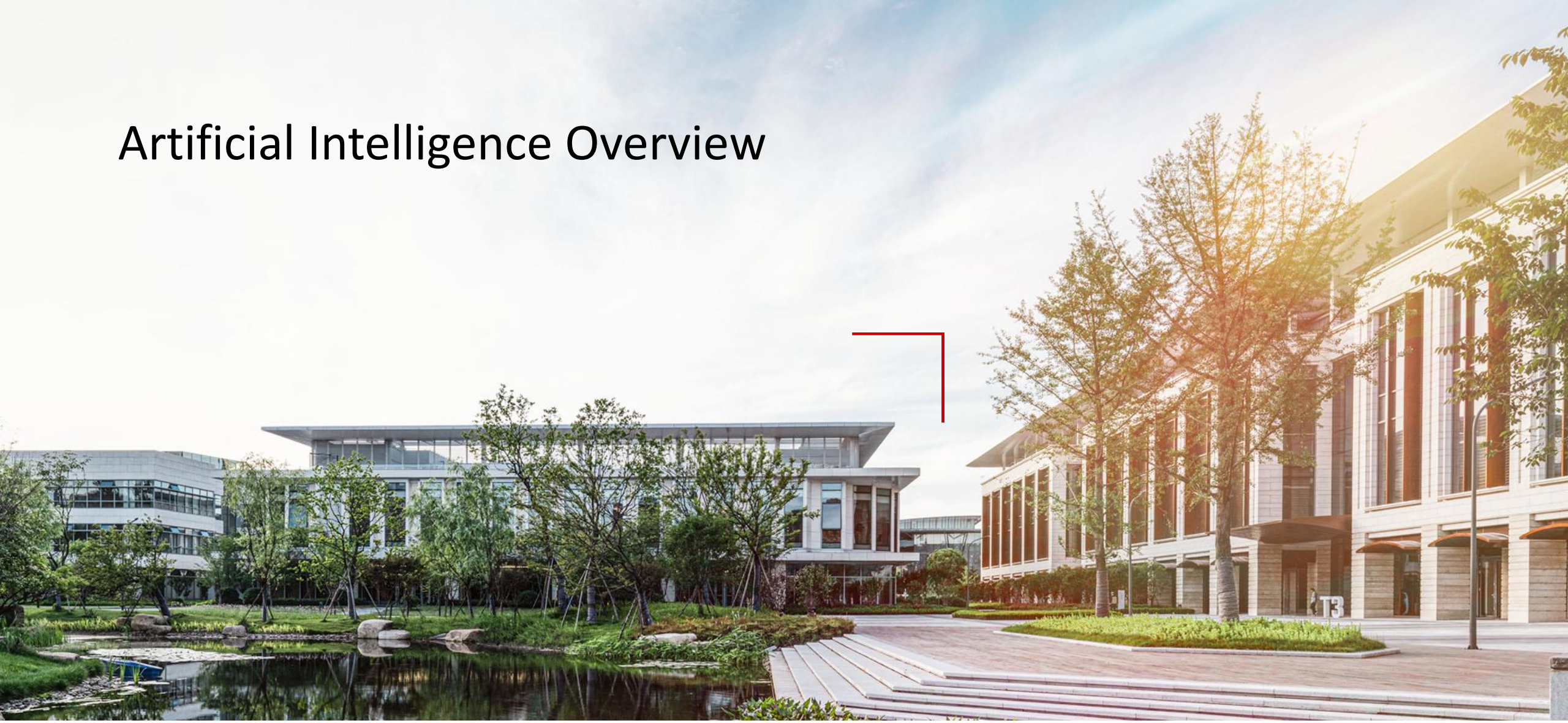
Artificial Intelligence Overview



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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

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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

