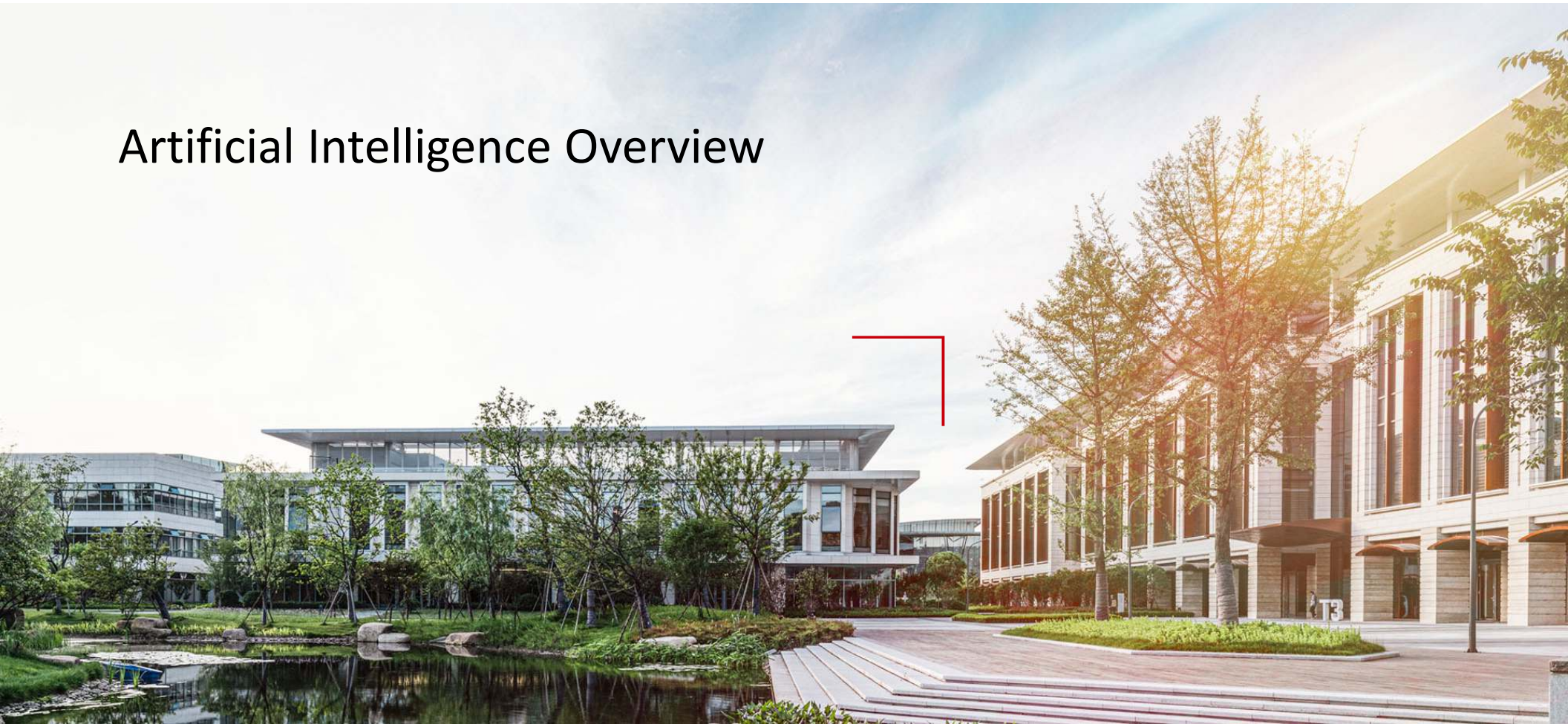


# Artificial Intelligence Overview



# Objectives

- Upon completion of this course, you will understand:
  - Basic concepts of AI
  - AI technologies and development history
  - Application technologies and fields of AI
  - Huawei's AI development strategy
  - AI development trends

# Contents

---

- 1. AI Overview**
2. Application Fields of AI
3. Huawei's AI Development Strategy
4. Controversies Over AI and Its Future

# Insights from Prominent Computer Scientists

"I propose to consider the question, 'Can machines think?'"

— Alan Turing, 1950

"...making a machine behave in ways that would be called intelligent if a human were so behaving."

— John McCarthy et al., 1956

"Artificial intelligence is the science of making machines do things that would require intelligence if done by men."

— Marvin Minsky

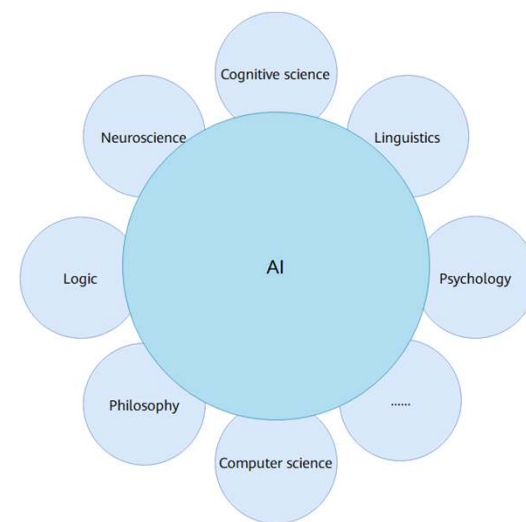
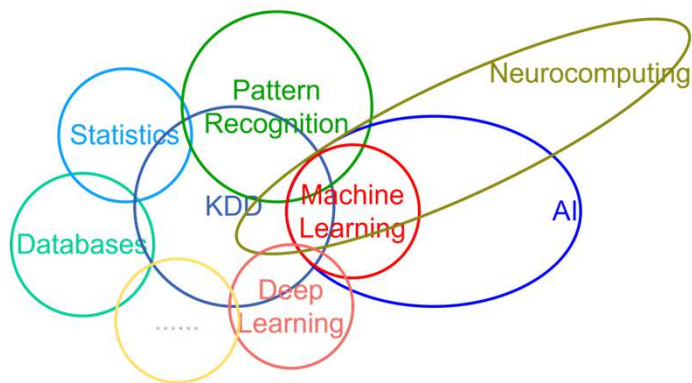
# What is intelligence?

- According to the theory of multiple intelligences proposed by Professor Howard Gardner, multiple intelligences are manifested by eight capabilities:
  - Linguistic-verbal intelligence
  - Logical-mathematical intelligence
  - Visual-spatial intelligence
  - Bodily-kinesthetic intelligence
  - Musical-rhythmic and harmonic intelligence
  - Interpersonal intelligence
  - Intrapersonal intelligence
  - Naturalistic intelligence

