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Abstract. The purpose of this paper is to put forward the concept of idea system and try to design its knowledge representation principle on the basis of academic discussion on the formation principle of the conceptual relationship of human knowledge. This method is an idea-based knowledge modeling method. The steps are: first, clearly define the concept as the mapping from sign to meaning; further, clarify that both sign and meaning are just a subclass of idea; finally, determine the separation of the sign relation network and the meaning relation network in the conceptual idea relation network, and modeling and computational processing are unified with the idea relationship network. It is characterized by: the knowledge representation method and principle of the idea relation network. The result is that the idea system, which is a new knowledge modeling tool system, systematically introduces its typical embodiments in combination with word, formula, figure, table, and compares and analyzes the research results of related knowledge graphs. Its significance lies in that: it is significantly different from the traditional method, that is, the knowledge representation model that uses symbols instead of meanings to model. This paper establishes a new method and new principle of knowledge construction model that is assisted by symbols and directly modeled with ideas, which is a new method for cognitive computing. It provides a new way to express knowledge based on meaning rather than symbols.

Keywords: Idea System, Human-Machine Collaboration, Knowledge Graph, Knowledge Construction, Cognitive Computing, Artificial Intelligence.

1 Introduction

1.1 Purpose

The purpose of this paper is to put forward the concept of idea and its system and try to design its knowledge representation method on the basis of academic discussion on the formation principle of the conceptual relationship of human knowledge.

1.2 Background

Knowledge engineering [1], knowledge graphs [2], cognitive science[3], cognitive processes and cognitive science and interdisciplinary study of the mind[4], cognitive

revolution and cognition computation[5], mental models on a digital computer [6], the representational theory of mind (RTM) in cognitive science[7], cognitive processes to cultural evolution -Bridging cultural gaps: interdisciplinary studies in human cultural evolution [8], deep learning (DL) methods [9], machine learning (ML) [10], Internet of Things (IoT) [11], statistical computing [12], cognitive systems engineering (CSE) [13], cognitive system architecture best suited to his modelling problem [14], a cognitive system and effective systems [15], a cognitive system algebra (CSA) [16], the cognitive approach based on symbolic information processing representational systems,cognitive terms,the human nervous system,a cognitively-inspired knowledge representation and reasoning system, while graph covering is a fundamental and well-studied problem, this field lacks a broad and unified literature review. The holistic overview of graph covering given in this article attempts to close this gap. The focus lies on a characterization and classification of the different problems discussed in this review extends to the corresponding problems.

2 Method

This method is an idea-based knowledge modeling method. The steps are: first, clearly define the concept as the mapping from sign to meaning; further, clarify that both sign and meaning are just a subclass of idea; finally, determine the separation of the sign relation network and the meaning relation network in the conceptual idea relation network, and modeling and computational processing are unified with the idea relationship network. It is characterized by: the knowledge representation method and principle of the idea relation network.

2.1 Review Concepts in Cognitive Science for Our Definition

Knowledge engineering is one of the important backbones of artificial intelligence development, and its goal is to establish a human knowledge base that can be used by computers, that includes three elements: acquisition, representation and application. Among the many knowledge representation methods, knowledge graph stands out in the Internet environment. Combined with machine learning and big data mining technology, it has become a highly potential knowledge representation method for the semantic web.Since the knowledge graph has not yet formed a complete theoretical system, it has the genes of symbolism in knowledge representation, and it is insufficient in the knowledge representation of non-logical complete meanings such as intuition, common sense, ambiguity, etc., and those knowledge just reflect characteristic of human intelligence. This deficiency of knowledge graph affects the breadth, depth and quality of its application. In order to explore the root cause of the deficiency of knowledge graph, it is necessary to explore the concepts and conceptual relationship networks that form knowledge from the perspective of cognitive science.In 1975, with the support of the famous Sloan Fund, a group of scholars from the six disciplines of philosophy, psychology, linguistics, anthropology, computer science and neuroscience were gathered in the United States to jointly study "how information is used in the process of cognition". Passed?" This profound cross-border

question eventually gave birth to a new discipline-cognitive science.Cognitive science is the theory and doctrine of the study of mind. The main objects of cognitive science research are: perception, attention, memory, language, thinking and imagery, consciousness, etc. These objects are all the products of people's brain and mental activities in a specific living environment. No matter what form these objects exist in the brain, or whether the brain can directly or indirectly perceive their existence (as in the subconscious, the brain cannot directly perceive their existence), but this does not change "they are the mind in the brain. the basic fact of existence.

