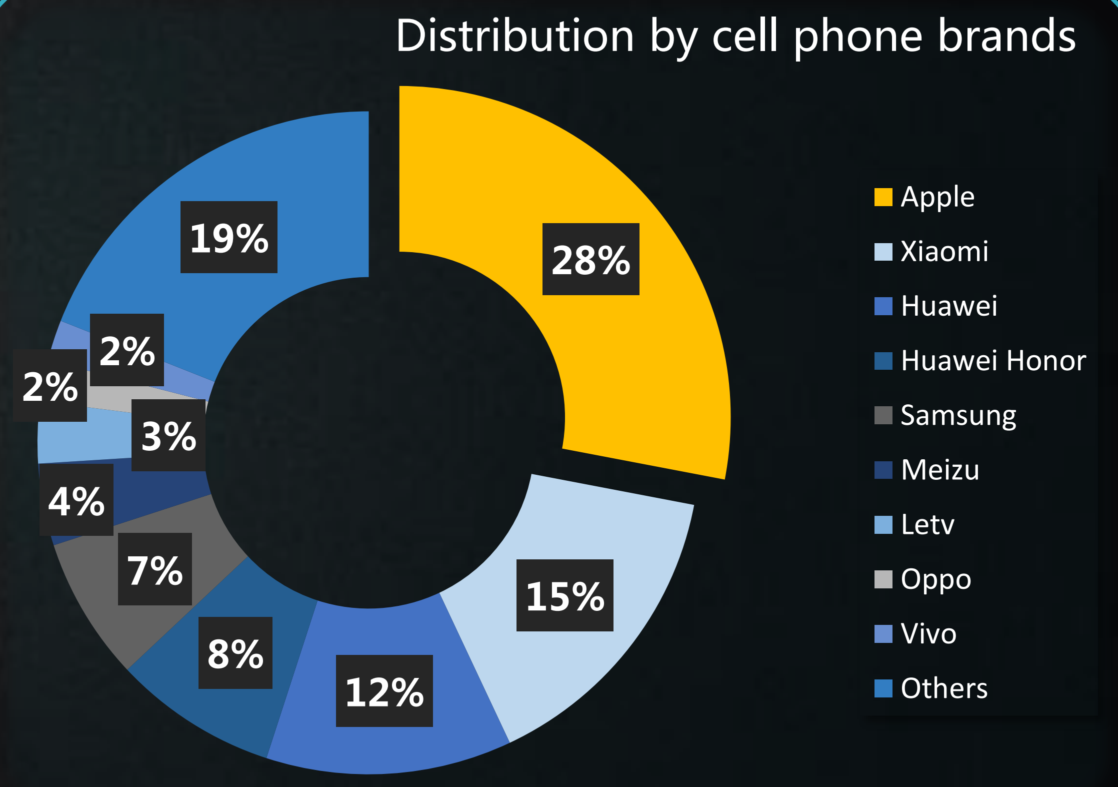
PART FOUR: Public Perception of AI

AI-User Profiles

- The majority of users interested in AI are aged between 18-30.

- Iphone, Xiaomi and Huawei are the most popular brands among the majority of users who show an interest in AI.





Appendix

- About the Data:
- Data source: Toutiao Index January 1, 2015 - May 11, 2017
- The Hotness Level Index cited in this report are based on these factors: the showing frequency (hotness level) of the key words, reading behaviors, sharing behaviors, and reader interaction behaviors.
- The Toutiao User Questionnaire Survey was conducted between May 9, 2017 and May 13, 2017 which included 3,088 valid samples.

Declaration

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Jinri Toutiao Algorithm and Data Center

Jinri Toutiao Algorithm and Data Center is the data research center dedicated to more comprehensive and deeper interpretation of reading data to discover its value. Relying on the huge amount of data generated by Toutiao users everyday, we try to test the effectiveness of each piece of information, establish an accurate profile for each of our users, and understand the underlying motivations behind reading behaviors.

Email：datadance@bytedance.com

Address：ZhongHang Plaza, The West of the North Third Ring Road, Haidian District, Beijing

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