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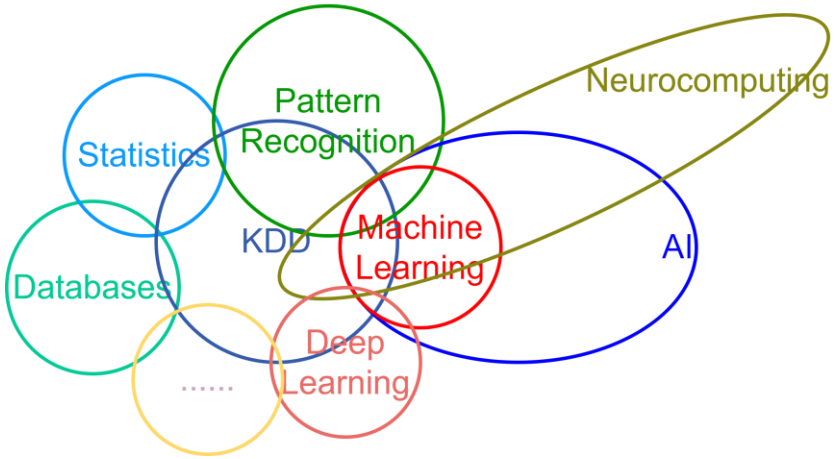
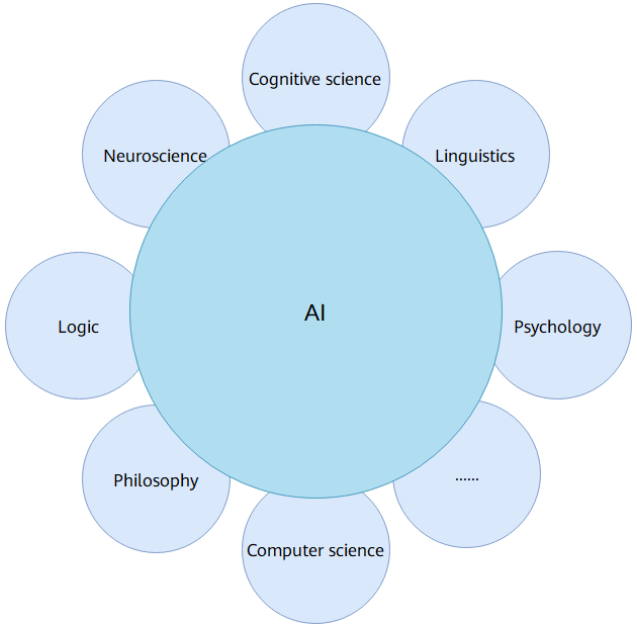
What is intelligence?

- 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.