In cognitive science, a concept is a kind of mental existence, that is, a kind of idea.

Saussure believes a symbol is composed of signifier and signified.

According to Peirce's classic triadic view of symbols divided into three categories: Icon, Index and Symbol.

If the "things represented by linguistic signs in the brain-mind" are defined as "meanings", and "the linguistic signs in the brain-mind" are defined as "signs". Then, the concept can be defined as: the mapping of symbols and meanings. Obviously, the concepts, symbols, and meanings so defined all belong to the category of "ideas" that was previously summarized.

2.2 Comparison of Knowledge Representation in Brain and Computer

Concepts are the elements that make up knowledge models, and this idea is used in both cognitive science and artificial intelligence. In order to discover the similarities and differences between knowledge representation methods in the human brain and computer, it is necessary to carefully analyze how the above ideas are applied both in the human brain and computer.

Regarding the relationship between concepts and knowledge, Kant made a classic exposition in the first part of his "Critique of Pure Reason": "The Elements of Knowledge" Kant proposed that the two elements that constitute knowledge are "intuition + concept". The concept can be regarded as the mapping of the symbols and meanings mentioned above.

According to Peirce's point of view, the meaning can also include the external things that are recognized, but this does not affect the connection. The conclusion of "How is knowledge generally represented in the human brain?" The brain establishes a series of interconnected concepts to external things or their intuitive representations, forming a conceptual relationship network. It is the combination of this conceptual relational network and intuitive representation that constitutes knowledge. It can be considered that the general representation of knowledge in the human brain is a network of conceptual relation.

The method that logic provides for the definition of the meaning of a concept is to determine its meaning by the "position of the concept's symbol in a logical framework in the form of a category". This represents a way of thinking and processing representations according to a specific logical mode. This method of defining the meaning of a concept is essentially a method of using existing concepts to form a relational network to define the meaning of a high level concept, which is a specific embodiment of the conceptual relational network.

Taking the knowledge graph as an example, the representation of knowledge in the computer is an attempt to establish a conceptual relationship network that is completely consistent with the human brain. Using the knowledge graph, the type relationship rule definition similar to the formal description of category logic which can be introduced in its schema layer to constrain the "meaning" of the things and their relationships described in the data layer, but this "meaning" is still a "form".

2.3 Build a human-machine collaborative smart system，problems and opportunities：Asking questions is more important than solving them

The first problem caused by the dependence of concepts on symbols is that in the knowledge representation of the computer, the establishment of the meaning space in the computer is directly abandoned. The computer processing can only do formal and logical thinking at the symbol level, completely giving up the opportunity to develop intuitive thinking.

In addition, another reason for the dependence of concepts on symbols is that humans use language to communicate outside the brain. Since the mapping between symbols and meanings is many-to-many, that is, a symbol can be mapped to multiple meanings, And only when combined with enough contextual information can a symbol be mapped to a meaning. According to Peirce's theory, these contextual information is the "interpretative term" implicit in the sign. This leads to the problem of ambiguity in language communication due to unclear contextual information, and different brains either generate different "interpretation items" for the same symbol, or directly map to different meanings.

The problem is that the conceptual relationship network in the human brain and the conceptual relationship network in the computer belong to two different types of subjects, and the language symbol system of a concept is completely different from the meaning system. The knowledge in the human brain is a conceptual relationship network established by the human being and the artificial ability to act.

If such a knowledge base can be established in a computer, and the meaning relation network of the knowledge base can be used for calculation directly, then the computer can get rid of the constraints of human language and various computer programming languages on computer cognitive computing or calculation.

3 Result

The result is that the idea system, which is a new knowledge modeling tool system, systematically introduces its typical embodiments in combination with word charts, and compares and analyzes the research results of related knowledge graphs.

