ISSN 2959-6149

Future Development of Artificial Intelligence from the Perspective of Tacit Knowledge

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Abstract:

The "Chinese Room Argument" is a thought experiment proposed by American philosopher John Searle in 1980. It refutes the claim that computer programs as symbolic representation systems can generate semantic understanding by arguing that artificial intelligence cannot express intentionality. In 1982, Australian philosopher Frank Jackson introduced the "Knowledge Argument," which questions the physicalism reducibility perspective by examining the concept of qualia. From the analysis of these two thought experiments, it can be concluded that the knowledge of computer programming and its machine simulation cannot truly understand the meaning understood by biological intelligence, and that meaning contains the content of tacit knowledge, so even the most complete artificial intelligence system still lacks the intrinsic, non-physical, and intimate properties that are characteristic of biological intelligence. It is these properties that make up the important difference between biological intelligence and artificial intelligence. This paper discusses how three tacit knowledge forms, relational, physical and collective, affect the development of artificial intelligence, and tries to explore a new direction for the development of artificial intelligence in the future.

Keywords: Tacit knowledge; Explicit knowledge; Artificial intelligence; Intentionality

I. Introduction

In 1956, during the Dartmouth Conference in the United States, experts from various fields—mathematics, computer science, cognitive psychology, economics, and philosophy—introduced the concept of artificial intelligence (AI). This followed two months of discussions. They proposed creating a machine capable of human-like thinking through symbolic reasoning and representation. This proposal led to the emergence of symbolic AI. Since then, the field of artificial intelligence has evolved significantly into the 21st century. The dramatic increase in big data and computing power has enabled AI to achieve or even exceed human performance in specific tasks. For instance, in 2016, Google's DeepMind developed AlphaGo, which defeated world Go champion Lee Sedol. In 2017, Carnegie Mellon University's Libratus triumphed over top poker players in no-limit Texas Hold'em.

Today, generative AI technologies, such as ChatGPT, are revolutionizing various aspects of life and work with their advanced capabilities. The Asia-Pacific region is experiencing a remarkable surge in Generative Artificial Intelligence (GenAI) adoption. This surge includes software, services, and hardware for AI-centric systems. According to the International Data Corporation (IDC), spending in this sector is expected to reach $26 billion by 2027. This growth highlights not only the vast potential of AI but also the high level of recognition and expectation from the community. It underscores the importance of considering AI's future development. By examining the fundamental differences between biological and artificial intelligence, we can gain valuable insights into the future trajectory of AI.

John Searle's "Chinese Room Argument" and Frank Jackson's "Knowledge Argument" are pivotal thought experiments that address these issues. Searle's argument challenges the notion that computers can achieve true semantic understanding. It questions AI's ability to grasp intentionality. Jackson's Knowledge Argument critiques physicalist reductionism by exploring sensory qualities. It also highlights the non-physical and knowledge-based aspects of biological intelligence. Together, these arguments suggest that despite significant advances in computation and symbolic processing, AI still falls short in understanding and conveying meaning. The deep, tacit knowledge inherent in biological intelligence—including relational, physical, and collective forms—cannot be replicated solely through programming and simulation. Therefore, understanding these tacit forms will be crucial for advancing AI. This comprehension will enhance our understanding of biological intelligence and guide the future development of AI. It will provide new directions and strategies for designing and implementing AI systems.

II. "Chinese Room Argument" and "Knowledge Argument"

The "Chinese Room Argument" was proposed by Searle in 1980 in response to the Turing Test. The introduction of the Turing test had a crucial impact on functionalism. Functionalism holds that the mind and the brain are as related to each other as a program is to hardware, and therefore for the study of the mind, it is the program that is crucial, and independent of the vehicle that enables the program, neurobiological research is not necessary. Applying this view to strong AI leads to the idea that a computer is not merely a powerful tool; rather, a properly programmed computer is actually a mind, in the sense that a computer given the right program can be said to understand and have other cognitive states. One might summarize this view by saying that thought is to the brain what a program is to computer hardware. Searle, on the other hand, challenged this view, and the "Chinese House Argument" was based on it.