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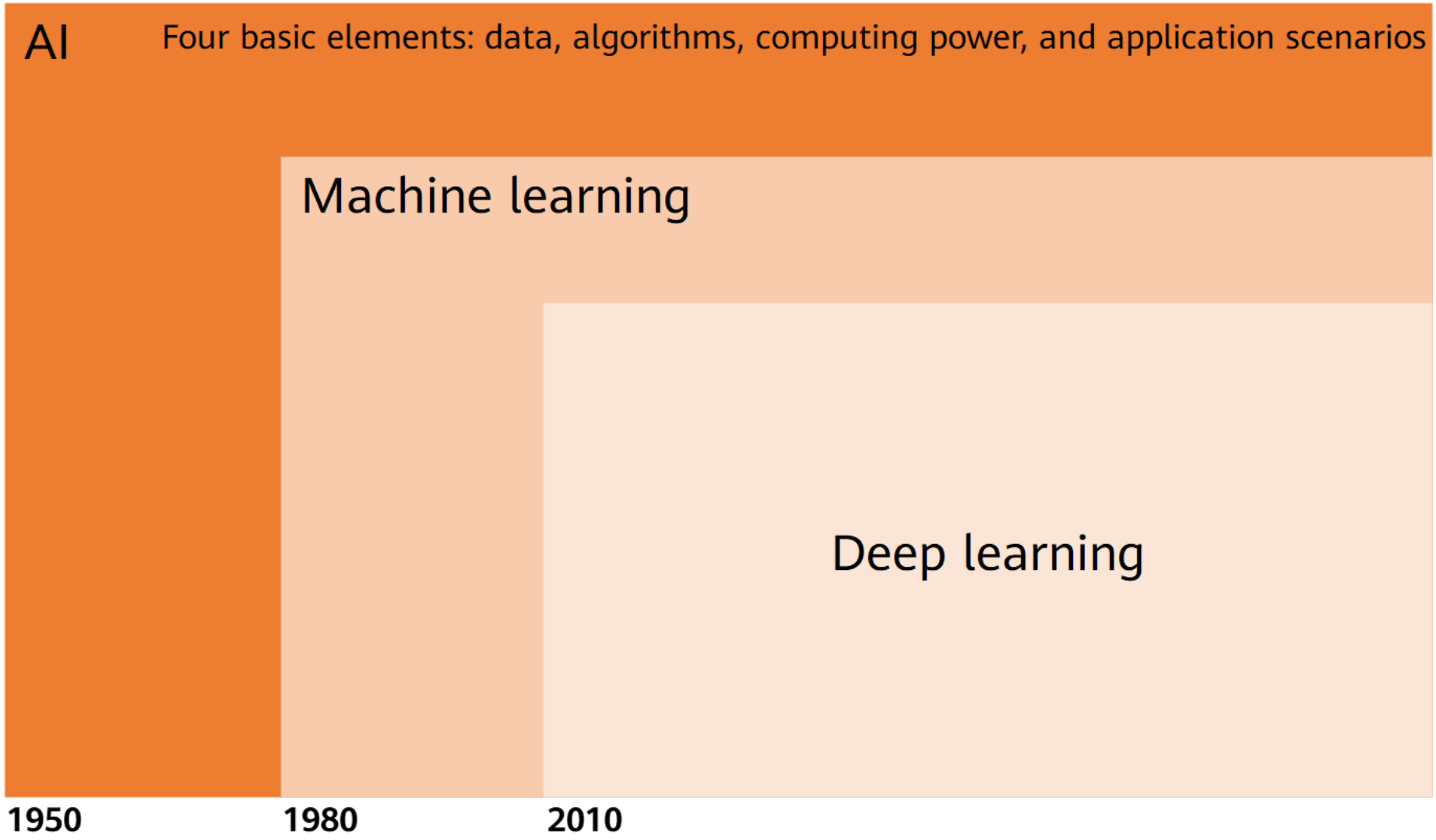
Relationship Between AI, Machine Learning, and Deep Learning



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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.

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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.

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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.