Proposition of the idea system

How to transfer the meaning network in the concept network to the computer?Return to the concept of "idea" proposed in the previous subsection from the perspective of cognitive science. Idea is a general term for the objects of cognitive science research,

including perception, attention, memory, language, thinking and imagery, and other objects in the human brain, even consciousness.Assuming that in the human mind in brain, no matter what kind of idea, its own meaning or content can always be connected by a series of ideas according to a certain relationship, that is, the idea relationship network which is used as a general realization. Because ideas are the generalization of symbols and meanings, the network of idea relationships can be a network of three kinds: symbol-symbol, symbol-meaning, and meaning-meaning, and unifying these three networks in the same big network, also It is the ability to unify language, concepts and meanings in the same model.

Meaning is a kind of idea, which means the use of meaning is the use of a group of ideas related to meaning-like ideas. This group of ideas may also include other meanings, symbols and relational ideas. Conceptual type ideas can be understood as a sub-type of the relational type ideas between symbolic type ideas and meaning type ideas. This group of ideas forms a partial idea relation network centered on meaning ideas, which can be called the neighborhood idea network of meaning. In this way, the meaning objects are embedded in the whole idea network through the domain idea network. Although different types of ideas have different usage methods, what types of ideas are constructed, and what types of ideas can be used in what ways, can also be defined in the entire network of idea relationships. Therefore, human beings and artifacts (including the execution method of computer software programs) can be defined as meanings in the idea relation network, which establishes the foundation for the grand unification of the meanings of the human brain and the meanings of artificial objects, and forms a way of constructing ideas by constructing ideas. Relational network to build a system that has both knowledge representation and knowledge meaning, and can directly support programmed knowledge processing, which is called "idea system".

The feature of "supporting procedural knowledge processing" comes from the fact that the use of ideas can finally be implemented into the execution of programs, which means that the idea system is a self-defined, open, borderless and programmable knowledge base system. At the same time, it also means that the objects that can be processed by software programs, in addition to "data", have since added another object called "ideas". Therefore, computer software programs can not only work hard at the data layer to mine information and knowledge, but also work happily at the knowledge layer.

The meta-model of the idea system

(1) idea

a. The concept of idea

From a business perspective, idea is a collective term for the object of cognitive science research. Everything that the human mind sees, feels, knows, thinks, and realizes is idea. There are only abstract objects of this type idea in the mind. The construction and use of knowledge in a computer can be achieved by constructing a

network of ideas and idea relationships in the idea system. Idea is the cornerstone of the idea system.

b. Classification of idea

Ideas fall into three categories: Symbol class, Meaning class,Relationship class.

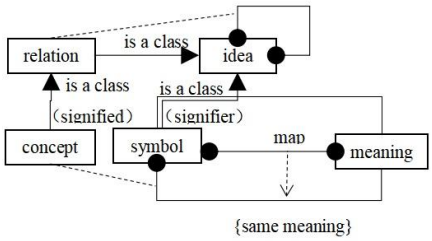

Fig. 1. idea class diagram.

Concepts are mappings of symbols and meanings. In fact, a concept should be uniquely identified by its meaning, then a concept is a number of symbols containing a meaning and all its inverse mappings.

c. The nature of idea

In Buddhism, there is the concept of "idea originates and arises", that is, all causal and evil conditions originate from idea. Ideas must be established at the same time as relationships (conditions). Ideas that are not related to other ideas have no meaning in existence. A new idea must start with a new relationship. The idea of losing all relationships is the idea of being eliminated.

(2) Ideas and facts

a.Concept of thought fact

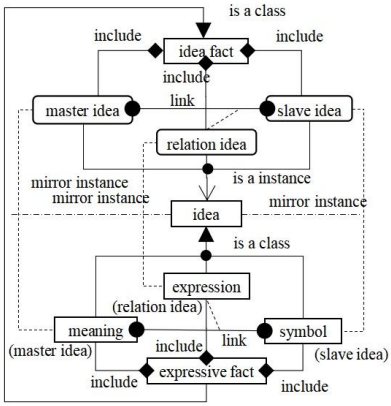

Fig. 2. idea fact and expressive fact.

