Hybrid-augmented intelligence: collaboration and cognition

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Motivation and Background

✓ **No matter how intelligent machines are, they are unable to completely replace humans.**

➢ For example, the Internet is full of disorganized, messy fragmentation of knowledge , and many of it can only be understood by humans. So the machine cannot complete all the tasks of Internet information processing. Human intervention is still needed in many occasions.

✓ **Goal : The long-term goal of artificial intelligence (AI) is to make machines learn and think like human beings.**

➢ To introduce human cognitive capabilities or human-like cognitive models into AI systems to develop a new form of AI.

➢ This new form of AI is hybrid-augmented intelligence which able to optimally integrate the intelligence of both human and computer.
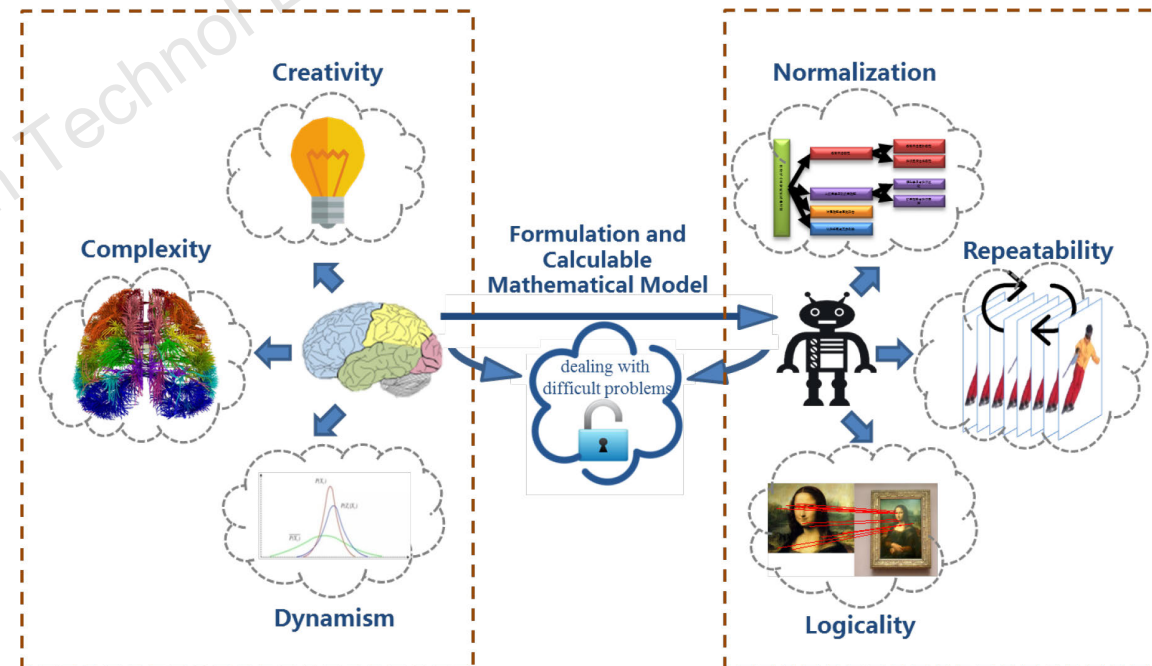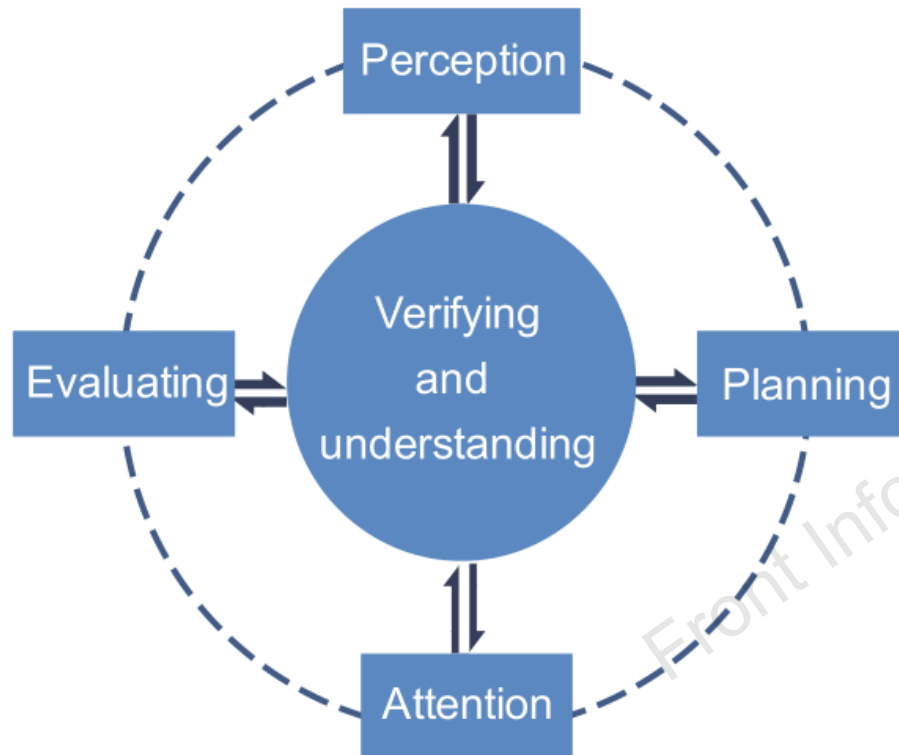
Human-in-the-loop hybrid-augmented intelligence