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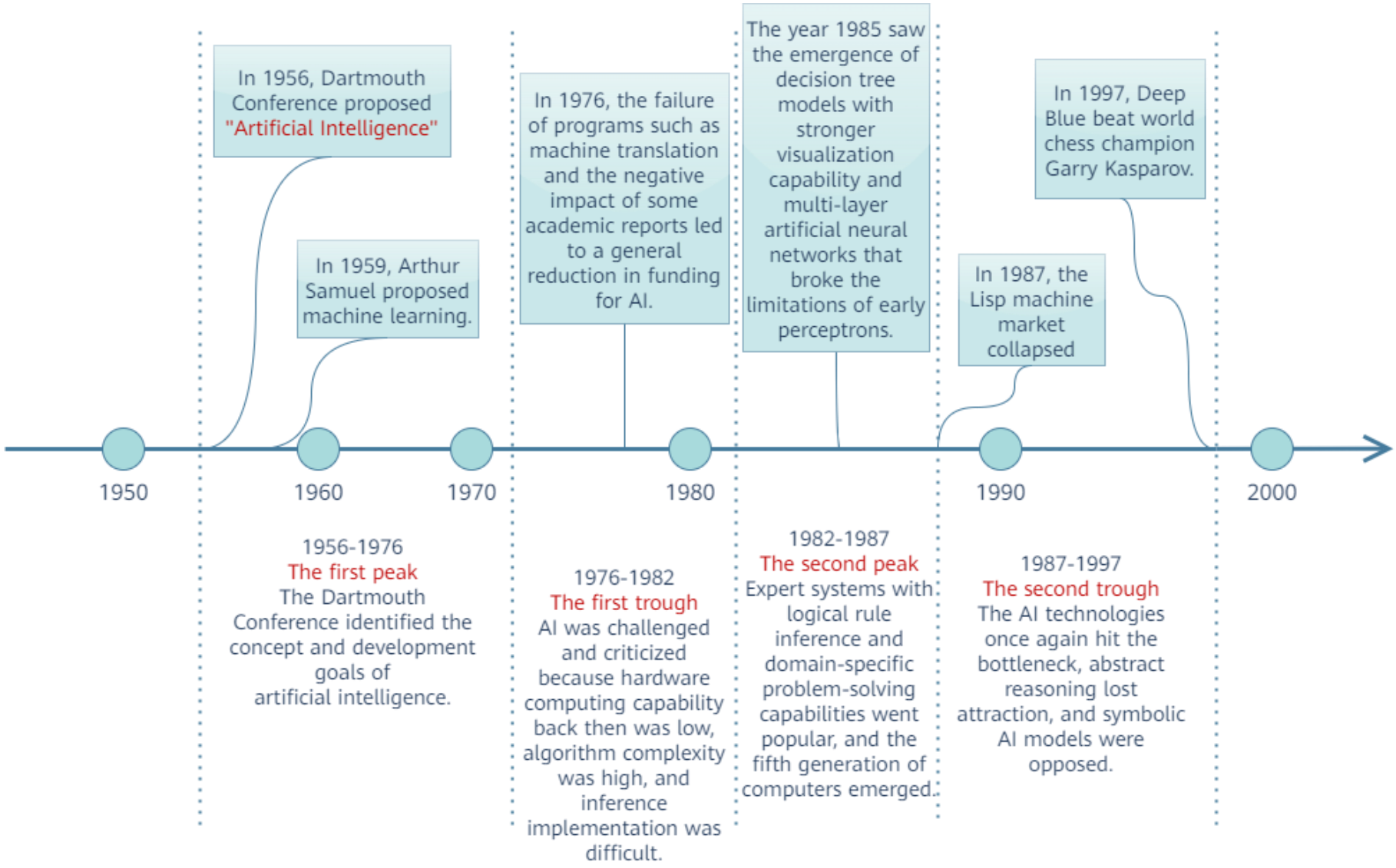
AI Development History (1)