Building relationships between ideas and ideas is the first step in knowledge building. Relationship is an idea. Therefore, a unit of fact of knowledge requires at least three ideas: the main idea, the relational idea and the subordinate idea.

b. Classification of idea Facts

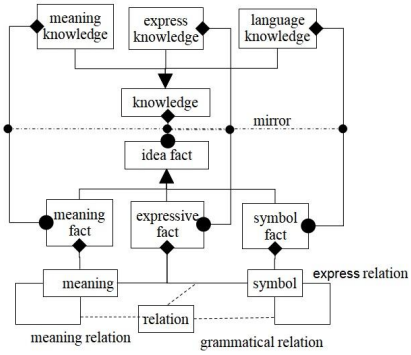

Fig. 3. three kinds of idea fact and knowledge.

As above, the symbols and meanings connected by the expression relation are the expression facts. Expression facts are used in the construction of knowledge representation.The relationship between meaning and meaning is called meaning fact. If the expression is not considered, the meaning fact and the symbol have nothing to do. Combining multiple meaning facts yields modular meaning knowledge. To express the knowledge of modular meaning, it is necessary to establish the relationship between symbols and symbols. The relationship between the sign and the sign is the sign fact, or the linguistic fact.

(3) Transformation of ideas and facts

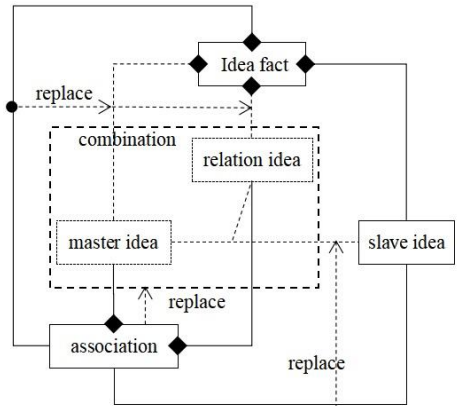

Fig. 4. idea fact transformation diagram.

An idea fact means "a master idea can be connected to a slave idea through a relational idea". A careful analysis of the relationship of the three ideas in the idea fact will reveal that:

Corresponding to the subordinate ideas is not only the main ideas, but the combination of the main ideas and the relational ideas. The combination of a main idea and a relational idea is called "an association", that is, the association generated by the main idea through the relational idea. [reveals the essential attributes of association] An association is a double-idea combination object of a relational idea subordinate to a main idea.

A relational idea subordinate to a master idea exists only under that master idea. That is to say, there is no situation where two main ideas and relational ideas are the same, but the objects represented by the combination are different.

An association is an object composed of two ideas. Then, each idea fact can be transformed to be composed of an "association" and a "sub-idea", and its meaning is: who's what relationship is connected to who. A ternary relation is reduced to a combination of two binary relations.

(4) The meta-model of the idea system

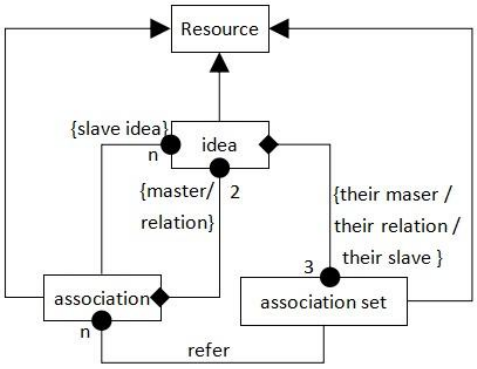

Fig. 5. idea system meta model.

An idea may play three possible roles in different idea facts: the master idea, the relational idea and the subordinate idea. As the master idea and the subordinate idea, it may participate in the composition of multiple associations; as the subordinate idea, it may become the connection target of multiple associations. Defining the reference set of multiple associations as an idea, then an idea can contain three ideas, respectively record the main idea as the association set of the main idea, the main idea as the association set of relational ideas, and the main idea as the subordinate idea. The set of associations to which it is connected.

Implementation Cases of Idea System

(1) Implementation points

The idea system is a knowledge system that builds a knowledge base by constructing an idea relation network and directly supports programmed knowledge processing. The key conceptual change of the idea system is to reverse the status of symbols and meanings in traditional concepts, so that the processing of knowledge is changed from symbolism to symbolic auxiliary. In cognitive computing, knowledge can take off the coat of symbols and run directly with meaning.