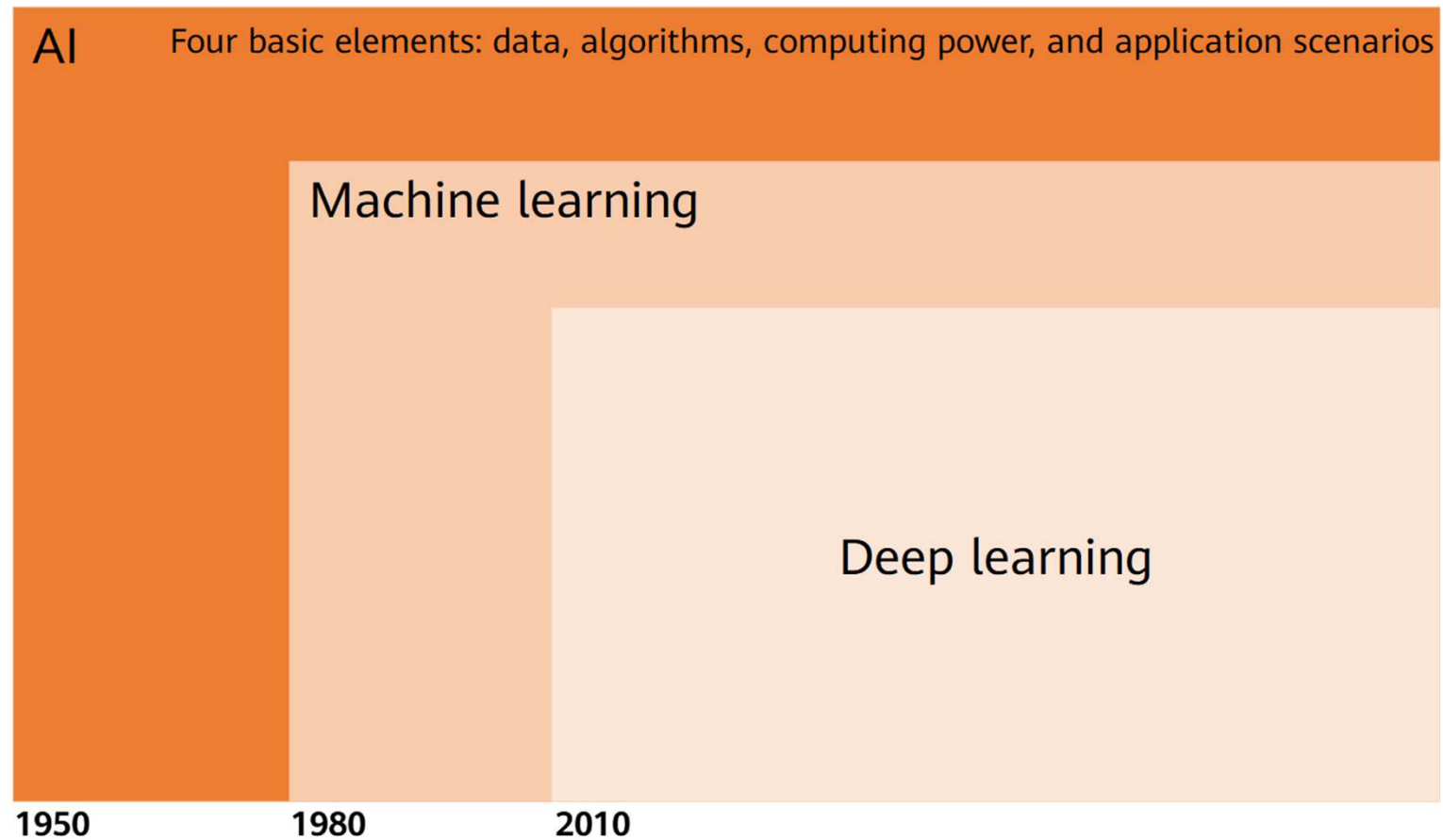


# What Is Artificial Intelligence?

- "Artificial" in artificial intelligence (AI) means that it is designed by and is created for humans.
- AI is a scientific discipline that studies and develops theories, techniques, and application systems used to simulate and extend human intelligence. The term was first coined by John McCarthy in 1956, who defined it as the "science and engineering of making intelligent machines, especially intelligent computer programs". The very premise of AI technology is to enable machines to learn from collected data, and make human-like decisions.
- Today, AI has become an interdisciplinary course that involves various fields.



# Relationship Between AI, Machine Learning, and Deep Learning





# Relationship Between AI, Machine Learning, and Deep Learning

- AI is a scientific discipline that studies and develops theories, techniques, and application systems used to simulate and extend human intelligence.
- Machine learning (ML) refers to the ability of computers to learn, simulate, or implement human behavior to acquire new knowledge or skills, and continuously update existing knowledge structures to improve performance.
- Deep learning (DL) is a research field in ML and originates from artificial neural network (NN) studies. Multilayer perceptron (MLP) is a deep learning structure. Deep learning uses higher level features derived from the lower level features to form a hierarchical representation, in which it simulates the mechanisms of the human brain to interpret data, such as images, voice, and text.

# Major Schools of AI - Symbolism

- Symbolicism, also called logicism, psychologism, or computerism, refers to the symbolic AI that is derived from mathematical logic.
- It suggests the basic cognition units of humans are symbols, and human cognition is a reasoning process based on various symbols. As humans and computers are both physical symbol systems, computers can be used to simulate intelligent human behaviors.
- This theory, proposed by McCarthy et al in 1956, first used the term "artificial intelligence" and made dominant contributions to the field's development, especially the success of expert systems.

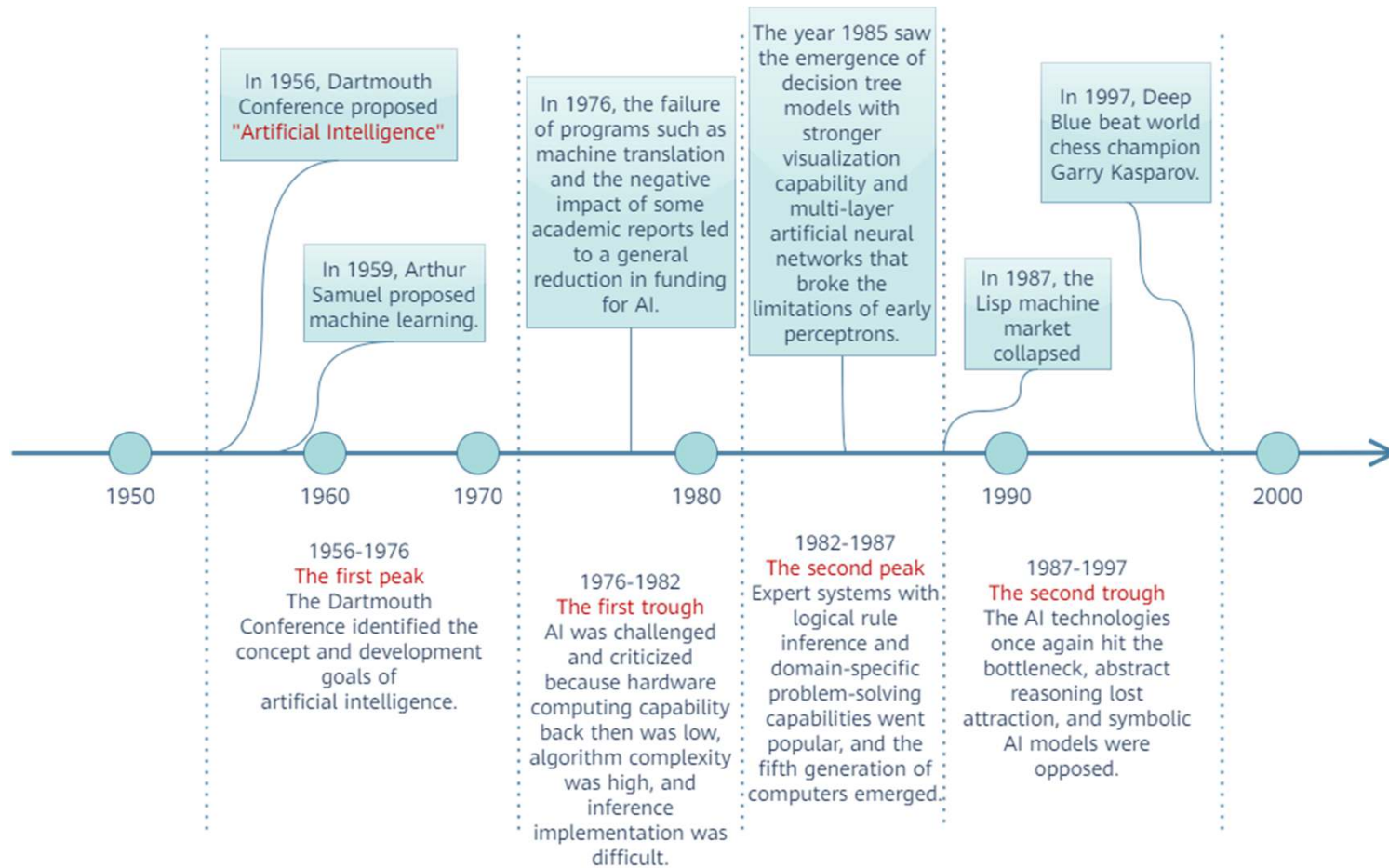
# Major Schools of AI - Connectionism

- Connectionism, also known as bionicsism or physiologism, argues AI originates from bionics, that is, it is the study of human brain.
- Researchers believe the neuron, and not symbol processes, is the basic thinking unit. Connectionism starts with neurons and studies NNs and brain models, to create a new development path for AI.
- The McCulloch-Pitts (MP) neuron model was proposed in 1943. However, the study of brain models was limited due to biological prototypes and technical conditions in the 1970s and 80s. It was not until the proposal of hardware-simulated neural networks that the trend of connectionism reemerged again.
- Nowadays, the artificial neural network (ANN) is a common technique but its complexity and scale has brought many interpretability problems.

