How to Make “Web Intelligence (WI) meets Brain Informatics (BI)” Successfully?

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1 Introduction

Recently, we gave a new perspective of Web Intelligence (WI) research from the viewpoint of Brain Informatics (BI), a new interdisciplinary field that studies the mechanisms of human information processing from both the macro and micro viewpoints by combining experimental cognitive neuroscience with advanced information technology [18]. We argue that new instruments like fMRI and information technology will revolutionize both Web intelligence and brain science. This revolution will be bi-directional: new understanding of human intelligence through brain science will yield a new generation of Web intelligence research and development (i.e. BI for WI), and Web intelligence portal techniques will provide a powerful new platform for brain science (i.e. WI for BI). The ultimate goal is to establish the foundation of WI towards human-level Web intelligence [19]. In this panel, we investigate how to make such a study successfully.

2 BI for WI

Although intelligence related topics have been investigated separately in several existing disciplines, such as AI, Cognitive Science and Neuroscience, there is a lack of unified framework so that intelligence can be studied systematically for developing human-level Web intelligence. We argue that human-level Web intelligence may be achieved by “WI meets BI” research.

The capabilities of human intelligence can be broadly divided into two main aspects: perception and thinking. So far, the main disciplines with respect to human intelligence are cognitive science that mainly focuses on studying mind and behavior based cognitive models of intelligence, as well as neuroscience that mainly focuses on studying brain and biological models of intelligence. In cognitive neuroscience, although many advanced results with respect to “perception oriented” study have been obtained, only a few of preliminary, separated studies with respect to “thinking oriented” have been reported [2]. Study of human information processing by “WI meets BI” should be “thinking oriented” first.

BI attempts to understand human intelligence in depth, towards a holistic view at a long-term, global vision to understand the principles, models and mechanisms of human multi-perception, language, memory, reasoning, planning, decision making, problem solving, learning, discovery and creativity.

By “BI for WI” research, one of the fundamental goals is to build WI foundation as well as discover new WI cognitive models and computational models, so that Wisdom Web based intelligent systems can be developed by integrating major capabilities of human-level intelligence [12, 14].

3 WI for BI

WI technologies provide an agent based multi-database mining grid architecture on the Wisdom Web for building a brain-informatics portal [15, 17, 20]. Building a brain informatics portal is, in fact, to develop a data mining grid centric multi-layer grid system on the Wisdom Web for multi-aspect data analysis [3, 15, 17]. We have been developing a full process from designing fMRI/EEG experiments based on WI needs to discovering new cognitive WI models. Such a full process means a systematic approach for measuring, collecting, modeling, transforming, managing, and mining multiple human brain data obtained from various cognitive experiments by using fMRI and EEG [16, 17].

The future of BI will be affected by the ability to do large-scale mining of fMRI and EEG brain activations. The key issues are how to obtain various data related to all major aspects and capabilities of human information processing mechanism by systematic fMRI/EEG experiments, how to build a brain database for systematic investigation and understanding of human brain, as well as how to analyze such data from multi-aspect and multi-level for discovering new models of human information processing.

Although several human-expert centric tools such as
SPM (MEDx) have been developed for cleaning, normalizing and visualizing the fMRI images, researchers have also been studying how the fMRI images can be automatically analyzed and understood by using data mining, reasoning, and statistical learning techniques [8, 9, 10, 16]. We are concerned with how to extract significant features from multiple brain data measured by using fMRI and EEG in preparation for multi-aspect data mining that uses various data mining techniques for analyzing multiple data sources.

The Wisdom Web [7, 13] and Grid computing [1] have provided the ideal infrastructures, platforms, and technologies for building such a Brain Informatics portal to support cognitive/brain scientists in multi-aspect analysis in multiple, distributed, large-scale data sources. We need to study experimental cognitive neuroscience, data mining, intelligent agents, data and knowledge grids, granular computing, the semantic Web and wisdom Web in a unified way [6].

4 Concluding Remarks

As two related emerging fields of research, Web Intelligence (WI) and Brain Informatics (BI) mutually support each other. Their synergy will yield profound advances in the analysis and understanding of data, knowledge, intelligence and wisdom, as well as their relationships, organization and creation process. When WI meets BI, it is possible to have a unified and holistic framework for the study of machine intelligence, human intelligence, and social intelligence.

BI can be regarded brain sciences in IT age, which represents a potentially revolutionary shift in the way that research is undertaken. It emphasizes on a systematic approach for investigating human information processing mechanisms, including measuring, collecting, modeling, transforming, managing, and mining multiple human brain data obtained from various cognitive experiments by using fMRI and EEG. Multi-aspect analysis in multiple human brain data sources is an important methodology in BI. The proposed methodology attempts to change the perspective of cognitive/brain scientists from a single type of experimental data analysis towards a holistic view at a long-term, global field of vision to understand the principle, models and mechanisms of human information processing. New generations of WI research and development need to understand multi-nature of intelligence in depth. The recently designed instrumentation (fMRI etc.) and advanced IT are causing an impending revolution in both WI and BI, making it possible for us to understand and develop human-level Web Intelligence.

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