(2) Design and implementation of the case

Although the mind system seems to be a revolutionary grand project, the core idea of this grand project is only as simple as the above-mentioned. As long as you grasp the main points of its core essence, realize its core principles, and show its development potential, it is not a very difficult thing.

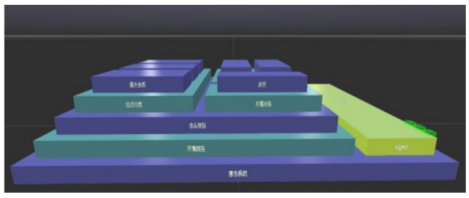

Fig. 6. Modeling tool 3D idea visualization renderings.

In the modeling tool, each meaning is visualized as a 3D rectangular block, and the name displayed for each meaning is one of multiple symbols selected for the concept to which the meaning belongs. The selection can be switched, and multiple symbols can refer to the same meaning or focus on meaning. The associative relationship of meaning and the grading of sub-meanings are carried layer by layer on the rectangular block of upwardly extending relational meaning with the main meaning as the platform. Each layer of meaning can be expanded and collapsed to form a 3D tree map showing the overall structure of the meaning relationship network. From the meaning of the upper and lower peripheral connections of the meaning, the uniqueness of the meaning seen can be further confirmed.

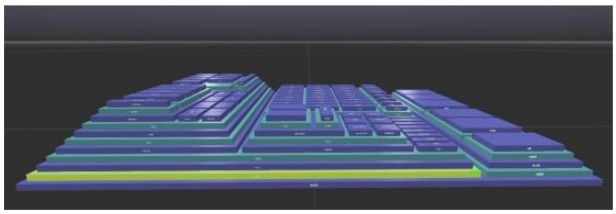

Fig. 7. Visualization rendering of virtual 3D tree map idea relationship network.

Executable program component resources can be converted into meaning relation network and loaded into the mind system, and used as atomic meaning in the mind system to construct a new meaning relation sub-net, which is equivalent to

programming with meaning. The comment added to the program resource node, as one of the multiple symbols of the node, is listed in the conceptual mapping symbol set, which can realize the multi-level symbolic expression (analysis, design, testing, implementation) of software functions and program execution functions. Microscopic aggregation of meaning.

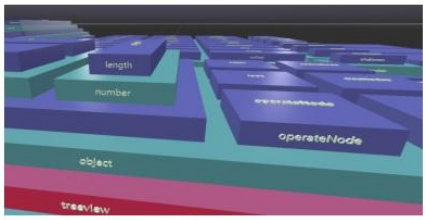

Fig. 8. Program resources are converted into meaning relation webs loaded into idea system.

The cloud deployable WEB modeling tool environment supports multi-team and multi-user collaborative and parallel modeling in different places. It can be used as a meta-meta model for the development of ecological application software. According to the MDA architecture, it can add paradigm-related, scenario-related, function -related, business-related, and tenant-related layers layer by layer. A system of ecotype modeling tools for semantic overlay transformations.

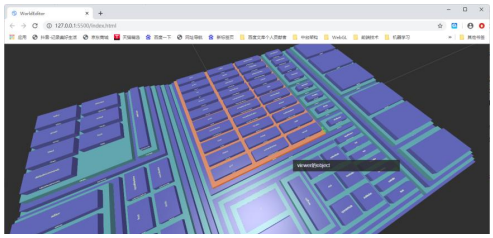

Fig. 9. Modeling tool environment deployed in the cloud.

In the modeling tool, each meaning is visualized as a 3D rectangular block, and the name displayed for each meaning is one of multiple symbols selected for the concept to which the meaning belongs. The selection can be switched, and multiple symbols can refer to the same meaning or focus on meaning. The associative relationship of meaning and the grading of sub-meanings are carried layer by layer on the rectangular block of upwardly extending relational meaning with the main meaning as the platform. Each layer of meaning can be expanded and collapsed to form a 3D tree map showing the overall structure of the meaning relationship network.