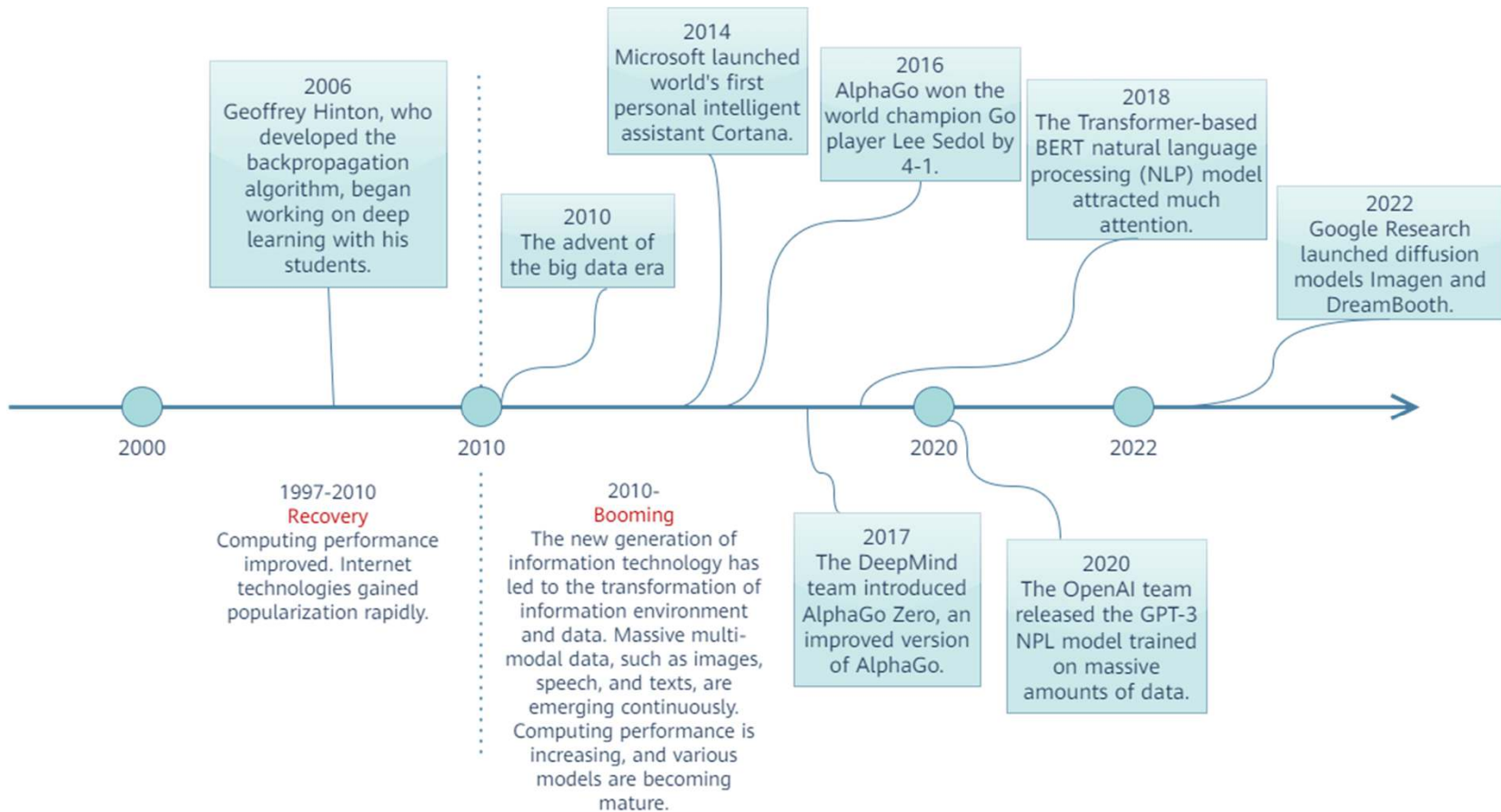
# Major Schools of AI - Actionism

- Actionism is also known as evolutionism or cyberneticsism and states that AI originates from cybernetics.
- It suggests intelligence depends on perception and actions, and that intelligence does not require knowledge, representation, or reasoning. AI can evolve like human intelligence, and intelligent behavior can only be manifested in the real world by interacting with the surrounding environment.
- Early research on actionism focused on simulating intelligent behavior of people in the control process. It led to the birth of intelligent control and robotics in the 1980s.

# AI Development History (1)



## AI Development History (2)

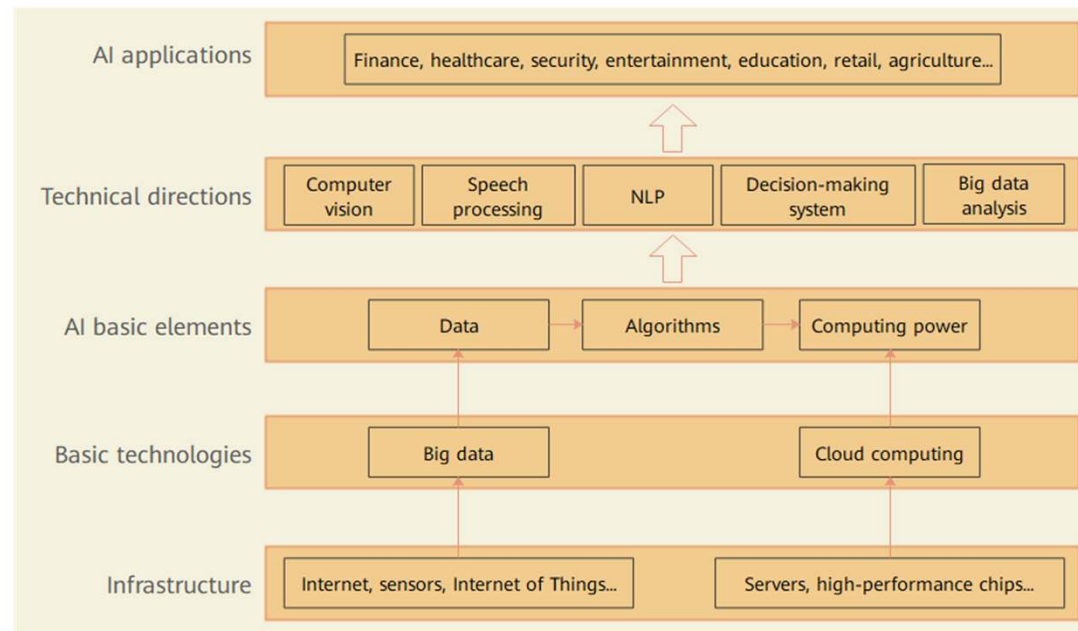


# Types of AI

- Strong AI:
  - This hypothesis aims to create intelligent machines that replicate human functions, such as reasoning and problem-solving, and are perceptive and self-conscious. Strong AI will be able to think independently and teach itself to solve new problems, and have its own values and worldviews, and will even have the same instincts as creatures, such as survival and safety needs. In a sense, strong AI can be seen as a new species.
- Weak AI:
  - Weak AI aims to build intelligent machines that can perform specific tasks but rely heavily on human interference. These machines may seem intelligent but are not self-conscious.

# AI Industry Ecosystem

- Data, algorithms, computing power, and application scenarios are the basic elements of AI applications. We must combine AI with premium cloud computing, big data, and IoT to facilitate our intelligent society.



