Cognitive Informatics and Computational Intelligence:
From Information Revolution to Intelligence Revolution

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ABSTRACT

Cognitive Informatics (CI) is a contemporary multidisciplinary field spanning across computer science, information science, cognitive science, brain science, intelligence science, knowledge science, cognitive linguistics, and cognitive philosophy. Cognitive Computing (CC) is a novel paradigm of intelligent computing methodologies and systems based on CI that implements computational intelligence by autonomous inferences and perceptions mimicking the mechanisms of the brain. This paper reports a set of position statements presented in the plenary panel of IEEE ICC’14 on Cognitive Informatics and Cognitive Computing. The summary is contributed by invited panelists who are part of the world’s renowned researchers and scholars in the transdisciplinary field of cognitive informatics and cognitive computing.

Keywords: Abstract Intelligence, Artificial Intelligence, Cognitive Computers, Cognitive Computing, Cognitive Informatics, Cognitive Robots, Cognitive Systems, Computational Intelligence, Denotational Mathematics, eBrain

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1. INTRODUCTION


The latest advances in CI and CC, as well as denotational mathematics, enable a systematic solution for the future generation of intelligent computers known as cognitive computers (CogCs) that think, perceive, inference, and learn [Wang, 2006, 2009b, 2010a, 2010b, 2012b, 2012h, 2013, 2014, 2015]. A CogC is an intelligent computer for knowledge processing as that of a conventional von Neumann computer for data processing. CogCs are designed to embody machinable intelligence such as computational inferences, causal analyses, knowledge manipulations, machine learning, and autonomous problem solving. Recent studies in cognitive computing reveal that the computing power in computational intelligence can be classified at four levels: data, information, knowledge, and intelligence from the bottom up. Traditional von Neumann computers are designed for imperative data and information processing by stored-program-controlled mechanisms. However, the increasing demand for advanced computing technologies for knowledge and intelligence processing in the high-tech industry and everyday lives require novel cognitive computers for providing autonomous computing power for various cognitive systems mimicking the natural intelligence of the brain.

This paper is a summary of the position statements of invited panellists presented in the Plenary Panel on Cognitive Informatics: From Information Revolution to Intelligence Revolution in IEEE ICCI*CC 2014 held in London, UK during Aug. 18-20, 2014. It is noteworthy that the individual statements and opinions included in this paper may not necessarily be shared by all panellists.

2. THE THEORETICAL FRAMEWORK OF COGNITIVE INFORMATICS AND COGNITIVE COMPUTING

The theoretical framework of intelligence science and brain science can be described as shown in Figure 1 where the brain is explained by a hierarchical reductive structure at the neurological, physiological, cognitive, and logical levels. The synergy of multidisciplinary studies at all levels forms the theory for explaining the brain supported by denotational mathematics. In other words, the brain may be inductively synthesized through the four levels from the bottom up and be deductively analyzed through the four levels from the top done. The fundamental theories underpinning the intelligence science framework are abstract intelligence and denotational mathematics.
A Lexical Knowledge Representation Model for Natural Language Understanding
[www.igi-global.com/article/lexical-knowledge-representation-model-natural/37487?camid=4v1a](www.igi-global.com/article/lexical-knowledge-representation-model-natural/37487?camid=4v1a)

Autism Diagnostics by 3D Shape Analysis of the Corpus Callosum
[www.igi-global.com/chapter/autism-diagnostics-shape-analysis-corpus/62236?camid=4v1a](www.igi-global.com/chapter/autism-diagnostics-shape-analysis-corpus/62236?camid=4v1a)