The "Chinese Room Argument" is designed in such a way that Searle, who understands only English but not Chinese, envisions himself locked in a room with various pieces of paper with characters on it. Through a window, people can pass him pieces of paper with characters on them, and he can pass other pieces of paper through the window. He learns from an English rule book inside the house how to match these characters, which are always identified by their shape or form. For the Chinese outside the house, he realized that the people inside the house always gave appropriate answers to questions asked in Chinese, and seemed to know the language. [1] In other words, Searle passed the "Turing Test", but in reality, for Searle inside the house, he still did not understand Chinese.

Searle's refutation of strong AI is then based on the insight that intelligent states have by definition a certain semantic content or meaning, whereas programs are purely formal and syntactic, i.e., a series of symbols that have no meaning in themselves. Thus, programs cannot be equated with semantics.

The logical structure of the argument is as follows :

Premise 1: Syntax cannot support semantics.

Premise 2: Programs are fully characterized by their formal syntactic structure.

Premise 3: Human thought has semantic content.

Therefore, the program is not sufficient to understand the semantics.

Searle argues that the computer in the "Chinese Room" thought experiment does not have real thought, but that the human psyche has a certain state characterized by intentionality, which has relevant semantic content. The computer program is a combination of syntax and form, and does not have the ability to produce semantics, and therefore cannot create real thought. In other words, semantic features are necessary to make computer programs capable of thinking. Searle further deepened the study of syntax and semantics into the theory of "intentionality". Searle defines intentionality as the notion that intentionality is the property of many mental states and temporal events that point to or about or relate to objects and states of affairs in the world.

Searle also emphasizes the fact that his argument is based solely on the property that programs are properly defined, regardless of which physical system is used to run them. Thus, it does not say that we cannot create a powerful AI today, but rather that it is impossible for any conceivable machine in the future to create a powerful AI, no matter how fast it is or what other properties it may have.

Searle's argument can be supported by the "Knowledge Argument" proposed by the Australian philosopher Frank Jackson in 1982. This thought experiment was born in the context of a philosophical debate about the question, "Is there really such a part of the mind as is destined to be beyond the grasp of material explanations?" Faced with this question, Jackson formally joined the debate by proposing the "Knowledge Argument" as a thought experiment.

The "Knowledge Argument" is designed like this: Mary is a brilliant scientist who, for some reason, is forced to investigate the world through a black-and-white television monitor in a black-and-white room. She specializes in the neurophysiology of vision, so let's assume that when we look at a ripe tomato or the sky and use words like "red" and "blue," she gets all the physical information she can. For example, she discovers which combinations of wavelengths in the sky stimulate the retina and how this actually produces contraction of the vocal cords and expulsion of air from the lungs via the central nervous system, resulting in the phrase "the sky is blue." What happens when Mary is released from her black-and-white room or given a color television monitor? Does Mary acquire new knowledge at this point? [2]

The logical structure of the argument is as follows :

Premise 1: Mary has all the physical information about human color vision before she is released.

Premise 2: There is some information about human color vision that is not known until she is released.

Premise 3: The experience of seeing the color red is not covered by the physical information Mary has.

Therefore, not all information is physical.

This thought experiment reveals what philosophers have discussed about the argument from knowledge, namely that these properties and knowledge of existence as non-physical can only be acquired utilizing conscious experience, a view that refutes physicalist reductionism. Physicalism holds that all things, even mental states, are describable in terms of physical facts. They believe that the mind is physical action and that nothing other than the action of matter exists in the mind, including the action of having brain nerves, the action of atoms, molecules, and so on, and that all action of matter is physical action.

If we think that in the experiment "Knowledge Argument," Mary has acquired new knowledge by stepping out of the black-and-white room, then we can further understand that the facts about color are not purely physical facts and that there must be knowledge in color vision that cannot be explained by physical description, and of course, the argument from knowledge is not limited to color vision. Limited to color vision. Jackson's argument can be understood as follows: first of all, Mary in the room has acquired all the relevant physical knowledge about color perception, but when Mary walks out of the room, she acquires a new knowledge, i.e., "red was like this," which is enough to show that at least one fact about color perception is not a physical fact. So we can argue that not all facts are physical facts. Then the physicalist can no longer claim that complete physical knowledge is complete knowledge, and that whatever exists in the world is a physical fact.