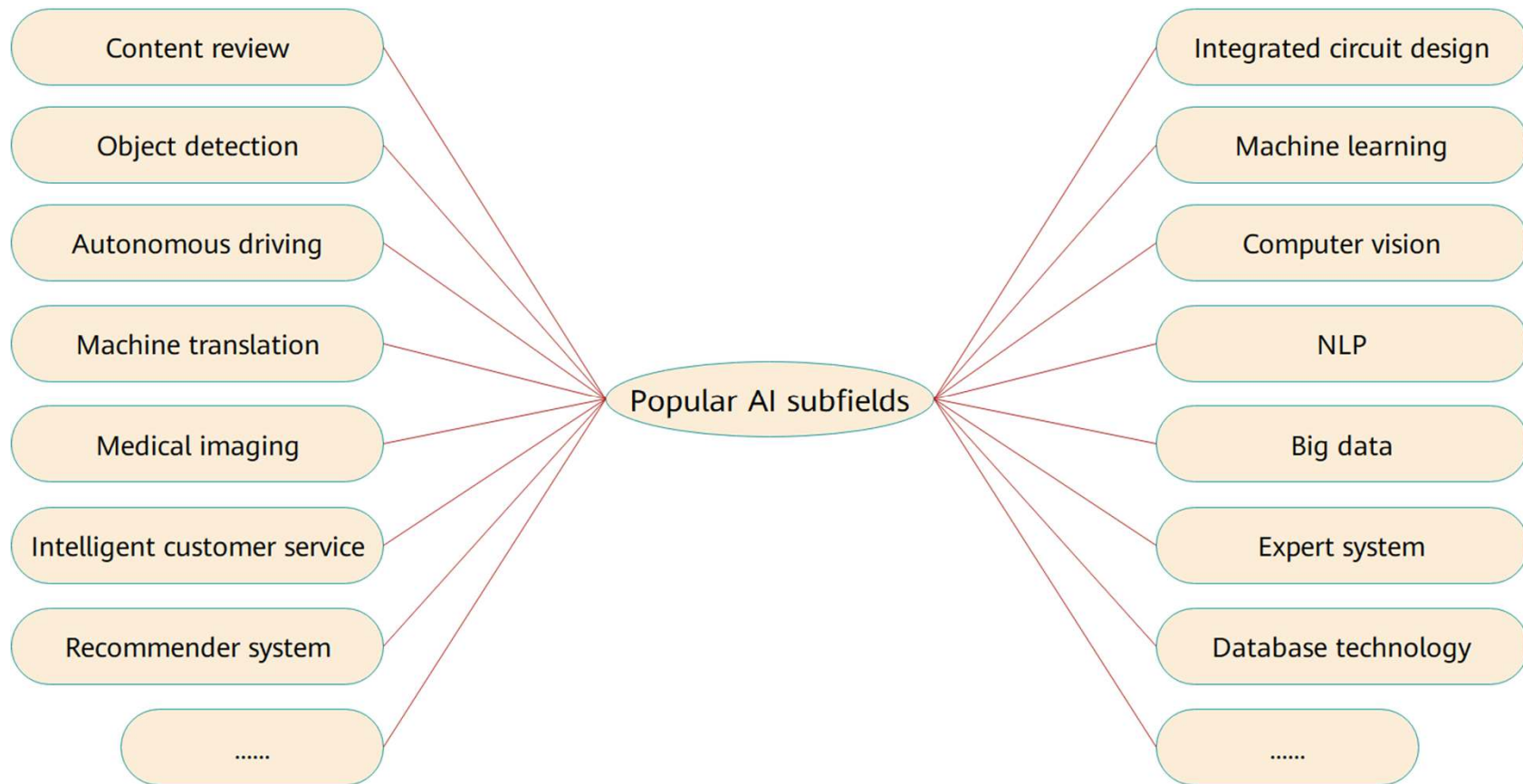


# Contents

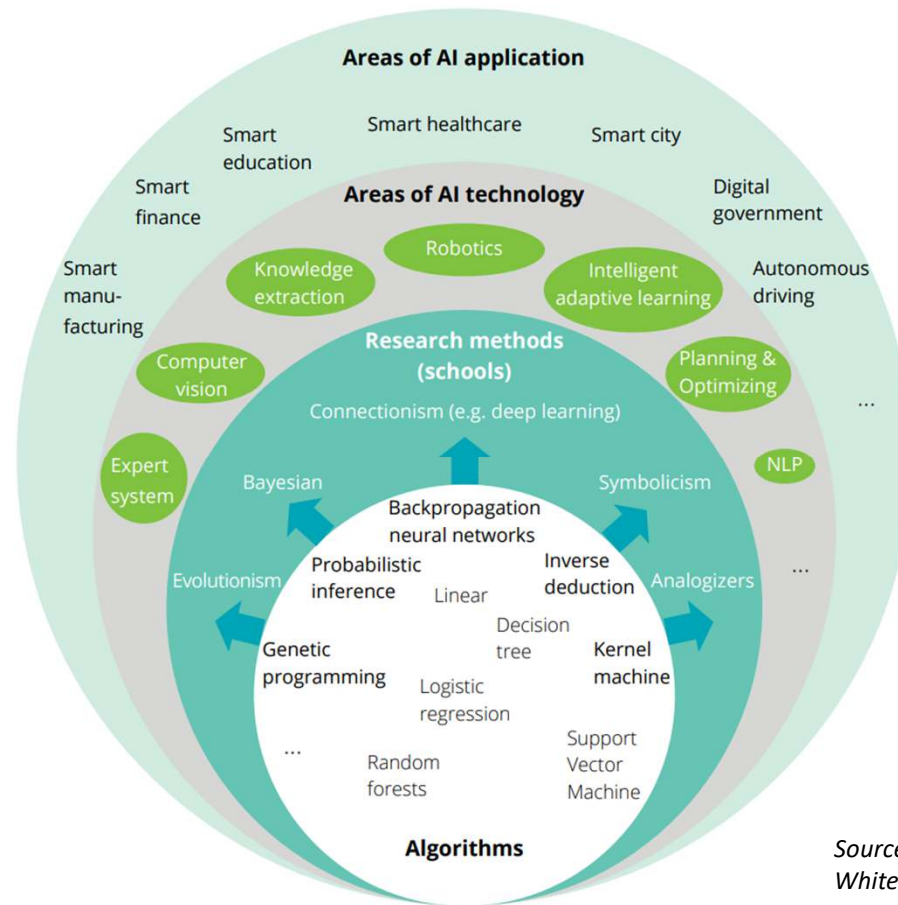
---

1. AI Overview
- 2. Application Fields of AI**
3. Huawei's AI Development Strategy
4. Controversies Over AI and Its Future

# Popular AI Subfields



# AI Technology and Application Fields



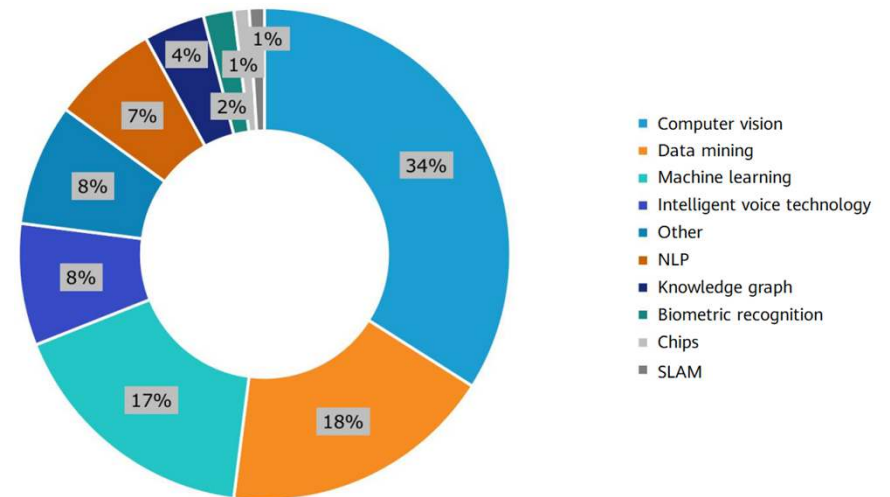
Source: Deloitte Global Artificial Intelligence Industry Whitepaper

# Distribution of AI Application Technologies in China

- Computer vision, robotics, natural language processing (NLP), machine learning, and biometric recognition are the most popular technology fields for China's AI enterprises.

• Currently, the directions of general AI technologies are:

- Computer vision
  - The study to make computers see things fast and accurately.
- NLP
  - The study making computers understand and use natural languages.



Source: EqualOcean 2022 China AI chips Industry Research

# Smart Mining

Scenario 1: Mining chamber that houses important devices such as power and communications devices

Goal: **Automatic inspection and unattended operation.**

**Challenge 1:** The chamber environment needs to be monitored 24/7.



**Challenge 2:** Manual inspection must be performed periodically.



## Solution for scenario 1: **Automatic inspection robot**

**Video surveillance:** Machine vision-based video surveillance for 24-hour monitoring of sensitive areas

**Sound detection:** AI sound detection techniques to intelligently monitor devices



## Scenario 2

Belt tear monitoring



Belt deviation monitoring



Belt cleanliness monitoring



## Scenario 2: Underground video surveillance system

### Challenges

Coal conveyor belt	The length of the coal conveying belt exceeds <b>20 km</b> . Manual inspection is time-consuming and insecure. Multiple belts need to work together to prevent coal accumulation.
Violation activities	Monitoring of personnel violations, such as not wearing safety helmets, smoking, passing under equipment, walking in roadways, and sitting on belts.
Violation operations	Gas drainage, water exploration and drainage.

# AI Safeguards Nature – A Protective Umbrella for Biodiversity in Chile

- The AI-powered "Nature Guardian" project has landed in the Nahuelbuta mountain range to study and protect the Darwin's fox. The "Nature Guardian", an acoustic monitoring system developed by the rainforest conservation organization Rainforest Connection (RFCx), has been deployed in several projects and is working effectively.
- It consists of solar devices equipped with microphones and antennas. These devices collect sound data from the surrounding environment and transmit it to the cloud through wireless networks for AI to analyze. Each device covers 3 square kilometers and runs around the clock.
- The "Nature Guardian" monitors gunshots from poachers, trucks and saws from illegal loggers, and cries from different animals to provide data for research.
- Trained AI analysis can identify the sounds of different animals, enabling experts to study the distribution and behavior of specific species and better implement environmental protection through adaptive management.
- If a threat is identified, the system sends a real-time alert to the ranger's mobile app, enabling the ranger to respond rapidly.

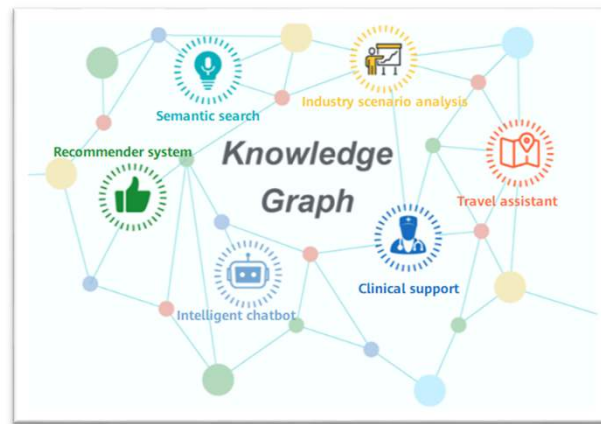


Darwin's fox

Source: <https://www.huawei.com/en/tech4all/stories/nature-guardians-for-biodiversity-in-chile>

# NLP Application Scenarios

- The research topics of natural language processing include machine translation, text mining, and sentiment analysis. Current NLP is technically difficult and not mature enough, and due to the highly-complex semantics, machines are unable to achieve the human understanding through deep learning based on big data and parallel computing.
- Development: From shallow semantics understanding to automatic feature extraction and deep semantics understanding; from single intelligence (ML) to hybrid intelligence (ML, DL, etc.).
- Application scenarios:



Knowledge graph

```
review_en = "the movie is so boring"  
inference(review_en)
```