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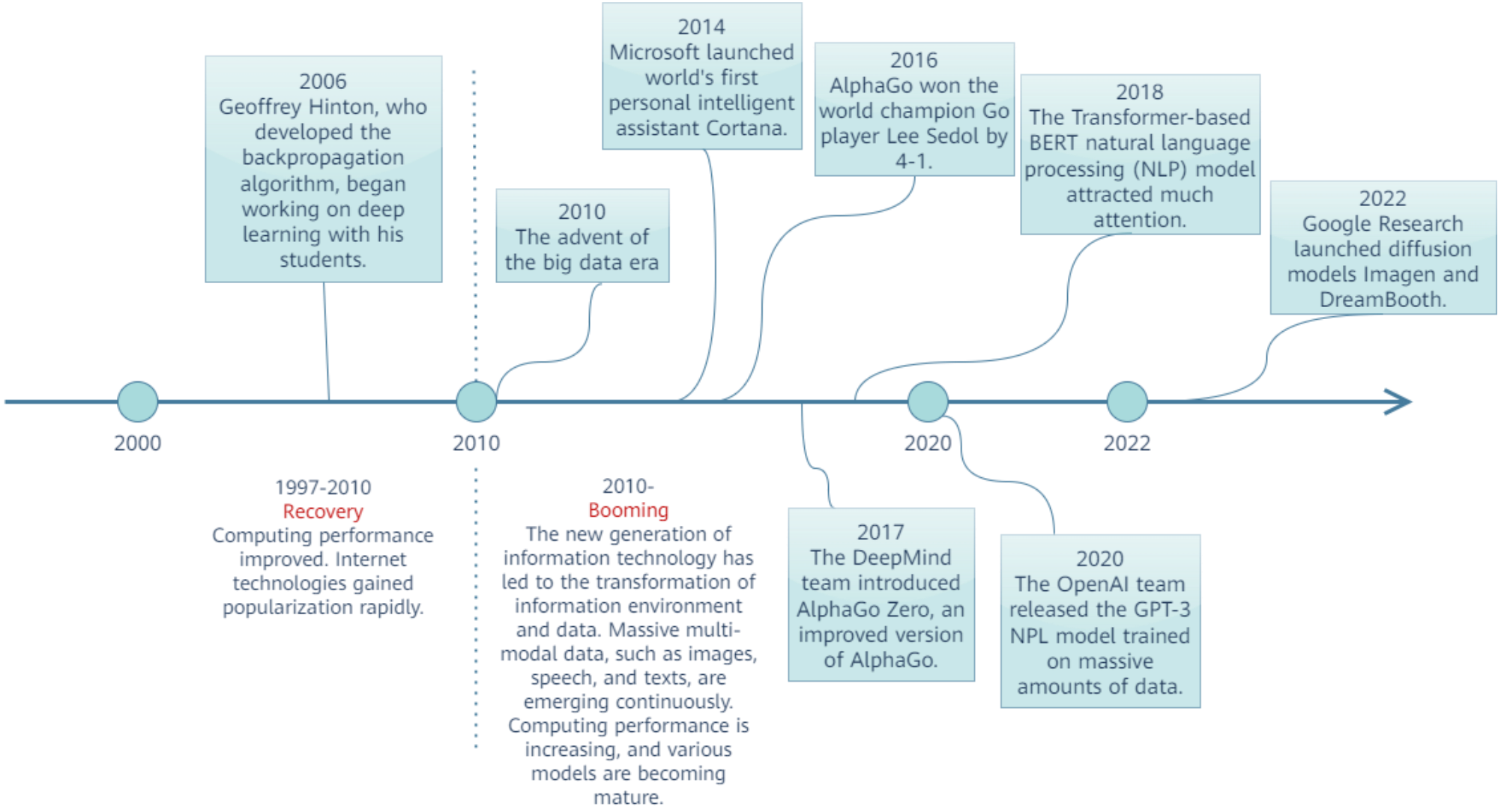
AI Development History (2)



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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.