If we replace Mary, the scientist who has all the knowledge of color, with an AI that also has all the knowledge of color, there is no difference between the two at this level of knowledge of color. The new knowledge of the color red that Mary, who has stepped out of the black and white room, has developed is also lacking in the AI. In this scenario, which represents the ideal AI, an AI that knows everything about physical properties is still vastly different from biological intelligence. Such a difference stems from the lack of sensory qualities of the AI.

Therefore, we can conclude that there is a barrier between knowledge generated from physical properties and the non-transmittable, tacit feelings and experiences generated by biological intelligence that cannot be converted into each other.

III. Tacit knowledge

How we make sense of our experiences and feeling states depends largely on introspection. We do not yet have a complete grasp of the objective workings of the brain and body, and there is an unfathomable gulf between this objective and subjective experience. Despite our intensive study of the physical structure of neurons and their chemical activity, which has yielded a great deal of objective information, there are still some phenomena that we have difficulty explaining in terms of objective physical changes. Such phenomena include the processes that produce specific subjective feelings, which have been called the "Explanatory Gap" of the sensorium.[3] It has been argued that this gap is the result of a lack of understanding of the physical structure of neurons and their chemical activity. It has been argued that this gap is insurmountable and that it can be inferred that experiences and sensations may have irreducible subjective, non-physical properties. [4]

For example, the Song Dynasty poet Xin Qiji's expression of "grief" in "Tune: Song of Ugly Slave,

Written on the Wall on My Way to Boshan" shows such an "Explanatory Gap."

The full poem is as follows, with the translation from Zhao Yanchun:

The youth knows nothing of woe.
Upstairs he'd go. Upstairs he'd go.
To write verse,
he feigns a throe.
And now he knows all that's woe.
Speak it out? No. Speak it out? No.
Instead he says: nice fall, lo.

Xu Yuanchong, another renowned translator, translated the sentence "Speak it out? No." Into "I would not have it told." Lin Yutang translates it into "And can't find a word," which emphasizes the hesitation of the poet. In the comparative analysis of grief in Xin Qiji's works, it can be clearly observed that he prefers the expression "Speak it out? No." By emphasizing the "Speak it out? No." he shows his disapproval of over-emphasizing sadness in his lyrics. Although the poet may not be completely lacking in the understanding of sadness, he is reluctant to over-express it in his compositions or pretend to be profound, which contrasts with the tendency of traditional literature that "great words come from poverty-stricken." In his compositions, Xin Qiji may have had to emulate his predecessors' habit of speaking of sorrow on the heights of mountains, although he realized that such an approach might convey a false or unrealistic sense of sadness. In contrast, the lower section of his work contrasts markedly with the upper section: although the poet "knows all that's woe," he chooses not to speak it out simply pointing out that the coming of autumn has made the weather cooler. This way of expression does not require a lengthy lyrical narrative; the simple word "all" is enough to make the reader realize the poet's deepest sorrow.

When he was a young man, he heard the sorrow of others, but he could not understand the taste and meaning of it, precisely because "grief" as a subjective feeling could not be fully characterized when it was expressed through language. "Grief" is also a feeling based on personal experience. When Xin Qiji was suppressed, ostracized, and experienced the pain of having no way to serve his country, and understood the taste of "grief", he also found that he could not fully express this feeling through language.

Similarly, in the modern poem Thirteen Ways of Watching a Blackbird by the American poet Wallace Stevens Stevens explores the meaning of feeling. In thirteen paragraphs, Stevens describes thirteen different "feelings". These "feelings" are almost like short, stand-alone poems, each of which refers to a blackbird in some way. As the title of the poem suggests, these fragments present different perspectives, and as the poem unfolds, the bird takes on many different meanings.