➢ Human-in-the-loop (HITL) hybrid-augmented intelligence is defined as an intelligent model that requires human interaction.

➢ In this type of intelligent system, human is always part of the system and consequently influences the outcome in such a way that human gives further judgment if a low confident result is given by a computer.

➢ HITL hybrid-augmented intelligence also readily allows for addressing problems and requirements that may not be easily trained or classified by machine learning.
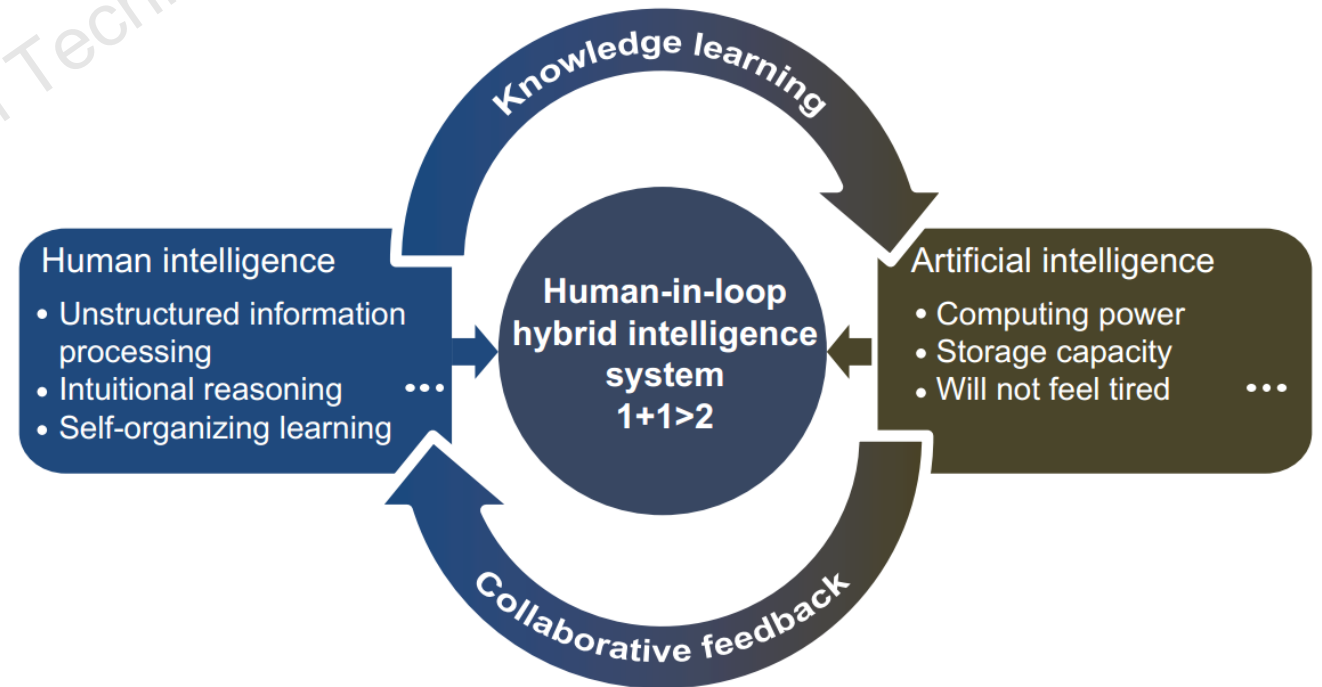
# Cognitive computing based hybrid-augmented intelligence


Basic framework of cognitive computing

➢ Cognitive computing (CC) based hybrid-augmented intelligence refers to new software and/or hardware that mimics the function of the human brain.

