

Important Position of Information Science In Studying Complex System

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Abstract. This paper firstly describes the important position of information science in complex system and the relationship between them. And then by the detailed analysis, point out that the uncertainty of information is absolute and certainty is relative in the information age. the important significance on uncertain information research is emphasized. and a research relationship: uncertainty information→information science→complex system is also established. Finally, that the research prospect, processing method and theoretical basis for uncertain information are proposed.

Introduction

In recent years the complexity of systems has aroused a broad attention. From the system science point of view, system model is regarded as the key aspect. Although some researchers begin to consider giving up the efforts of modeling to turn to find a kind of model free controller, new concepts and new ideas on the complex system modeling have been proposed and developed. It is well known, the concept of Hall for Workshop of Meta-synthetic Engineering has been proposed for coping with opened complex giant systems, this is the scientist of our country professor Xue-sen Qian firstly presented in 1990-1992. where “complex giant systems” (1990), “Hall for Workshop of Meta-synthetic Engineering”(1992). and he thinks that complexity problem is actually the dynamics property problem of opened complex giant system. which with the complexity scientific / complex systematic was proposed by abroad is expressing the same idea in different words. Originally ,Xue-sen Qian point out that is a scientific new field, afterwards, Ru-wei Dai with it to summarize the science of the 21 century.

In 1992, Professor Xue-Sen Qian again present a conceive: that construct a system of “Hall for Workshop of Meta-synthetic Engineering” which from qualitative to definite quantity. And pointing out that the method of research and resolve the complex giant system of open should be will systematology regard as direction. system of “Hall for Workshop of Meta-synthetic Engineering” its substance ,it is will expert group (the expert of each aspect), data , various information and computer , and network etc. information technique organic combine , and combining the scientific theoretical and knowledge of person of various subjects , the forms system by this 3 which is based on network. The composition of “Hall for Workshop of Meta-synthetic Engineering” is that from investigate terminal and center investigate hall , investigate hall key net (Internet or WAN) , investigate hall management service system , investigate hall information resource storehouse , as well as distribution every place is interested in with related to investigate group and the group of tech support.

From the above, it is easy to see: Studying complex giant system will inevitably be concerned with information. therefore the author is being this to discuss the relation between complex system and information , and present some viewpoints for with same occupation discuss.

On Position of Information Science In Complexity Research

Information idea is that the people carry information as a kind of the basic existence for difference from material (quality and energy), as well as the generality understanding, stipulation and knowledge that made for its essence, existent way, meaning and value. And according to corresponding understanding,

stipulation and knowledge, since the structure of extant thing organizes and concerns the evolution program and generation course pattern and type of movable mould, holds and describes method and the way of property, characteristic and the essence of thing, is program course, relation and the structure of extant thing the carrier of information or is consistent yard, and from this decoding happen in which implication method and the way about the indirect existent contents such as thing historical state, realistic relation and future trend, as well as will realistic object thing or information again pedestrian is symbolism, and method and the way of composing the acting type relation that it specifies have formed the information way or information thought way of knowing, namely information thought.

Reasonable theory considers that the system theory, information theory, cybernetics, dissipative structure, synergetics and hypercycle theory etc. are all complex system theory. However, for the feelings boundary of initial origin of above-mentioned theories, they can not be at last complexity research theory of standard. If decipher again for above-mentioned theory with the more comprehensive visual angle that complex information system explains for studying theory, make above-mentioned theory have the nature of complex information system theoretical research probably, however, this has been a kind of form of above-mentioned theory that has developed more. Though the information scientific research can not be simple directly regard as complexity research, but compared with the systems scientific research and from organization research, information scientific research is not only more fundament and also more synthesized, but also it can be embody the related basic feature of complexity research. Information scientific research is more basic, which because of the development of information science has first revealed a brand-new existent field in the sense of world this body existent theory, and in the layer with normally abstract philosophy surface on, have demonstrated the brand-new world view of a kind of material world and information world double existence and double evolution, and then have again founded information intermediary theory of a kind of philosophy theory of knowledge.

We know, complexity research emphasize that the inner randomness of systems and the autonomy of vital factor, as well as that the feature of inter-dependent and relative independent of the systems with vital factor, system and environment. So "reductionism" with "overall doctrine (emerge to discuss)", system theory and information theory, "decision theory" with "not decide theory", inner randomness and outside randomness, feedback and outside feedback, vital factor and overall relation network, and the mass-energy factor and information factor has been unified dialectically. that the basic theory was explains by information research can embody reasonably many basic feature for the above-mentioned complexity research.