The full poem is as follows:

I
Among twenty snowy mountains,
The only moving thing
Was the eye of the blackbird.
II
I was of three minds,
Like a tree
In which there are three blackbirds.
III
The blackbird whirled in the autumn winds.
It was a small part of the pantomime.
IV
A man and a woman
Are one.
A man and a woman and a blackbird
Are one.
V
I do not know which to prefer,
The beauty of inflections
Or the beauty of innuendoes,
The blackbird whistling
Or just after.
VI
Icicles filled the long window
With barbaric glass.
The shadow of the blackbird
Crossed it, to and fro.
The mood
Traced in the shadow
An indecipherable cause.
VII
O thin men of Haddam,
Why do you imagine golden birds?
Do you not see how the blackbird
Walks around the feet
Of the women about you?
VIII
I know noble accents
And lucid, inescapable rhythms;
But I know, too,
That the blackbird is involved
In what I know.
IX
When the blackbird flew out of sight,
It marked the edge
Of one of many circles.
X
At the sight of blackbirds
Flying in a green light,
Even the bawds of euphony
Would cry out sharply.
XI
He rode over Connecticut
In a glass coach.
Once, a fear pierced him,
In that he mistook
The shadow of his equipage
For blackbirds.
XII
The river is moving.
The blackbird must be flying.
XIII
It was evening all afternoon.
It was snowing
And it was going to snow.
The blackbird sat
In the cedar-limbs.

Stevens associates feelings with imagery in an attempt to convey his view of things. In stanza five, Stevens writes, "I do not know which to prefer, the beauty of inflections or the beauty of innuendoes, the blackbird whistling or just after." With this quote, Stevens explores meaning. Decoding meaning is easy when stated bluntly in simple language. But meaning can be equally encoded and hidden in words, body language, and vocal cues. And in stanza thirteen, "It was evening all afternoon. It was snowing and it was going to snow." supports the belief that there is no single, true meaning throughout the poem. The meaning of "blackbird" is given by everyone who observes it and feels it.

What Stevens discusses in this poem is the fact that all we are able to communicate through language is the expression of an arbitrary object or an arbitrary point of view, which limits our ability to describe and present our particular perceptions to others. As a result, writers have no control over how others perceive their work, as each person has their view of objects in the world and the world itself. This poem creates a philosophical conversation about feelings and discusses the struggle that every poet faces with their feelings: the poet cannot fully express their feelings through words, and the reader's feelings about the poet's poem are completely determined by the reader's own experience.

This is the deep-seated reason why artificial intelligence is unable to produce semantic understanding; experience and sensation constitute the bulk of the knowledge possessed by biological intelligence, and only a small portion of this knowledge can be adequately characterized through language. Knowledge that cannot be adequately characterized by language is also known as tacit knowledge, a concept introduced by M. Polanyi in 1958. Polanyi asserted that "we can know more than we can say." [5]

Xin Qiji summarized his bitter and unfulfilled feelings with the word "grief" in "Tune: Song of Ugly Slave, Written on the Wall on My Way to Boshan", and Wallace Stevens presented his thirteen feelings in different scenes in "Thirteen Ways of Observing a Blackbird". However, such explicit knowledge that can be characterized through language cannot be equated with the knowledge that Xin Qiji and Stevens produced through experience.

H. Collins has further categorized tacit knowledge into relational tacit knowledge, bodily tacit knowledge, and collective tacit knowledge. Relational tacit knowledge exists primarily in interpersonal interactions, manifests itself in the form of implicit knowledge, and is associated with a particular social structure, and is therefore considered to be a weaker form of tacit knowledge that can usually be stated explicitly. Physical tacit knowledge involves knowledge related to bodily skills, which is more difficult to accurately express or explain due to bodily limitations and specific contexts, and is more complex than relational tacit knowledge. Although, in principle, bodily tacit knowledge can be explicitly expressed through mechanistic or causal explanations as well as machine simulations, when it is combined with social norms (e.g., traffic rules), it transforms into collective tacit knowledge. This collective tacit knowledge exists in groups rather than between individuals and is therefore considered to be the strongest tacit knowledge. [6]

