Cognitive Computing and World Wide Wisdom (WWW+)

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ABSTRACT

It is recognized that the key theoretical and technical problems toward the next generation internet are not only a speed issue, but also a more fundamental issue of the increasingly demands for the sharing of computational intelligent capabilities. According to cognitive informatics [1, 2, 3, 5, 9, 14, 16, 18], the cognitive information that humans acquire, process, retain, and share can be classified into four profound forms known as knowledge, experience, skill, and wisdom. Among them, wisdom is the most advanced cognitive objects, which is a form of natural intelligence of humans that transfers a query or instruction into an action or behavior based on a well developed reasoning and judgment.

However, the current Internet is still remains as an information network. Towards the development of next generation Internet as a wisdom network, the World Wide Wisdom (WWW+) network infrastructures and technologies are yet be sought on the basis of cognitive informatics and cognitive computers. In WWW+, each node is a cognitive computer (CC) [3, 9, 10, 15], which is a form of autonomous and intelligent computers that think, perceive, and learn. CC enables the simulation of machinable thought such as computational inferences, reasoning, and causality analyses by autonomous inferences and perceptions mimicking the mechanisms of the brain [3, 15]. The cognitive learning engine of a CC is an autonomous learning system that enables machines learn in natural languages and symbolic notations. The cognitive search engine of a CC is a machine-learning-based search system that results in cognitive knowledge acquisitions and manipulations. On the basis of the development of CCs, the next generation internet, WWW+, will be developed as a world-wide intelligent network for knowledge processing, autonomous learning, and machine-supported problem solving.

The theoretical foundations for WWW+ and cognitive computing are cognitive informatics [1, 2, 3, 5, 9, 14, 16, 18], with underpinning contemporary denotational mathematics [6, 12], such as concept algebra [7], system algebra [17], real-time process algebra [4, 8], granular algebra [12], and visual semantic algebra [11]. Denotational mathematics provides a coherent set of powerful mathematical means and explicit expressive power for the design, modeling, and implementation of cognitive computers and WWW+, as that of Boolean algebra for conventional computing technologies.

WWW+ extends the current information-search-based Internet to wisdom providing and intelligence services that mimic and simulate the brain in the largest scope of the cyberspace in which each node plays a role as an autonomous super neural cell. As that the conventional Internet provides a solution to the “to do” category of problems for information sharing based on searching technologies, the WWW+-based internet solves the advanced “to do” category of problems for wisdom and intelligence capability sharing based on cognitive computing technologies. WWW+ will be the largest scope of computational intelligence and the closest embodiment of the brain as interconnected constituent intelligent components. A wide range of applications of WWW+ and cognitive computers have been identified such as, inter alia, theories, methodologies, and infrastructures of collective intelligence, networks of computational intelligence, services providing networks, distributed agent networks, distributed cognitive sensor networks, and distributed remote control systems.

Keywords: Cognitive informatics, abstract intelligence, world-wide wisdom, WWW+, cognitive computing, cognitive computers, computational intelligence, denotational mathematics, next generation internet

REFERENCES


### About the Keynote Speaker

Dr. Yingxu Wang is professor of cognitive computing and software engineering, Director of International Institute of Cognitive Informatics and cognitive computing (IICICC), and Director of Theoretical and Empirical Software Engineering Research Center (TESERC) at the University of Calgary, Canada. He is a Fellow of WIF, a P.Eng of Canada, a Senior Member of IEEE and ACM, and a member of ISO/IEC JTC1 and the Canadian Advisory Committee (CAC) for ISO. He received a PhD in Software Engineering from the Nottingham Trent University, UK, in 1997, and a BSc in Electrical Engineering from Shanghai Tiedao University in 1983. He has industrial experience since 1972 and has been a full professor since 1994. He was a visiting professor in the Computing Laboratory at Oxford University in 1995, Dept. of Computer Science at Stanford University in 2008, and the Berkeley Initiative in Soft Computing (BISC) Lab at University of California, Berkeley in 2008, respectively. He is the founder and steering committee chair of the annual IEEE International Conference on Cognitive Informatics (ICCI). He is founding Editor-in-Chief of *International Journal of Cognitive Informatics and Natural Intelligence* (IJCINI), founding Editor-in-Chief of *International Journal of Software Science and Computational Intelligence* (IJSSCI), Associate Editors of IEEE Transactions on System, Man, and Cybernetics (Part A), Journal of Advanced Mathematics and Applications (JAMA), and International Journal of Applied Metaheuristic Computing (IJAMC), as well as Editor-in-Chief of *CRC Book Series in Software Engineering*.

Prof. Wang is the initiator of a number of cutting-edge research fields or subject areas such as cognitive informatics, abstract intelligence, cognitive computing, cognitive computers, denotational mathematics (i.e., concept algebra, system algebra, real-time process algebra, granular algebra, visual semantic algebra, and inference algebra), software science (i.e., theoretical software engineering and mathematical laws of software engineering), coordinative work organization theory, deductive semantics, LRMB, the reference model of autonomous agent systems, cognitive complexity of software, and built-in tests (BITs). He has published over 110 peer reviewed journal papers, 200+ peer reviewed full conference papers, and 14 books in cognitive informatics, software engineering, and computational intelligence. He is the recipient of dozens international awards on academic leadership, research achievements, best papers, and teaching in the last 36 years.