(3) An example of thought relationship modeling

Next, a fictional short story knowledge representation problem is used to illustrate the characteristics of the application of idea relationship modeling. The story goes like this: One day, two aliens X and Y visited Earth for the first time and landed in two places. X finds a cow, sees that it "has horns on its head, can walk, and eat grass", so he calls it "animal". Y finds a horse and sees that it has "hair on its neck, can walk and eat grass", and also calls it "animal". When the two met and talked, they both believed that the other party had a wrong definition of animals. So find the earth to judge right and wrong. The earth gave them the idea system M and let them do a knowledge modeling together. After modeling, the two aliens suddenly realized that they praised the idea system and thought they were gods.

The following is the knowledge model building process and results that take place in the minds of X and Y respectively.

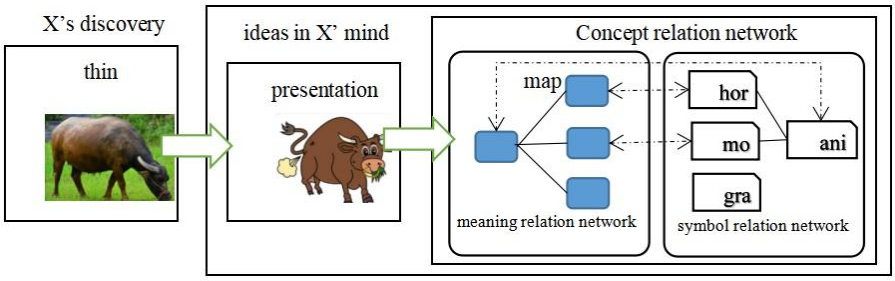

Fig. 10. Knowledge model building process and results in the minds of X.

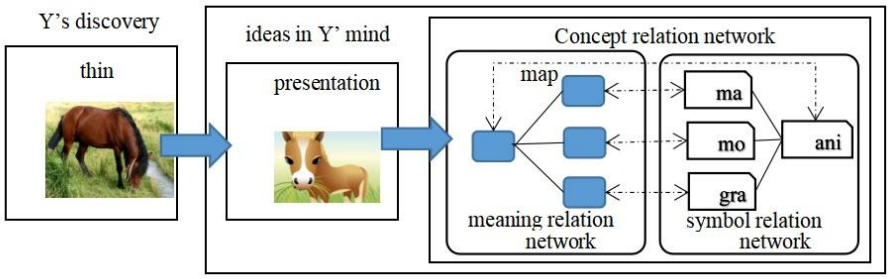

Fig. 11. Knowledge model building process and results in the minds of Y.

The modeling process in X is as follows: first, the instance of the cow found and the selection of its 3 characteristics are established to establish 1-4 instance meaning ideas; then, each meaning is named, and 4 symbolic ideas are created. Establish an

expression relationship with the meaning of the corresponding instance; next, establish the type meaning idea of 5-8, and establish a categorization relationship with the meaning idea of the corresponding instance.

Here are the results of Alien X's modeling in Mind System M:

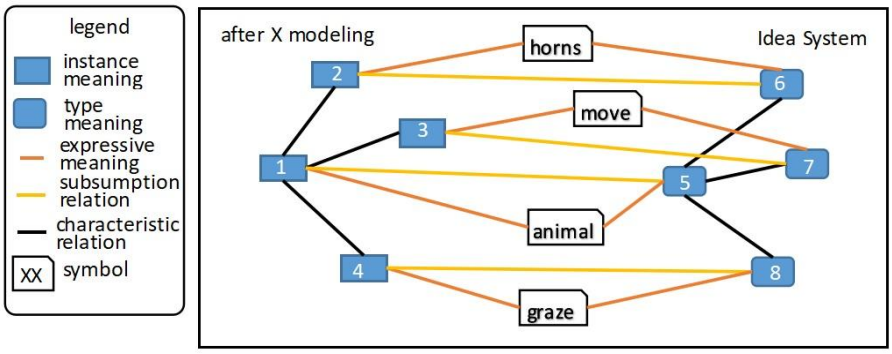

Fig. 12. the state of idea system after X modeling.

Y follows X and starts to model in the mind system at the same time.