Collins' concept of collective tacit knowledge emphasizes a collective orientation that embodies social knowledge as a shared mental content that can be downloaded and used by individuals. S. Turner, on the other hand, proposes an individual orientation that emphasizes the transmission and interaction of tacit knowledge among individuals to understand its social nature. Focusing on the dynamic relationship between transmitters and receivers, Turner's research provides an in-depth description of how tacit knowledge is explicitly articulated in everyday practice, an activity that is highly dependent on the context and the particular receiver. These explicitly expressed activities are usually aimed at solving specific problems and reaching specific goals. [7]

The distinction between strong and weak tacit knowledge is an important contribution of Wittgensteinian scholars. Tacit knowledge in the strong sense refers to knowledge that cannot in principle be adequately expressed in words; tacit knowledge in the weak sense refers to knowledge that is not in principle insufficiently verbalized, although it is not represented by words.

Wittgensteinian scholars argue that there are non-verbal means of expression, such as action/practice, in addition to verbal means of expression. Strong tacit knowledge differs from mystical intuition in that it can be adequately expressed by action/practice, though not by language.

Tacit epistemology emphasizes that whenever we try to make sense of the world, we have to rely on tacit knowledge of the world's effects on our bodies and our bodies' complex responses to those effects. Not only are body-based perceptions and experiences mostly tacit, but tacit knowledge all needs to be expressed through the movements, activities, and states of body parts.

Another important aspect of tacit knowledge is that the absence of tacit knowledge is sometimes seen in life situations as a sign of failure to acquire explicit knowledge. As an example, in the academic field, there is a type of tacit knowledge called "savior-faire", which refers to knowing how to deal with conflicting rules and knowing when to invoke one of them when it is possible to practice the other. Tacit knowledge also determines one's perception of the boundaries of the field. This "intuitive" sense of the nature of a discipline is often presented indirectly through one's sense of what "belongs" or "does not belong" to a discipline. If a student does not perceive such underlying behavioral norms through contact with professors and peers in the academy, then the student's academic performance will suffer and be less than ideal. [8] The importance of learning conventions is well articulated by the American anthropologist P. Radin: "Most good investigators have little awareness of the precise methods they use in collecting data." [9]

The more important influence of tacit knowledge on academic expression is that tacit knowledge directly affects people's ability to use different discourse types on different occasions. In the words of R. Rorty, it is the tacit knowledge that determines "what counts as a relevant contribution, what counts as an answer to a question, and what counts as a good argument for that answer or a good criticism of it." [10] When presenting research to an external audience, scholars need a formal style of presentation, whereas internal seminars require a less formal style of discourse. Slips in the type of discourse may sometimes cause distrust of the speaker by others. If a person is only exposed to situations where formal discourse is prevalent, then that person cannot easily form a realistic conception of how research is accomplished.

The ability to use appropriate corpora for communication in a given language domain, also known as stylistic competence, has come to occupy an important place in the competence assessment of large-scale language models. Through the stylistic transformation task that requires large models to transform a given text with a higher/lower degree of formality, researchers have focused on examining the stylistic transformation and stylistic expression abilities of large models. The results of the large-scale language model's corpora conversion evaluation show that several models have exceeded the human experts' formalism scores, demonstrating the outstanding ability of the large model in formalism, but the large model's informalism, especially in the metric of consistency, still has a considerable distance compared with human experts. Such a result is that the Big Language Model uses written language as its main training corpus, which limits its degree of informality. This result at the same time illustrates the difficulty of informal genres, a type of discourse that contains more tacit knowledge, in being mastered by artificial intelligence. [11]

Based on the current state of AI and the dependence of tacit knowledge acquisition on perception through the body, AI can be further developed by simulating the process of acquiring tacit knowledge by biological intelligence by incorporating actions into the consideration of AI.

IV. The past and future of artificial intelligence

The concept of Artificial Intelligence can be traced back to the 1940s when Alan Turing proposed the theoretical model of the "Turing machine", which laid the foundation for computer science, in 1950, he published the article "Computers and Intelligence", which put forward the famous Turing test, which was the first criterion for evaluating the intelligence of machines. In the summer of 1956, the first symposium on artificial intelligence in history was held at Dartmouth College in the U.S. This meeting marked the birth of artificial intelligence as an independent discipline. During this period, AI research focused on problem-solving and symbol processing, and early AI systems such as ELIZA and SHRDLU demonstrated the ability of machines to process natural language and understand simple commands.