Negative comments

Sentiment analysis

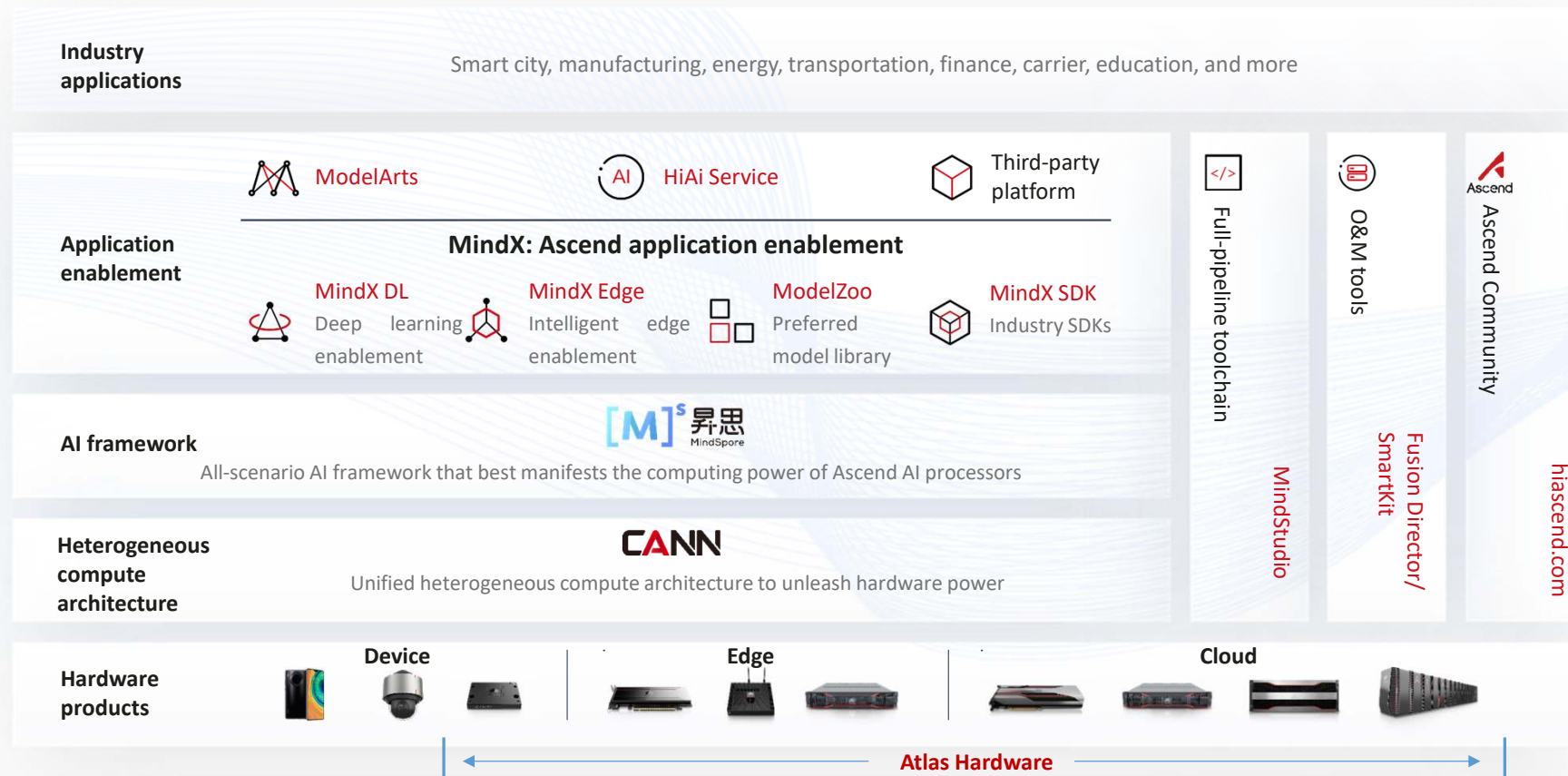
# Contents

---

1. AI Overview
2. Application Fields of AI
- 3. Huawei's AI Development Strategy**
4. Controversies Over AI and Its Future



# Huawei Full-Stack All-Scenario AI Solution



# Ascend AI Processors Empower Smarter, Superior Computing



**Ascend AI inference Chip series**

Energy-efficient AI SoC

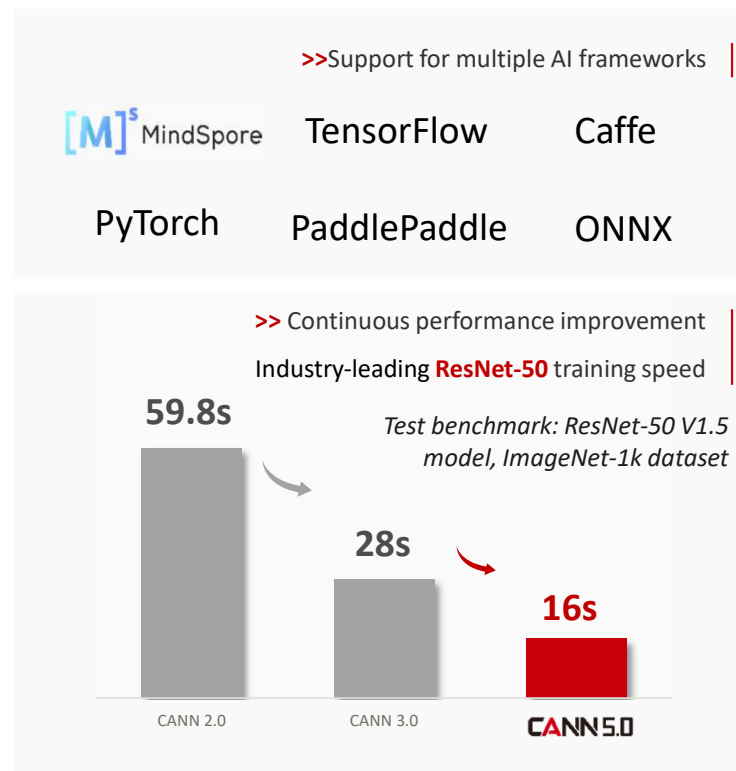
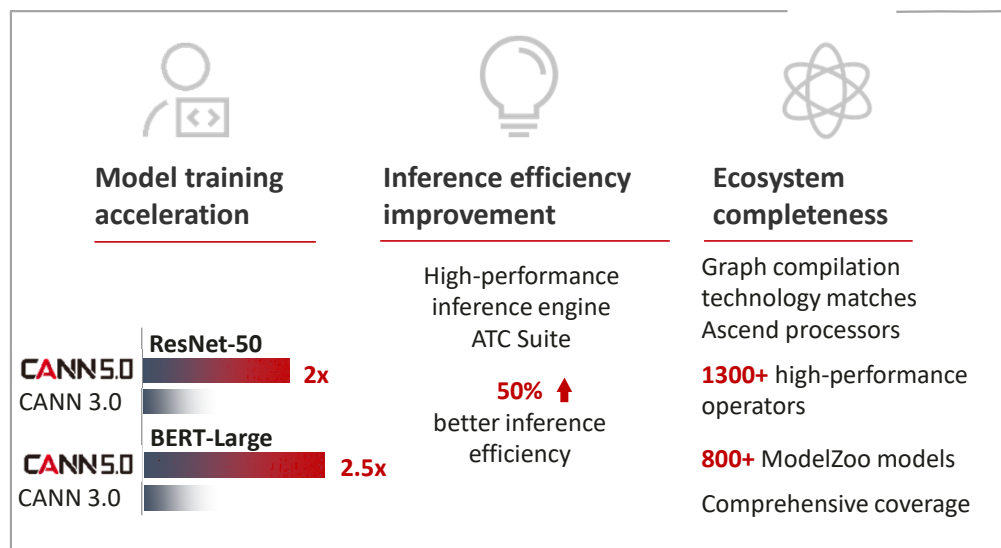
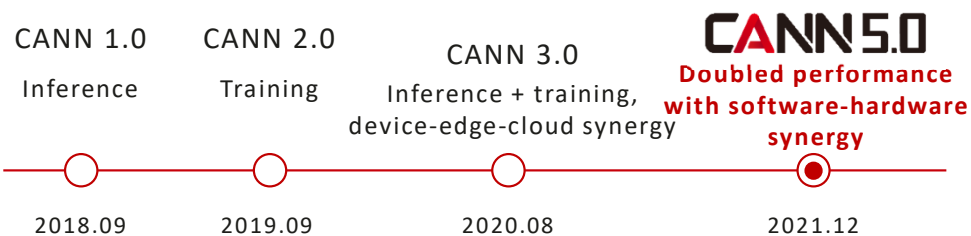


**Ascend AI Training Chip series**

Powerful AI Processor

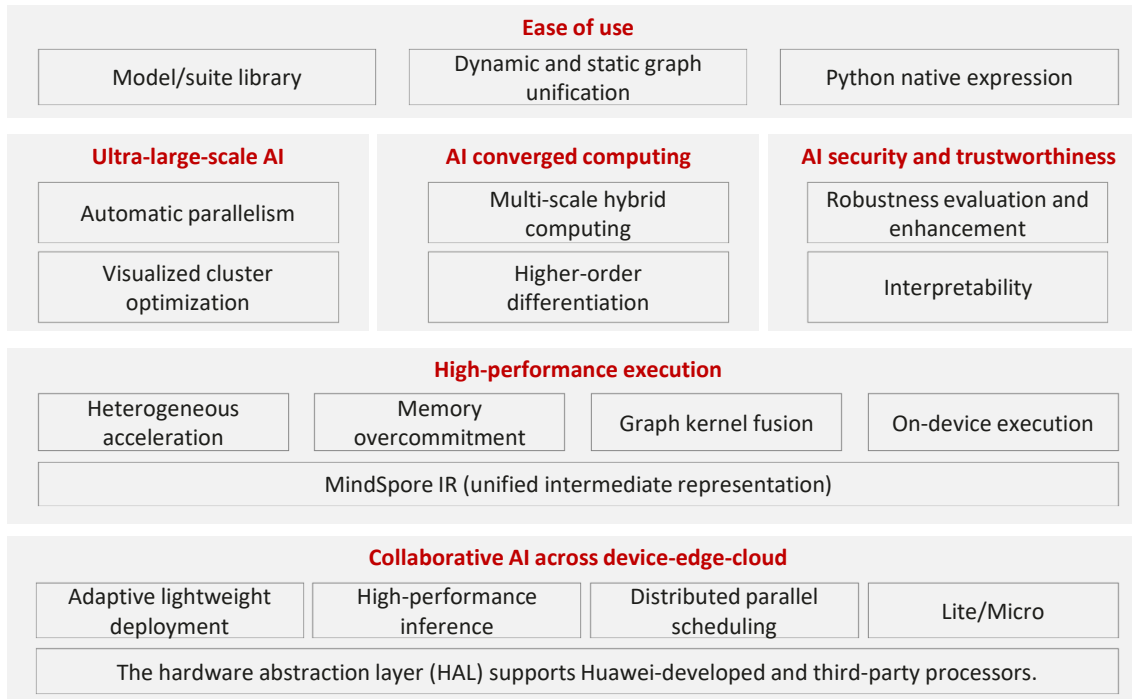
# CANN Heterogeneous Computing Architecture

Software and Hardware Synergy to Double Computing Power



# MindSpore AI Computing Framework

AI computing center, manufacturing, finance, Internet, transportation, government, energy, university scientific research, public safety, and carrier



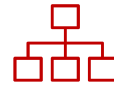
Ascend/Kunpeng/Kirin/GPU/CPU/...

