

# Is Computational Intelligence Merely a Data-Driven Technology? - Theories of Big Data Algebra and Abstract Intelligence

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**Abstract**—Is computational intelligence merely a data-driven engineering technology? How may big data inductively produce useful information, knowledge and intelligence from the bottom up?

This keynote lecture presents the theories of big data algebra and abstract intelligence. It formally describes the cognitive foundations of intelligence science and data science as well as paradigms of computational intelligence and big data engineering technologies. It explores what were missing between computational intelligence and big data engineering. It elaborates the relationship among fundamental cognitive objects in the brain known as data, information, knowledge and intelligence. It analyzes the advantages and disadvantages of data-driven technologies in computational intelligence such as deep neural networks and big data systems towards applications in information processing, knowledge acquisition and wisdom generation.

**Keywords**—Intelligence science, computational intelligence, data science, big data algebra, big data engineering, cognitive computing, neural networks, AI, cognitive robots, cognitive systems

## ABOUT THE KEYNOTE SPEAKER



**Yingxu Wang** is professor of cognitive systems, brain science, software science, and denotational mathematics. He is the Founding President of International Institute of Cognitive Informatics and Cognitive Computing (ICIC, <http://www.ucalgary.ca/icic/>). He is Fellows of BCS, ICIC and WIF, P.Eng of Canada, and Senior Members of IEEE and ACM. He has held visiting professor positions at Oxford University (1995), Stanford University (2008 | 2016), UC Berkeley (2008), and MIT (2012), respectively. He received a PhD in Computer Science from the Nottingham Trent University in 1998 and has been a full professor since 1994. He is the founder and steering committee chair of the annual IEEE International Conference 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*, *Int'l Journal of Software Science & Computational Intelligence*, and *Journal of Mathematical & Computational Methods*. He is Associate Editor of *IEEE Trans. on Cognitive and Development Systems* (TCDS) and the Computer Society Representative to the steering committee of TCDS.

Dr. Wang is the initiator of a few cutting-edge research fields such as cognitive informatics, denotational mathematics (concept algebra, process algebra, system algebra, semantic algebra, inference algebra, big data algebra, fuzzy truth algebra, fuzzy probability algebra, fuzzy semantic algebra, visual semantic algebra, and granular algebra), abstract intelligence ( $\alpha$ I), the neural circuit theory, mathematical models of the brain, cognitive computing, cognitive learning engines, cognitive knowledge base theory. His work and basic studies have been across contemporary disciplines of intelligence science, robotics, knowledge science, computer science, information science, brain science, system science, software science, data science, neuroinformatics, cognitive linguistics, computational intelligence, and engineering systems. He has published 480+ peer reviewed papers and 36 books in aforementioned transdisciplinary fields. He has presented 39 invited keynote speeches in international conferences. He has served as general chairs or program chairs for more than 23 international conferences. He has led 10+ international, European, and Canadian research projects as PI by intensive collaborations with renowned peers and leading industrial partners. He is the recipient of dozens international awards on academic leadership, outstanding contributions, best papers and teaching in the last three decades. He is a top 2.5% scholar worldwide and top 10 at



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