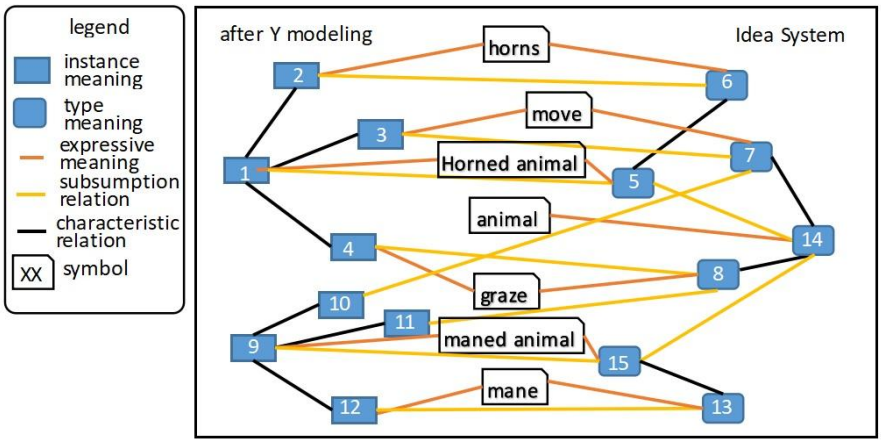

Fig. 13. the state of idea system after X and Y modeling.

Y first found the instance of the horse and selected its three characteristics to establish the idea of the instance meaning of 9-12; when classifying ..... .

Comparison with Knowledge Graph

From the example in the previous section, it can be seen that the knowledge modeling of the idea system is divided into three layers: instance, type and symbol, which is different from the two-layer structure of data and ontology model of knowledge graph. What do these differences mean? What are the benefits? Combined with the full text analysis, an inductive comparison is made here.

Table 1. Inductive Comparison of Knowledge Graph and Idea System

No.	Comparison item	KG	IS	+	Superior's advantage description
1	Concept Logo	Symbol	Meaning	IS	Transforming the ambiguity problem into a choice-symbol problem
2	Meaning Sign	Symbolic Relationship	Meaning Relation	IS	A network of computational meaning relationships can be directly constructed
3	Conceptual Integrity	Incomplete	Relatively Complete	IS	Recordable meaning-symbol mapping
4	Main Service Object	Humanity	Man-Machine	IS	Can be built with a mix of human-machine capabilities
5	Mathematical Calculation Model	Picture	Picture	=	Also adapt to the graph computing algorithm model
6	Ontological Knowledge Representation	Pattern Layer	Type Meaning	=	Equivalent ontology knowledge representation ability
7	Instance Knowledge Representation	Data Layer	Instance Meaning	=	Equivalent instance knowledge representation ability
8	Triple Abstraction Layer	Content Related	Content Is Irrelevant	IS	The idea-relational model has a higher level of abstraction
9	Interpretability	Powerful	Weak	KG	Symbolic descriptive knowledge is easy to understand
10	Enforceability	Weak	Powerful	IS	Meaning includes operability capability
11	Knowledge Is Computational	Content	Method | Content	IS	Calculate knowledge with constructed knowledge
12	Knowledge Redundancy	Big	Small	IS	No synonym redundancy
13	Easy To Model	Easy	Disaster	KG	Modeling is more intuitive
14	Flexibility	Weak	Powerful	IS	Adapt to formal and informal knowledge.
15	Global Consensus	Not Support	Support	IS	The whole network unified knowledge meaning base
16	Generality	Field	Universal	IS	Multi-domain hybrid integrated modeling
17	Scalability	Domain Boundary	Domain Fusion	IS	Unified idea-relational meta-model
18	Scale	Limited	Unlimited	IS	Open mind relationship network application model

（KG-Knowledge Graph; IS-Idea System.）

To sum up, the fundamental difference between the knowledge graph and the idea system is: the knowledge graph is a knowledge content management tool with the offline application of knowledge as the service goal, conceptual symbols as the identification and operation objects, and the idea system is based on human-machine collaboration. Online application of knowledge as the service goal, with conceptual meaning as the identification and operation object, and knowledge running the operating system.

4 Conclusion

Its significance lies in that: it is significantly different from the traditional method, that is, the knowledge representation model that uses symbols instead of meanings to model. This paper establishes a new method and new principle of knowledge construction model that is assisted by symbols and directly modeled with ideas, which is a new method for cognitive computing. It provides a new way to express knowledge based on meaning rather than symbols.

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