Information thought is a kind of brand-new complexity thought way. Obviously, by from the above-mentioned is related explain, we can see distinctly, that the related theory, viewpoint, way and method was provided by the information scientific research which embodies information thought, it able better embody general feature of holographic comprehensive for complexity research, and then it offered one brand-new explain dimension degree for the complexity. On this new dimension degree, not only systematic complex behavior can get explanation from the angle of information campaign and information campaign is complex. Is just based on this, we just reasonable from say, the information scientific in development of present science, which with very unique position and role, it's brand-new research viewing angle is that the other already some research all cannot be replaced. That is just information scientific research may offer certain kind the most fundamental theoretical normal-form for the complex system research, and it is that has nucleus theoretical meaning.

Important Significance On Studying Uncertain Information

It is well known, Our epoch straight trend information epoch, however, it is fairly too serious that information theory fall behind the condition of times. Though Shannon's information theory have gone through reputation distinguished, but his information theory been concerned with that daily language claims it is a little part of information only, that is, the uncertainty was reduced. And the information that offers for semantic information, feeling information, accident cause and measure data is to be unable

to help. In Shannon information theory was born near, somebody has used it, is in daily information alternating occasion, as a result, full of loopholes. Therefore, Shannon is very indignant, and wording give blame sternly, ask people not to overstep random statistical field for the application of his theory. So this, in afterwards numerous work in, as soon as talking about uncertainty information, it is random information. We think that this is not overall Because the feature of information is that the unity of function, structure and the essential factor of thing shows. Information course has 3 links: source information-channel-old information. Source information is thing place built-in, is objective. It projects under the role of energy to around. Channel is medium and the channel of transmission information. Through channel, go to source information transmission to take over system. Old information is to accept the information presented by system. Mankind can get, the information of grasp can only be old information. It decision in thing the spread course of place built-in source information and channel, it still suffer that restriction of the receiving system with person identification ability. Because of interference of external noise, source information goes to old information pass through channel, which usually has the distorted phenomenon of different level and different aspect. Since restriction of the receiving system with person identification ability, this kind of again spread course can also make information serious distortion. Obviously, distortion information can't exact and over-all reflect innate of object, this is the uncertainty of information. The distortion information is called as uncertainty information.

From the course of producing of uncertainty information, we can find out, it is the result in human's process of cognition, it is also the inevitable result of mass sport. If we say that information is determined, then we can only say it is source information, (but from the spread course of information has known: What we can get can only be old information, that source information is direct got is impossible) or say thing fairly simple, we can man-made regard it as determinate. However because of the complexity in information course, that can be regarded as definite old information is very few. Our conclusion is: In the old information that obtained by mankind, uncertainty information is absolute, deterministic information is relative. So we study information science and must study uncertainty information. Sum up the above, we don't difficult to get that a research relationship: uncertainty information \rightarrow information science \rightarrow complex system. It obviously reflects the important significance on uncertain information research. furthermore, because the produce source of uncertainty information is not one-side, so besides classical random information, we still should study other several uncertainty information, such as Fuzzy information, grey information, pan-grey information and unascertained information.

Processing Method, Theoretical Basis And Prospect For Uncertain Information

Up to the present, handle various uncertainty information, we already have got the processing technique of each, is in proper order: Radom mathematics, fuzzy mathematics and grey mathematics, unascertained mathematics and Fan-grey theory and method. We have known that in the various systems such as economic system, various uncertainty information all may has expression. This is not accidental, because uncertainty information produce is the inevitable result of material sport. Any a thing and a system which as long as have person to participate in, then have uncertainty information for necessity to present, and present different uncertainty information according to the different property of thing that studied to know a systematic optimization control of realizing for system well, so we must consider the comprehensive handling for various different uncertainty information. that the mathematics technique and theory for comprehensive handles uncertainty information be called as uncertainty mathematics. What here still emphasize is that we will not only emphasize the development and establishment of 5 kinds of uncertainty mathematics branch (contain pan-grey set theoretical method), but also will more notice to that establish and develops problems of the uncertainty mathematics that handles various uncertainty information. Point out incidentally, the theoretical basic for the 5 kind of uncertainty mathematics is respectively: Cantor set theory, Fuzzy set theory, Grey set theory, Unascertained set theory and Pan-grey set theory.

It is noted that various kinds of uncertain system as well theory method is respectively discussed above, but in objective world, some big system may have not merely a kind of uncertainty, may have two or three kinds of uncertainty, which demands people plan as a whole in dealing with uncertain information. In aspect of handling system with two kinds of uncertainty, professor Wang Guanyuan and Zhang Yue have established “fuzzy” random system theory [11-12], then, how to handle the problem of the other two or more kinds of information coexisting? It wait people to tap and open up.

Conclusions

In this paper, the important position of information science in complex system and the relationship between them are discussed. And by the detailed analysis, point out that the uncertainty of information is absolute and certainty is relative in the information age. That the important significance on uncertain information research is emphasized. So the research relationship: uncertainty information → information science → complex system is also established. Finally, that the research prospect, processing method and theoretical basis for uncertain information are proposed.

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