## Key Features



### Ease of use

Models for popular scenarios, Python native expression, and dynamic and static graph unification.



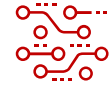
### All-scenario AI

Diversified computing power, collaborative systems, and smart devices over edge and cloud.



### High-performance execution

Full-stack collaborative acceleration and Ascend-affinitive execution engine to maximize performance.



### Ultra-large-scale AI

Distributed parallel training of ultra-large trillion-parameter models, with a series of pre-trained influential models available.



### AI converged computing

X-fold acceleration of AI+scientific computing converged applications for electromagnetic, biopharmaceutical, and other usages.

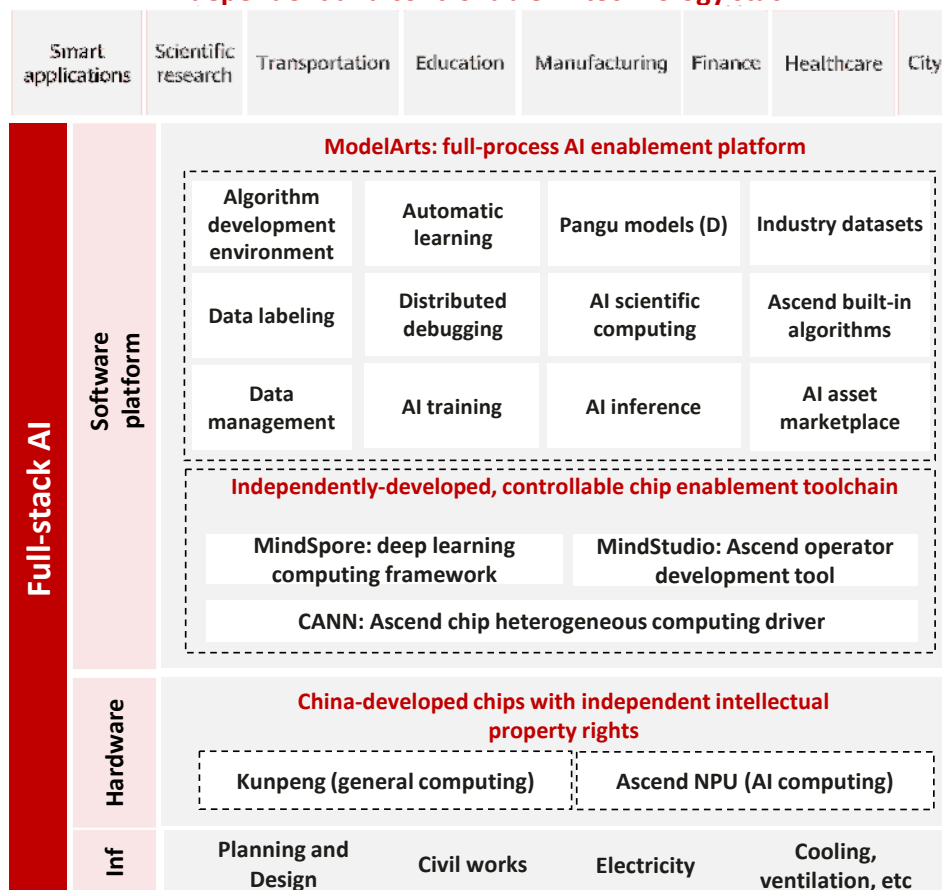


### AI security and trustworthiness

Secure and trustworthy training, evaluation, and deployment of models.

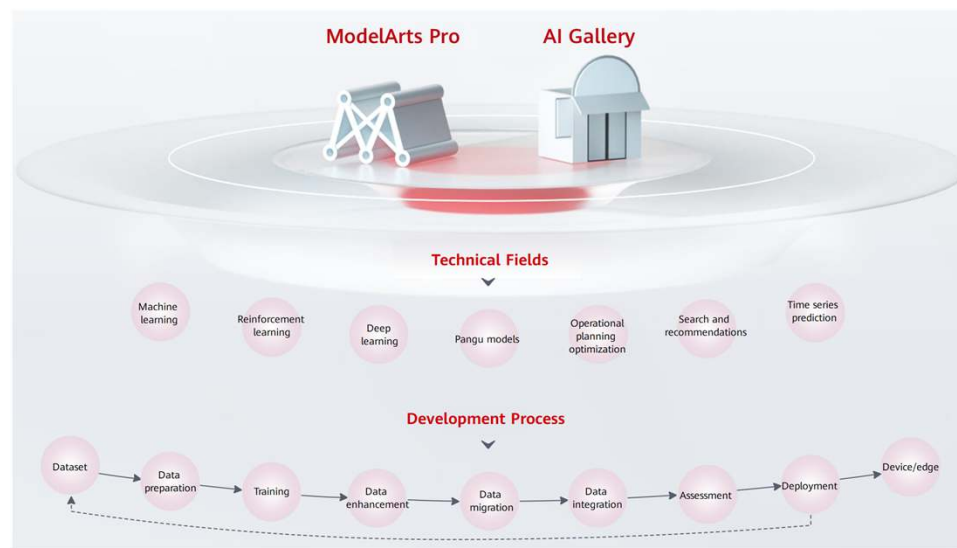
# ModelArts: Ascend-based Full-Stack Independence and Controllability

## Independent and controllable AI technology stack



ModelArts is a **one-stop** AI development platform that offers tools to help developers and data scientists of all skill sets build, train, and deploy models (cloud to edge), and manage full-lifecycle AI workflows. The platform makes it easier to develop AI by providing key capabilities, including data preprocessing and auto labeling, distributed training, automated model building, and one-click workflow execution.

## ModelArts Pro: Enterprise-Grade Development Platform for Specific Industry Needs

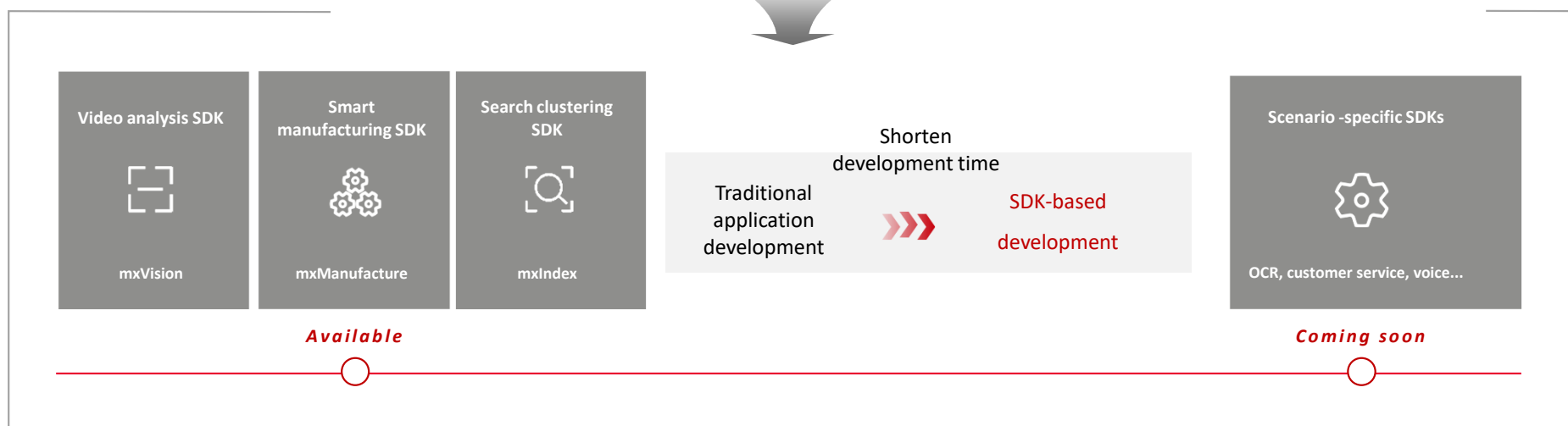


# MindX: Application Enablement with Ascend

## MindX: Ascend application enablement



## MindX SDK: Accumulated industry knowledge to simplify application development



# From AI+ to +AI: The Never-Ending Evolution of Best Practices

## AI+

### Exploring AI capabilities

Image  
classification

**EfficientNet** model accuracy:  
98.7%, higher than human  
accuracy (96%)

Speech  
recognition

**RNN-T** model accuracy: 96.8%,  
higher than human accuracy  
(94.17%)

Reading  
comprehension

**BERT** model accuracy: 90.9%,  
higher than human accuracy  
(82%)



## +AI

### Powering core production systems with AI

Smart city

Smart campus

Industrial  
Internet

Smart  
healthcare

...