Over time, however, the early boom in artificial intelligence has cooled. Many of the predicted goals did not materialize, and the AI field entered the so-called "AI winter," with reduced research funding and declining public interest. But during this downturn, researchers didn't give up. They began to explore more practical problems, such as expert systems and natural language processing and gradually developed a set of more practical techniques.

Into the 1980s, AI began a gradual renaissance with advances in computer technology and increased data availability. Expert systems achieved success in fields such as healthcare and finance, while the rediscovery of neural networks injected new vigor into the development of AI. In the 21st century, with the huge increase in big data and computing power, deep learning has become the new engine of AI. Deep learning, a machine learning method based on artificial neural networks, enables machines to meet or even exceed human levels in tasks such as image recognition, speech recognition, and natural language processing.

In the future, artificial intelligence will continue to play an important role in various fields. Introducing Collins' three classifications of tacit knowledge into the exploration of AI may facilitate the development of the field of AI. In the process of revealing the importance of tacit knowledge, it is also important to explore the mechanisms by which technical tacit knowledge is acquired. Ludwig Wittgenstein (L. Wittgenstein) resorted to the notion of practice: "Practice gives meaning to discourse." [12] Practice is precisely the key to the acquisition of tacit knowledge by biological intelligence, from which relational, bodily, and collective tacit knowledge all emerge. By modeling how biological intelligences are exposed to environments and thus develop an understanding of tacit knowledge, AIs can also gain competence from the specific field provided. The AI can embody the understanding of tacit knowledge in practical action and achieve a level of competence that is closer to that of biological intelligence in a given project.

(i) Constructing an artificial intelligence development paradigm for dynamic human-computer interaction

Human-Computer Interaction (HCI) studies the processes by which humans and computer systems interact and influence each other. Recent advances in HCI have seen the emergence of new agent-based interaction paradigms utilizing large-scale models. Agents are autonomous systems that are capable of perceiving information, making decisions, and performing actions in a given environment. These intelligences mimic human cognitive processes to enable autonomous decision-making and autonomous actions. Physical agents include robots, smart appliances, and IoT devices, while virtual agents include AI assistants, digital humans, and customer service robots.

The agent consists of five main modules: a sensory unit (sensor), a processing unit (processor), a storage unit (memory), a communication unit (transmitter), and an action execution unit (actuator). The agent's task execution process is similar to human activities and usually follows the sequence of "goal-plan-execute-evaluate". The agent interacts with humans, other agents, and its environment through these modules. Large-scale models accumulate a large amount of declarative knowledge, which significantly enhances scale, complexity processing, context understanding, multi-task learning, generative capabilities, knowledge integration, and self-supervised learning compared to earlier AI systems. This enhanced procedural knowledge reasoning gives large-scale models a significant advantage in solving complex problems and providing intelligent services. Future developments portend increasing capabilities of intelligence in perception, reasoning, cognition, learning, creation and generation, emotional understanding and expression, and social interaction.

Human-Robot-Interaction builds on this foundation to better demonstrate the possibilities of AI for the presentation of tacit knowledge. From the original human-computer interaction model to the human-robot interaction model, AI needs to deal with dynamic, real-time interaction environments. Such a shift requires including multidimensional considerations ranging from physical to psychological to social dimensions. To handle different tasks in complex environments, autonomous robots must interact with humans. Additional goals, such as obstacle avoidance or interference compensation in dynamic environments, further complicate the tasks. In this context, the Learning by Demonstration (LfD) approach is a promising way to initialize self-improving autonomous systems. In the LfD approach, a human expert teaches a new skill to a robot through a demonstration task, which is characterized by sensors measuring joint angles, a visual tracking system, and other input devices such as sensing gloves to capture the skill. Although this technique currently has some limitations, providing learning capabilities to an autonomous robot allows the human user and the learning algorithm to adapt to each other during the interaction, thus achieving the effect of simulating the process of acquiring tacit knowledge and presenting it through actions. [13]

(ii) Constructing a self-evolving artificial intelligence development paradigm

Self-evolving AI models have more training modes, among which Meta-learning, also known as "learning by learning", is an advanced stage of AI self-evolution. By learning the common features of different tasks, AI can quickly adapt to new tasks. The advantage of meta-learning is that it improves the generalization ability of AI and can quickly adapt to new environments, while the disadvantage is that the training complexity is high. For example, the MAML model can use a small amount of data to find a suitable range of initial values, to change the direction of the gradient descent, to find the initial parameters that are more sensitive to the task, so that the model can be quickly fitted to a limited dataset, and obtain a good result.