➢ CC improves computer's capabilities of perception, reasoning, and decision-making.

➢ CC based hybrid-augmented intelligence is a new framework of computing with the goal of more accurate models of how the human brain/mind senses, reasons, and responds to stimulus.

- how to build causal models
- how to build intuitive reasoning models
- how to achieve associative memories in an intelligent

Relation of intuitive reasoning and cognitive mapping

➢ Intuition is a series of processes in the human brain including high-speed analysis, feedback, discrimination, and decisions.

➢ Intuition reasoning helps humans make rapid decisions in complex and dynamic environments.

➢ Cognitive mapping is a dynamic process with steps of data acquisition, encoding, storage, processing, decoding, and using external information.

➢ The role that intuition plays can be considered guidance for a decision-making search as well as the construction of a cost space in the computing process.
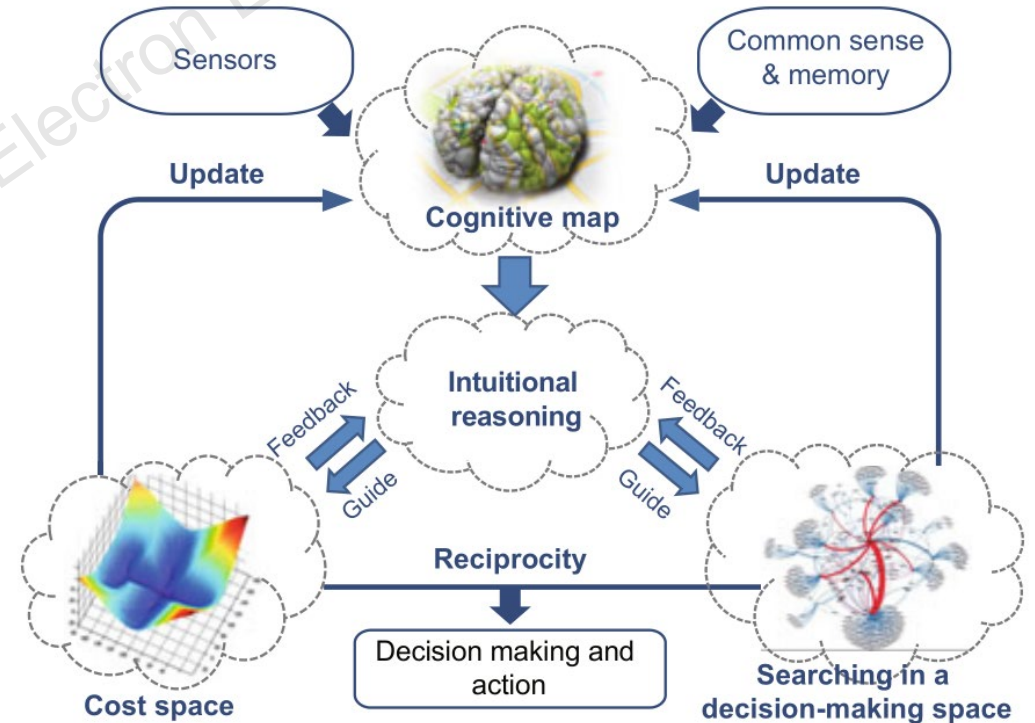
Machine implementation of intuitive reasoning
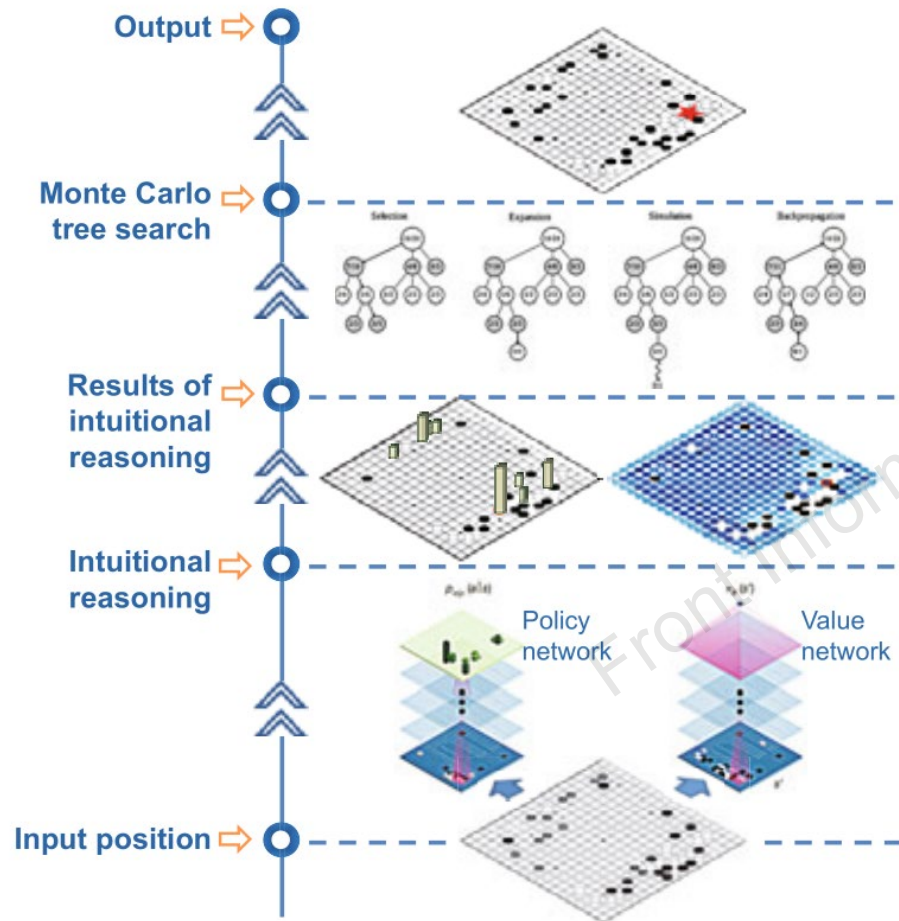
Intuitive reasoning of AlphaGo