Autonomous  
driving

Smart finance

# Contents

---

1. AI Overview
2. Application Fields of AI
3. Huawei's AI Development Strategy
- 4. Controversies Over AI and Its Future**
  - **Controversies Over AI**
  - The Future of AI



# Controversies Over AI

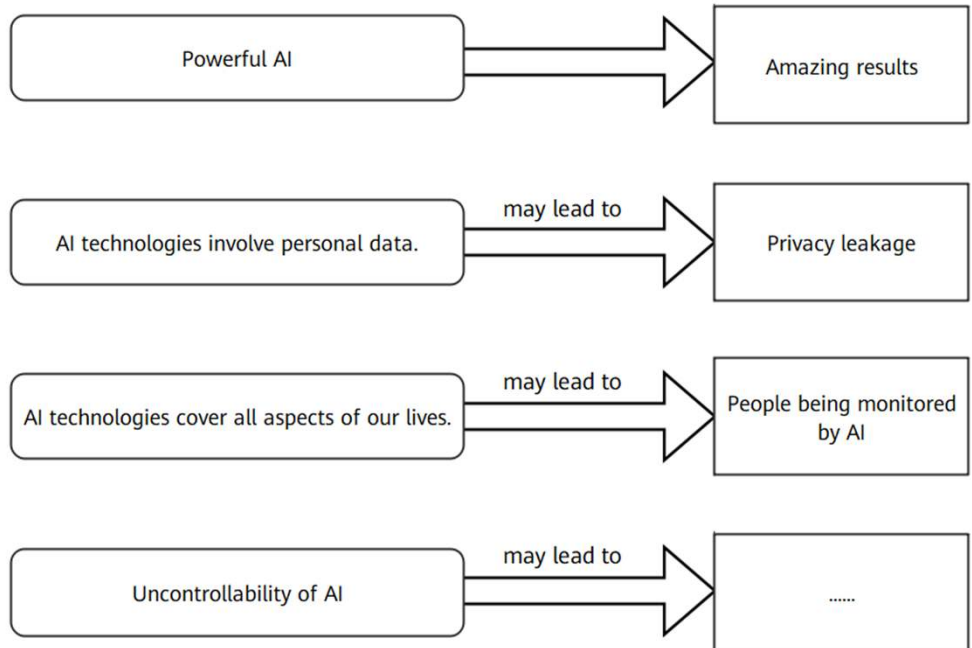
- Every year we are gainin a clearer understanding of underlying AI concepts. However, many are concerned about the future of AI:
  - Do we still see and hear reality?
  - What are the ethical issues of AI?
  - Will AI take over our jobs?
  - Will our privacy be violated? How to ensure privacy security?
  - Is future AI controllable?
  - .....

# Seeing Is Not Believing

- Breakthroughs in computer vision, such as photoshop and generative adversarial network (GAN), means now we can generate fake images that indistinguishable from real photos, impacting the credibility of image and video data.
- For example:
  - Weight-loss shops use Photoshop to produce fake images that show fast weight loss.
  - Lyrebird is a tool that can clone human voices based on a few minutes of recording samples. Such a tool could be exploited for malicious purposes.
  - Room pictures on rental or hotel booking platforms could be fake and generated by a GAN.

# Ethical Concerns of AI

- Discrimination and stigmatization: AI can be used to impact on social justice and freedom.
- The autonomous decision-making mechanism of AI: This mechanism endangers human autonomy and the results cannot be traced or reproduced to provide effective remedies for incorrect decisions.
- Defects of AI: The objectives, methods, and decisions of AI systems cannot be interpreted.
- Damage to human dignity, minds, and bodies: Robots are vulnerable to malicious use and can be altered to make environments unsafe, while AI can expose people to deception and manipulation.

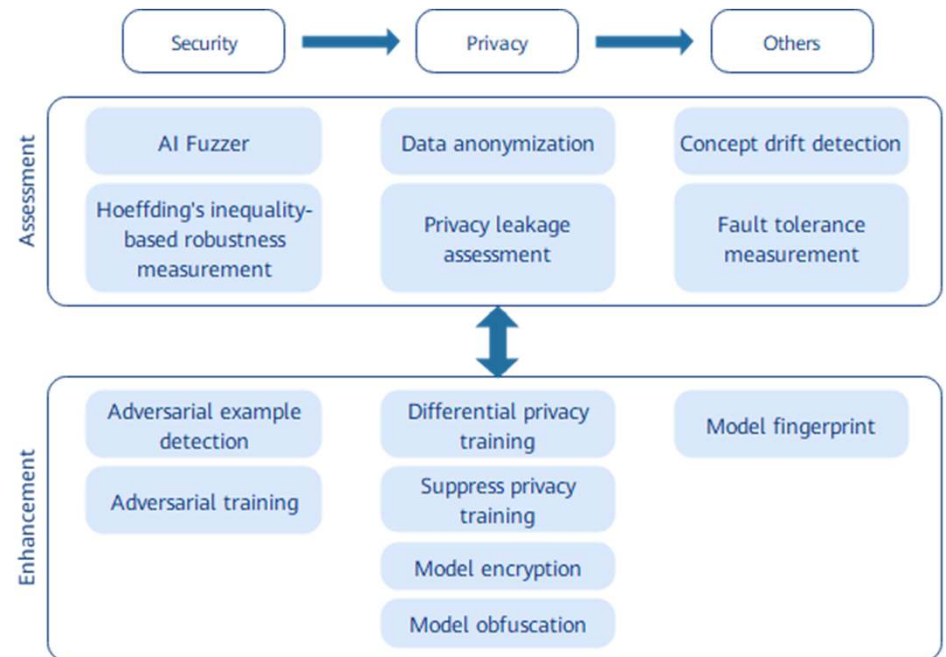


# Will AI take over our jobs?

- Throughout the course of history, humans have sought ways to improve efficiency, that is, to obtain more from fewer resources. Just as sharp stones improve hunting, and steam engines reduce the demand for horses, every step towards automation has changed our society. In the AI era, what tasks will be taken over by AI?
- AI may take over:
  - Repeatable tasks
  - Non-creative tasks
  - Tasks that require weak social skills
  - Dangerous tasks
  - .....

# Privacy and Data Security

- In the era of big data and AI, we can obtain information with convenience and efficiency. However, while we are obtaining convenience, our behavior is recorded, learned, and used for different purposes. How can we **protect private data**?
- 1. End users need to read **privacy terms** before giving consent to a mobile app to collect user information, and limit the information available to the app.
- 2. **Privacy protection laws and regulations should be developed**, to implement industry code of conduct and strengthen supervision.
- 3. **Confidential computing, model privacy protection, federated learning, or adversarial learning**, in addition to protection frameworks, such as **MindArmour**, can prevent reverse attacks and protect user privacy.



Typical application scenarios of MindArmour

# Issues to Be Resolved

- Are AI-generated content protected by copyright laws?
- Who will grant rights to robots?
- What rights can be granted to robots?
- .....

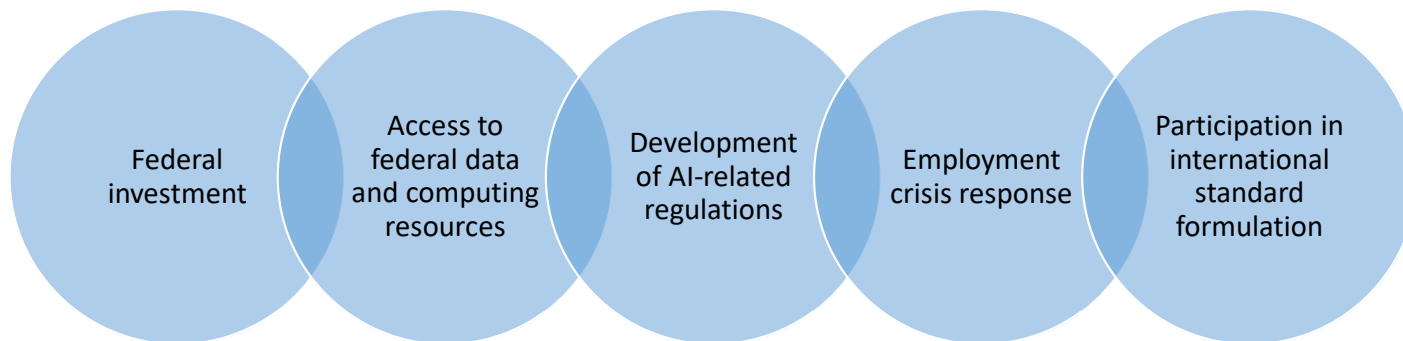
# Contents

---

1. AI Overview
2. Application Fields of AI
3. Huawei's AI Development Strategy
- 4. Controversies Over AI and Its Future**
  - Controversies Over AI
  - The Future of AI**