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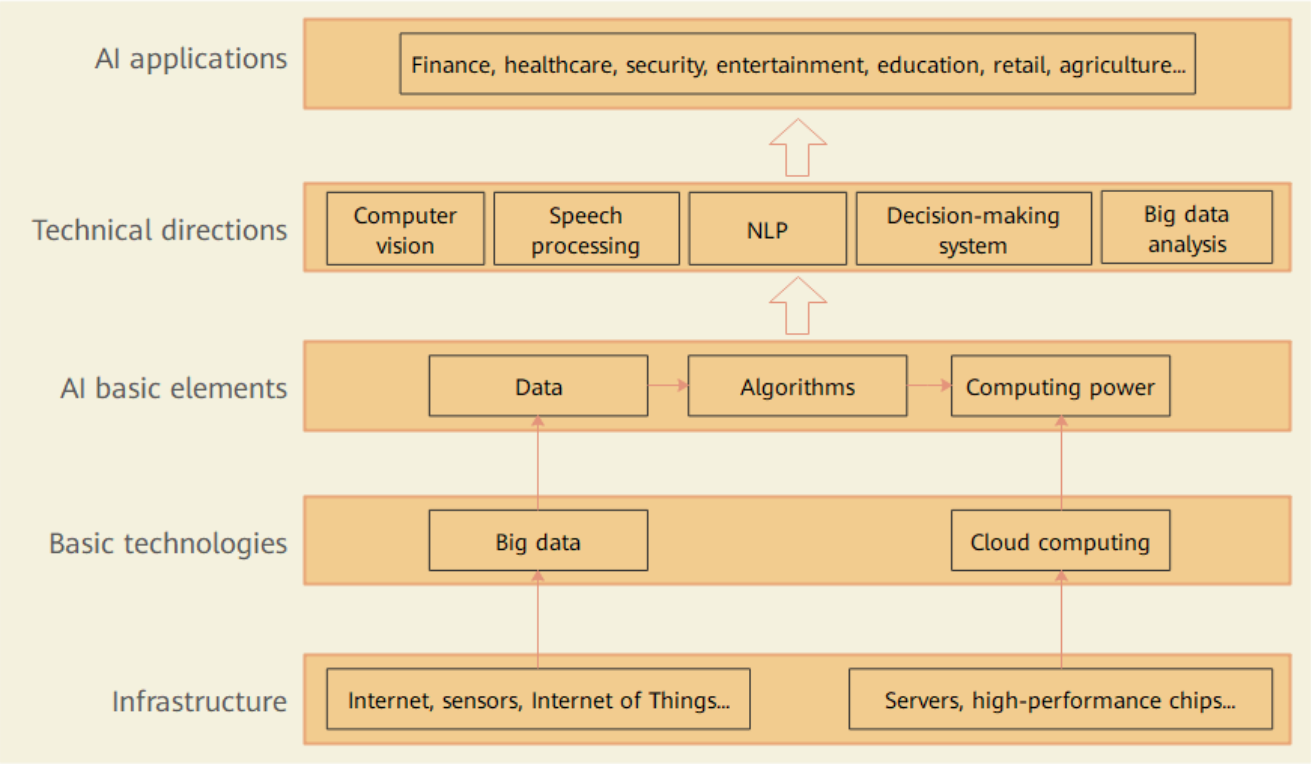
AI Industry Ecosystem

- 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.



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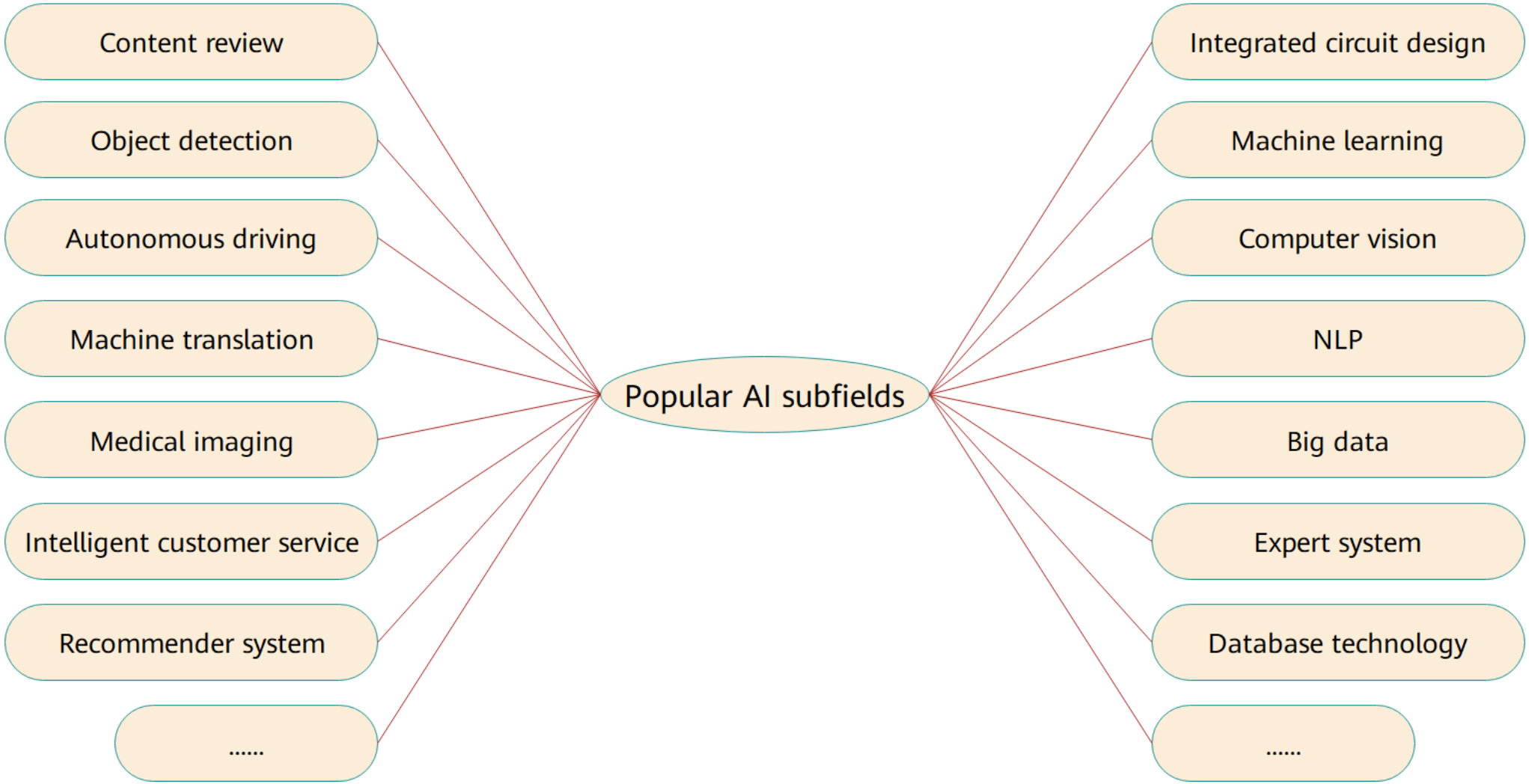
Popular AI Subfields