➢ If the intuitive response can be considered as finding the global optimal solution in the search space, intuition can be regarded as the initial iteration position of the solution.

➢ In common machine learning methods, the initial iteration position is usually obtained at the sacrifice of the generalization abilities of the algorithm

➢ The success of AlphaGo can be seen as a successful example of the application of machine intuitive reasoning.

# Competition-adversarial cognitive learning method
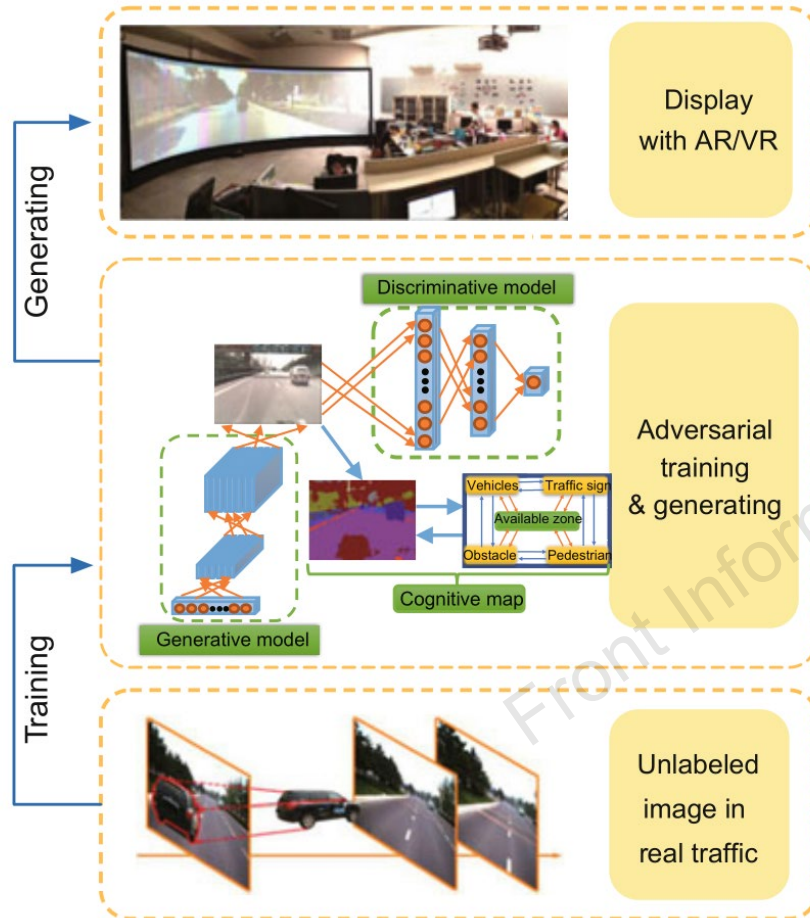
Generative adversarial networks in self-driving cars

