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Neurological Foundations of Knowledge Representation and the Memory Capacity of the Brain

It is recognized that the natural neural networks and neuro signals in the nerves systems embody the structural and functional representations of human abstraction power and consciousness. This keynote presents a Neural Circuit (NC) theory [1] and the Spick Frequency Modulation (SFM) theory [2] for explaining the cognitive mechanism of neurology. The former denotes the structural models of neurology and the space-divided semantics of neural pathways. The latter decodes the functional models of the time-divided neural signals for representing the quantification of neuroinformatics. Both NC and SFM theories provide a formal model for neuroinformation representation, transmission, processing, memorization, retrieval and reasoning [3].

The neurological foundation of knowledge science [4] not only explains the human abstraction and quantification mechanisms for knowledge representation via neurol structures, but also reveals the mechanisms of the sixth yet the most important form of human and machine learning for knowledge acquisition, which is fundamentally different from traditional aggressive learnings for pattern regression in AI. The myth about the potential capacity of human memory is quantitively revealed based on the properties of neural networks in the brain. It leads to the clarification of how the four-level cognitive entities in the brain, i.e., data, information, knowledge and intelligence are inductively aggregated from the bottom up. It becomes a common neurological foundation for enabling highly autonomous systems [5] for cognitive robots, cognitive computers and human intelligence augmentation systems in the era from information revolution to intelligent revolution.

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Biography:

Yingxu Wang is a professor of cognitive systems, brain science, software science and intelligent mathematics. He is the Founding President of International Institute of Cognitive Informatics and Cognitive Computing (ICICC). He is FIEEE, FBCS, FICICC and FWIF. He has held visiting professor positions at Univ. of Oxford (1995, 2018-22), Stanford Univ. (2008, 16), UC Berkeley (2008) and MIT (2012). He received a PhD in Computer Science from the Nottingham Trent University, UK in 1998 and has been a full professor since 1994. He is the founder and steering committee chair of IEEE Int'l Conference Series on Cognitive Informatics and Cognitive Computing (ICCI*CC) since 2002. He is founding Editor-in-Chiefs of Int'l Journal of Cognitive Informatics & Natural Intelligence (IJCINI), of Software Science & Computational Intelligence (IJSSCI), of Advanced Mathematics and Applications (JAMA) and of Mathematical & Computational Methods (IJMCM). He is an Associate Editor of IEEE Trans. on Systems, Man and Cybernetics-Systems (TSMC-Systems), Cognitive and Development Systems (TCDS) and SMCM and the IEEE Computer Society Representative to the steering committee of TCDS. He is Chair of IEEE SMCS TC-BCS on Brain-inspired Cognitive Systems and Co-Chair of IEEE CS TC-CLS on Computational Life Science. He is an IEEE FDC Steering Board Member on Symbiotic Autonomous Systems Initiative and members of the IEEE Brain and SPS Autonomous Systems Initiatives. He has published 530+ peer reviewed papers and 36 books. He has presented 58 invited keynote speeches in international conferences. He has served as honorary, general and program chairs for 38 international conferences. He has led 10+ international, European and Canadian research projects as PI. His h-index is 53 with 15,238+ citations. He is recognized by Research Gate as among the top 2.5% scholars worldwide with a 46.9 RG score and 328,000+ reading-index.