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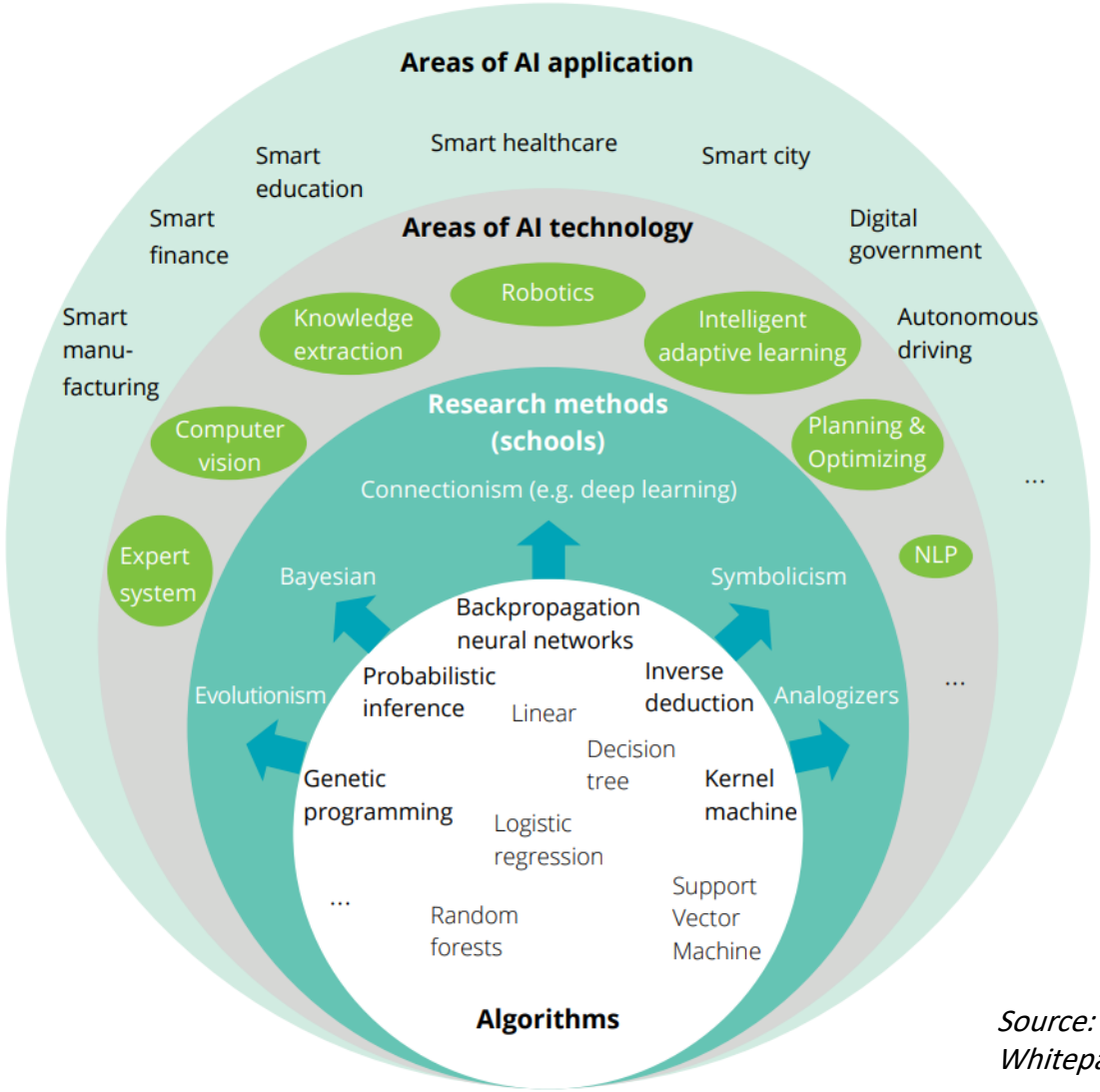
AI Technology and Application Fields