# Policy Trends - United States (1)

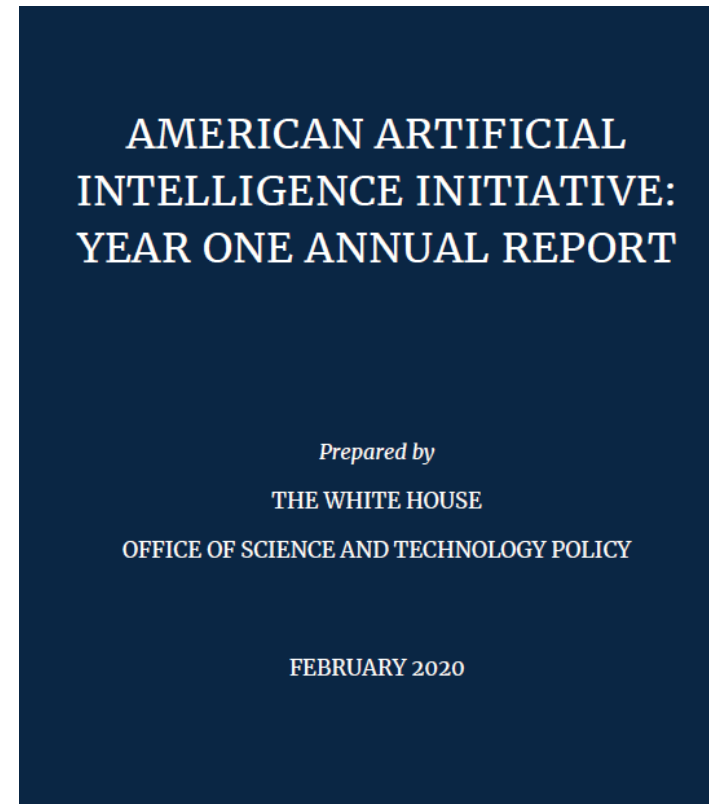
- Executive Order - American Artificial Intelligence Initiative
  - In February 2019, the US released the *American Artificial Intelligence Initiative*, which states that the US will take various ways to improve American leadership in AI. It covers federal investment, access to federal data and computing resources, development of AI-related regulations, employment crisis response, and participation in formulation of international standards. It specifies the AI development direction of the US in the future, proposes key propositions in fields such as smart healthcare and smart city, and clearly expresses the exclusion of cross-border acquisitions of key AI technologies from competitive countries.





## Policy Trends - United States (2)

- Main Content of *American Artificial Intelligence Initiative: Year One Annual Report*:
  1. Invest in AI Research and Development
  2. Unleash AI Resources
  3. Remove Barriers to AI Innovation
  4. Train an AI-ready Workforce
  5. Promote an International Environment Supportive of American AI Innovation
  6. Embrace Trustworthy AI for Government Services and Missions



## Policy Trends - United States (3)

- To promote technological innovation and scientific research development in the US, the US government passed the *United States Innovation and Competition Act of 2021* in June 2021. The act covers multiple topics including chips, 5G, aerospace, cyber security and AI, medical research, and American manufacturing. The act proposes to reform the **National Science Foundation (NSF)** and authorizes \$81 billion for it to conduct research in 10 key fields including AI and computer technology. In addition, \$10 billion is authorized for technology centers and innovation research institutes of universities for research in related fields.

Home > Legislation > 117th Congress > S.1260

**S.1260 - United States Innovation and Competition Act of 2021**  
117th Congress (2021-2022) | [Get alerts](#)

**BILL** Hide Overview X

**Sponsor:** [Sen. Schumer, Charles E. \[D-NY\]](#) (Introduced 04/20/2021)

**Committees:** Senate - Commerce, Science, and Transportation

**Committee Meetings:** [05/12/21 10:00AM](#) [04/28/21 10:00AM](#)

**Latest Action:** Senate - 06/08/2021 Passed Senate, under the order of 5/28/21, having achieved 60 votes in the affirmative, with an amendment by Yea-Nay Vote. 68 - 32. [Record Vote Number: 226](#). (text: CR S4049-4499) ([All Actions](#))

**Roll Call Votes:** There have been [22 roll call votes](#)

**Tracker:**

Introduced → **Passed Senate** → Passed House → To President → Became Law

# Policy Trends - China (1)

- In July 2017, AI was first written into the government's work report. The **New Generation of Artificial Intelligence Development Plan** issued by the State Council proposed a three-step strategic goal:
- Step 1: By 2020, the overall technology and application of AI will be in step with globally advanced levels.
- Step 2: By 2025, achieve major breakthroughs in basic theories for AI, and be a world-leading player for technologies and applications.
- Step 3: By 2030, realize world-leading status of nationally-developed AI, technologies, and applications, ensure China is the world's primary AI innovation center, achieve tangible results in intelligent economy and intelligent society, and lay an core to become a leading innovation-style nation and an economic power.

索引号: 000014349/2017-00142 发文机关: 国务院 标 题: 国务院关于印发新一代人工智能发展规划的通知 发文字号: 国发〔2017〕35号 主 题 词:	主题分类: 科技、教育\科技 成文日期: 2017年07月08日 发布日期: 2017年07月20日
---	--

**国务院关于印发  
新一代人工智能发展规划的通知**  
国发〔2017〕35号

各省、自治区、直辖市人民政府，国务院各部委、各直属机构：  
现将《新一代人工智能发展规划》印发给你们，请认真贯彻执行。

国务院  
2017年7月8日

（此件公开发布）

**新一代人工智能发展规划**

人工智能的迅速发展将深刻改变人类社会生活、改变世界。为抢抓人工智能发展的重大战略机遇，构筑我国人工智能发展的先发优势，加快建设创新型国家和世界科技强国，按照党中央、国务院部署要求，制定本规划。

**一、战略态势**

人工智能发展进入新阶段。经过60多年的演进，特别是在移动互联网、大数据、超级计算、传感网、脑科学等新理论新技术以及经济社会发展强烈需求的共同驱动下，人工智能加速发展，呈现出深度学习、跨界融合、人机协同、群智开放、自主操控等新特征。大数据驱动知识学习、跨媒体协同处理、人机协同增强智能、群体集成智能、自主智能系统成为人工智能的发展重点，受脑科学研究成果启发的类脑智能蓄势待发，芯片化硬件化平台化趋势更加明显，人工智能发展进入新阶段。当前，新一代人工智能相关学科发展、理论建模、技术创新、软硬件升级等整体推进，正在引发链式突破，推动经济社会各领域从数字化、网络化向智能化加速跃升。

**相关报道**

- 国务院印发《新一代人工智能发展规划》

**图解**

- 国务院印发《新一代人工智能发展规划》

**解读**

- 总理政府工作报告带火的这件事，有了国家规划！
- 构筑人工智能先发优势 把握新一轮科技革命战略主动 ——科技部党组书记、副部长王志刚解读我国首个人工智能发展规划
- 大智能时代的关键之举——五问AI国家战略

## Policy Trends - China (2)

- The Outline of the 14th Five-Year Plan for Economic and Social Development and Long-Range Objectives Through the Year 2035 of the People's Republic of China was released in March 2021, which emphasized that China "will explore the establishment of regulatory frameworks for autonomous driving, online medical care, financial technology, and intelligent delivery, and improve the relevant laws, regulations, and rules for ethical reviews". The statements reflect China's priority for and determination to overhaul AI ethics and its governance.
- The infringement on personal information is becoming more rampant, and there is an urgent need to protect personal information. To protect the rights and interests on personal information, regulate its processing, and guide its reasonable use, Personal Information Protection Law of People's Republic of China was passed on August 20th, 2021 and came into force on November 1st, 2021.

# AI in More Industry Practices

- With further breakthroughs in AI in various vertical industries, AI technologies will be used in an increasing number of scenarios.
  - Smart transportation - highways, airports, railways, logistics, ports...
  - Energy - electric power, oil and gas...
  - Finance - bank, insurance, securities...
  - .....

# Summary

- This course introduces the definition and development history of AI, describes the popular fields and application scenarios of AI, briefly introduces Huawei's AI development strategy, and discusses its most pressing topics and trends.

# Quiz

---

1. (Multiple-answer question) Which of the following are Huawei's full-stack all-scenario AI solutions?
  - A. ModelArts
  - B. MindSpore
  - C. Atlas 800 Servers
  - D. ModelZoo

# Recommendations

---

- Huawei Talent
  - <https://e.huawei.com/en/talent/#/home>
- Ascend official website
  - <https://www.hiascend.com/>
- MindSpore
  - <https://mindspore.cn/>
- Huawei Cloud
  - <https://www.huaweicloud.com/>



# Thank you.

把数字世界带入每个人、每个家庭、  
每个组织，构建万物互联的智能世界。

Bring digital to every person, home, and  
organization for a fully connected,  
intelligent world.

Copyright©2023 Huawei Technologies Co., Ltd.  
All Rights Reserved.

The information in this document may contain predictive statements including, without limitation, statements regarding the future financial and operating results, future product portfolio, new technology, etc. There are a number of factors that could cause actual results and developments to differ materially from those expressed or implied in the predictive statements. Therefore, such information is provided for reference purpose only and constitutes neither an offer nor an acceptance. Huawei may change the information at any time without notice.