The key to meta-learning is the discovery of universal laws between different problems and the solution of end-knowledge puzzles by generalizing the universal laws. Pervasive laws need to achieve a balanced representation of the commonalities and characteristics of problems. The search for universal laws mainly relies on discovering the parts that are closely connected between the already solved problems and the new problems, extracting the universal laws of the already solved problems and using them for the new problems; decomposing the new problems, simplifying them, and finding the universal laws that are closely connected with the various subtasks of the new problems and the range of applicability of these laws in the already solved problems; and learning the reasoning logic in the new problems, and using the reasoning logic to represent the new problems. Learning the logic of reasoning in the new problem, using the logic of reasoning to represent the new problem, finding the laws in these representations, and finding the solution to the new problem through the logic of reasoning between the parts of the new problem itself.

Prior knowledge and strategy are two ways of thinking about the ability of biological intelligence to process tasks in a statistical and information-theoretic way. The evidence of the transfer of prior knowledge in problem-solving is a reflection of biological intelligence's understanding of tacit knowledge.

(iii) Constructing a generalized artificial intelligence development paradigm for multi-intelligent collaborative systems

Multi-Agent Collaboration Systems, on the other hand, represent hybrid AI. Multi-Agent Collaboration Systems (MACS) is a special kind of multi-intelligence system whose goal is to enable multiple intelligences to collaborate effectively to realize some tasks that are beyond the capability of a single intelligence. The core challenges of multi-intelligence collaborative systems are how to achieve a balance between collaboration and competition among the intelligences, and how to enable the intelligences to adapt and learn according to different tasks and roles. With the advancement of Artificial Intelligence (AI), more and more AI systems are being used in a wide range of fields such as gaming, robotics, transportation management, healthcare, education, and the military. These AI systems are often no longer individuals operating in isolation but are integrated to become Multi-Agent Systems (MAS).

Planning a large language model for multi-intelligent body collaboration requires communication or credit allocation between intelligence as feedback to readjust the proposed plan and achieve effective coordination. In one study, researchers optimized a framework for multi-intelligent collaboration systems inspired by human social collaboration mechanisms. When human teams work together to accomplish a task, they often need an "evaluator" to measure each individual's contribution to the team's overall goal, guide the direction of individual efforts, and ensure the successful completion of the overall goal. In the absence of an "evaluator" and relying on individual communication, it is difficult for each individual to determine whether his/her work is beneficial to the overall team goal. Based on this, this study introduces the "dominance function" as a similar "evaluator" in large model collaboration, and provides a theoretical basis for group strategy improvement based on multi-intelligence reinforcement learning. [14]

V. Conclusion

This paper discusses Searle's "Chinese House Argument" and Jackson's "Knowledge Argument", and points out that the fundamental difference between current AI and biological intelligence lies in intentionality, and tacit knowledge is an important manifestation of intentionality. Artificial intelligence is a system that deals with programmed language, and since it does not possess intentionality, it does not produce semantic understanding. From the perspective of developing AI, to improve the current level of AI development, while training the large language model and inputting explicit knowledge text into AI, we should consider adding the training content of tacit knowledge. Tacit knowledge is knowledge acquired by biological intelligence through sensory qualities and experiences that cannot be fully characterized by language, but by considering the views of Wittgensteinian scholars, tacit knowledge can be defined as knowledge that can be presented through actions and further applied to the field of artificial intelligence. Using Collins' classification of tacit knowledge, the attributes of tacit knowledge such as placing AI in a scenario so that its interactions with the environment, people, and AIs are relational may expand new space for the development of AI.

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