Perspectives on the Field of Cognitive Informatics and its Future Development

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ABSTRACT

The contemporary wonder of sciences and engineering has recently refocused on the beginning point of: how the brain processes internal and external information autonomously and cognitively rather than imperatively like conventional computers. Cognitive Informatics (CI) is a transdisciplinary enquiry of computer science, information sciences, cognitive science, and intelligence science that investigates the internal information processing mechanisms and processes of the brain and natural intelligence, as well as their engineering applications in cognitive computing. This paper reports a set of eight position statements presented in the plenary panel of IEEE ICCI'10 on Cognitive Informatics and Its Future Development contributed from invited panelists who are part of the world's renowned researchers and scholars in the field of cognitive informatics and cognitive computing.

1. INTRODUCTION

Cognitive informatics is a transdisciplinary enquiry of computer science, information science, cognitive science, and intelligence science, which investigates into the internal information process-

ing mechanisms and processes of the brain and natural intelligence, as well as their engineering applications in cognitive computing (Wang, 2002a, 2003, 2006, 2007c, 2009c, 2009d; Wang & Kinsner, 2006; Wang & Wang, 2006; Wang & Chiew, 2010; Wang, Kinsner, & Zhang, 2009; Wang, Johnston, & Smith, 2002; Wang, Wang, Patel, & Patel, 2006; Wang, Zhang, Latombe, & Kinsner, 2008, Wang et al., 2009; Baciu et al., 2009; Chan et al., 2004; Kinsner et al., 2005; Patel et al., 2003; Yao et al., 2006; Zhang et al., 2007; Sun et al., 2010). Cognitive informatics is a cutting-edge and multidisciplinary research area that tackles the fundamental problems shared by computational intelligence, modern informatics, computer science, AI, cybernetics, cognitive science, neuropsychology, medical science, philosophy, formal linguistics, and life science (Wang, 2002a, 2003, 2007c, 2009c, 2010b, 2010d). The development and the cross fertilization among the aforementioned science and engineering disciplines have led to a whole range of extremely interesting new research areas known as Cognitive informatics, which investigates the internal information processing mechanisms and processes of the natural intelligence – human brains and minds – and their engineering applications in computational intelligence. Cognitive informatics studies the natural intelligence and internal information processing mechanisms of the brain, as well as processes involved in perception and cognition. Cognitive informatics forges links between a number of natural science and life science disciplines with informatics and computing science.

Definition 1. *Cognitive informatics* (CI) is a transdisciplinary enquiry of computer science, information science, cognitive science, and intelligence science that investigates into the internal information processing mechanisms and processes of the brain and natural intelligence, as well as their engineering applications in cognitive computing.

The IEEE series of International Conferences on Cognitive Informatics (ICCI) has been established since 2002 (Wang, 2002a). The inaugural ICCI event in 2002 was held at University of Calgary, Canada (ICCI'02) (Wang, Johnston, & Smith, 2002), followed by the events in London, UK (ICCI'03) (Patel et al., 2003); Victoria, Canada (ICCI'04) (Chan et al., 2004); Irvine, USA (ICCI'05) (Kinsner et al., 2005); Beijing, China (ICCI'06) (Yao et al., 2006); Lake Tahoe, USA (ICCI'07) (Zhang et al., 2007); Stanford University, USA (ICCI'08) (Wang, Zhang, Latombe, & Kinsner, 2008); Hong Kong (ICCI'09) (Baciu et al., 2009); and Tsinghua University, Beijing (ICCI'10) (Sun et al., 2010). Since its inception, ICCI has been growing steadily in its size, scope, and depth. It attracts worldwide researchers from academia, government agencies, and industry practitioners. The conference series provides a main forum for the exchange and cross-fertilization of ideas in the new research field of CI toward revealing the cognitive mechanisms and processes of human information processing and the approaches to mimic them in cognitive computing.

The latest advances and engineering applications of CI have led to the emergence of *cognitive computing* (CC) and the development of *cognitive computers* that think, perceive, learn, and reason (Wang, 2006, 2009e, 2010a, 2010b; Wang et al., 2009; Wang, Kinsner, & Zhang, 2009). CI has also fundamentally contributed to autonomous agent systems (Wang, 2009a) and cognitive robots (Wang, 2010b). A wide range of applications of CI has been identified such as in the development of cognitive computers, cognitive robots, cognitive agent systems, cognitive search engines, cognitive learning systems, and artificial brains. The work in CI may also lead to a fundamental solution to computational linguistics, Computing with Natural Language (CNL), and Computing with Words (CWW) (Zedeh, 1975, 1999).

This paper is a summary of the position statements of panellists presented in the *Plenary Panel on Cognitive Informatics and Its Future Development* in IEEE ICCI 2010 at Tsinghua

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