- ➤ The generative model and adversarial network are combined by the competitive and adversarial cognitive learning methods, which can effectively represent the intrinsic nature of the data.

- ➤ Self-driving car is a hotspot of recent AI research.
  - How to acquire enough training samples?
  - How to build a off-line test system to verify the performance of unmanned vehicles?

Typical applications of hybrid-augmented intelligence

➢ AI technology is creating numerous new products and changing the way of people's work, study, and life in almost every aspect.

➢ It has become a powerful driving force to promote sustained growth and innovative development of social economy.

➢ Typical applications of hybrid-augmented intelligence:

- Managing industrial complexities and risks
- Collaborative decision-making in enterprises
- Online intelligence learning
- Medical and healthcare
- Public safety and security
- Human-computer collaborative driving
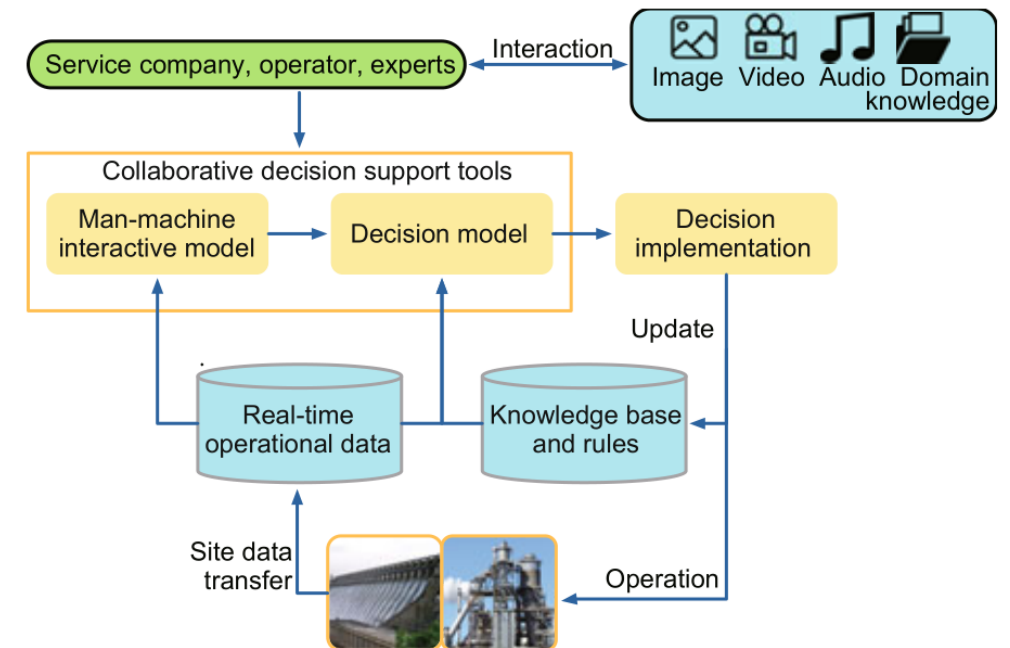
General framework of hybrid-augmented intelligence for enterprise collaborative decision-making

Conclusions

✓ Hybrid-augmented intelligence is one of the important directions for the growth of AI. Intelligence machines have become human companions, and AI is profoundly changing our lives and shaping the future.

✓ Building human-computer interaction based HITL hybrid-augmented intelligence can greatly enhance AI system's decision making capability, the level of cognitive sophistication required to handle complex tasks, and adaptability to complex situations.

✓ Hybrid-augmented intelligence based on CC can solve the problems of planning and reasoning that AI research area has been facing for a long time through intuitive reasoning, experience learning, and other hybrid models.