Source: Deloitte Global Artificial Intelligence Industry Whitepaper

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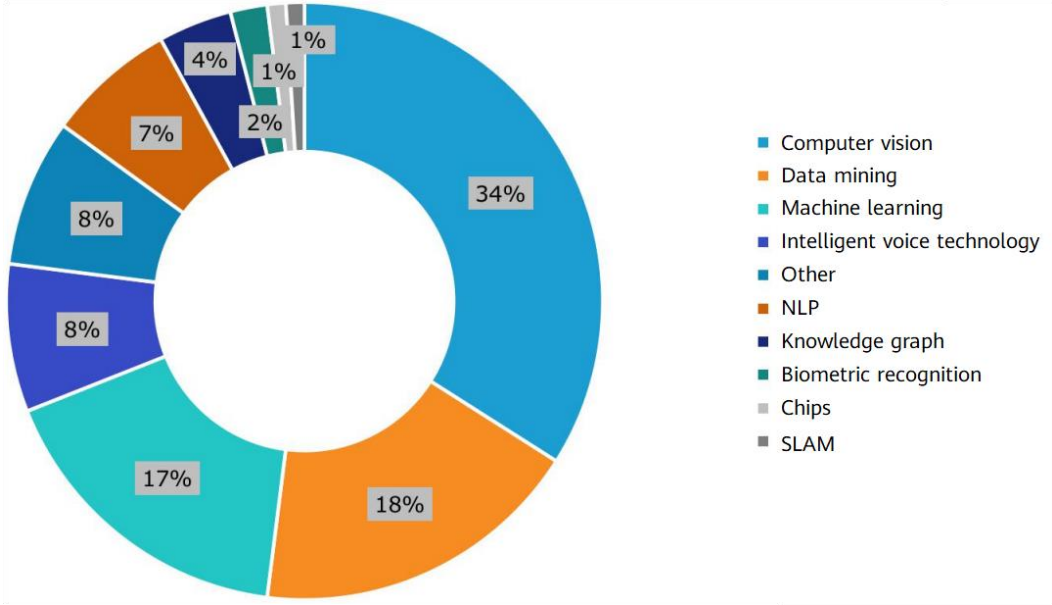
Distribution of AI Application Technologies in China

- 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