

## Editorial

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# 20 years of Web Intelligence: Call for a new era of AI in the Connected World

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### 1. Introduction

Web Intelligence (WI) is a dynamic field with flourishing over the past 20 years, running with an eminent journal of Web Intelligence (since 2003) and a major conference of the Web Intelligence and Intelligence Agent Technology (WI-IAT since 2002). WI has always been closely entwined with, and contributed to, all the latest developments in Artificial Intelligence (AI), especially for the future of the highly connected world, which makes use of the power of human ingenuity and man-made networks to create a better world. We continually promote the key theme:

*WI = AI in the Connected World*

where the field explores how advanced intelligence theory and practice impact the Web of People, Web of Trust, Web of Things, Web of Data, Web of Agents, and Web in Industry, Society, Health and Smart Living, and the Web of Everything.

Timely, the development of WI can be divided into three significant stages of WI 1.0 (Wisdom Web [11], 2001–2009), WI 2.0 (Wisdom Web of Thing [12], 2010–2017), and WI 3.0 (Wisdom Web of Everything [4], since 2018). While WI further evolves in the 3.0 era, many new ideas, methodologies, and techniques will continue to emerge with the contributions of all the researchers in the field. Therefore, it is the time to launch an open call for:

**The progress of WI** through studying the existing works on WI and its relevant fields to enrich the concept and definition;

**The practice of WI** through studying the applications and services of WI to extend WI-based techniques and/or methodologies;

**The challenge of WI** through studying the motivations on AI in the connected world towards the future intelligence society;

**The position of WI** through studying the matters in general interest of the broad WI community and different global centers;

**The vision of WI** through studying the future of WI-based symbiotic ecosystems and the impact of WI on technology and future.

Looking back, WI has brought enormous progresses of techniques and methods along with the development of the time, as a distinguishing direction of AI. However, many ideas are still in their infancy, such as the nature of next-generation Web, the nature of intelligence, and their integrated practices. Looking forward, WI is encouraged to build an unified ecosystem through merging all technologies and methodologies into one to create a better living condition (such as health, safety, morality and education) for human beings. To meet the requirements of the future intelligent society, WI 3.0 is devoted to acceleratingly bring the development of Artificial Intelligence (such as, Generative Content, Foundation Models, Machine Learning, and Natural Language Processing), Brain Intelligence (such as, Brain Informatics, Brain Big Data Science, and Brain-inspired Computing), and Connectedness (such as, Web of Everything, Social-Cyber-Physical Space, Digital twins, Human-machine Symbiosis, and Information and Communication Technology) together, that is the ABC of WI 3.0.

## 2. Embrace from a new start

Facing the new era, we selected the following works that have been published and will be published in the newest and coming issues from the Web Intelligence journal as a start point to promote more global collaborations of WI under different scenarios.

- The first paper entitled “Web Intelligence: In Search of a Better Connected World” by Prof. Zhong, Prof. Liu, and Prof. Yao [13] gives a brief survey of WI in search of a better connected world. As the founders of the WI field, the authors personally summarized the journal of WI from the “When-What-Where” viewpoints. They recall the context and a timely story from the start point of the WI concept in 2000; introduce the origin of WI driven by the interdisciplinary connections of World-Wide-Web, Artificial Intelligence, and Information Technology; and give a broad directions in the coming WI era. The experiences shared by them will inspire further research and explorations of WI, as well encouraging future collaborations of researchers from different backgrounds.
- The second paper entitled “Thinking Space Generation using Context-enhanced Knowledge Fusion for Systematic Brain Computing” by Dr. Kuai and Prof. Tao, et al. focuses on the studies in cross-cutting areas between WI and other domains, specially on brain informatics [5]. Accordingly, the authors propose a context-enhanced knowledge fusion method to build a thinking space, in response to the complexity of brain computing. The thinking space inspires the systematic fusion computing operations during a brain investigation process from the four dimensions of function, experiment, data, and analysis. A core task announced by the authors is that developing advanced WI technology to decode the nature of human intelligence, at the same time, enhancing the WI technology driven by the decoded human intelligence mechanisms.
- The third paper entitled “A Bias Study and an Unbiased Deep Neural Network for Recommender Systems” by Dr. He and Dr. Zhao, et al. conducts a comprehensive study on biases from a unified perspective [1]. The authors focus on the ranking problems introduced by different types of biases from the user feedback in recommender systems, specifically sharing their experiences on feeds recommendation. Several unbiased models have been developed to decrease the effects of biases and increase the ranking performance, comparing with other methods. The effectiveness of the method has been demonstrated by several extensive offline experiments and online A/B testing in a real-world recommender system.
- The fourth paper entitled “Exploring ChatGPT for Next-generation Information Retrieval: Opportunities and Challenges” by Dr. Huang and Prof. Huang discusses the influence of ChatGPT on information retrieval tasks [2]. As we all known, information retrieval is one of the most important practical AI technologies on the growth of Web and Internet. Meanwhile, the current AI generated content (AIGC) technology, represented by ChatGPT, has rode the new waves of innovations and creations. Challenging the traditional paradigms, the integration of information retrieval and AIGC brings the enormous expectation and opportunities in the next-generation Web. The new direction will play an important role in the coming decade and beyond.

- The fifth paper entitled “Analyzing the Role of Big Data and its Effects on the Retail Industry” by Dr. Kames, et al. evaluates the function of big data and its consequences on the retail business [3]. In particular, several main factors of big data technologies are investigated by using a quantitative method, such as data sources, data analysis, data storage, data security and privacy, real-time processing, and messaging system. Such studies in the retail industry are the important field to the new wave of industrial innovation.
- The sixth paper entitled “Truthful Mechanisms to Maximize the Social Welfare in Real-time Ride-sharing” by Dr. Shi, et al. focuses on the order pairing issues in the real-time ride-sharing scenarios [8]. Considering the characteristic of trust, they introduce two order pairing mechanisms to maximize the social welfare among platform, drivers, and users. Such related studies are beneficial to addressing the issues like traffic congestion and air pollution, which are the important points to promote the achievement of the sustainable development goals (SDGs).
- The seventh paper entitled “Survey on Data Replication in Cloud Systems” by Dr. Rambabu, et al. surveys the data replication issues in a distribution environment [7]. Facing the three challenges from the moment, form and location of data replication, they review 65 articles published on related topics in the cloud. The current work inspires researchers to promote the future studies and helps us break limitations on data replication, such as the pattern mining issues in the cloud.
- The eighth paper entitled “Deep Hybrid Model for Attack Detection in IoT-fog Architecture with Improved Feature Set and Optimal Training” by Dr. Pokale, et al. focuses on the security risk issues from the end IoT (Internet of Thing) devices [6]. For this, they propose a deep hybrid detection model for attack detection in the IoT-Fog architecture, corresponding to the three stages of data preprocessing, feature engineering, and classification models, respectively. The methods and models like this can provide a wide range of services and meet the requirements for security-enhanced end applications.

It is notable that it is extremely difficult to split a significant boundary to decouple the works mentioned above. The intersection phenomenon is also universal from other domains, which will become increasingly apparent, and its demands will become stronger in the coming era [9,10]. For example, the first paper gives a summarization related to all six tracks; the second paper can be identified in Web of Data, Web of Agents, and Web in Industry, Society, Health and Smart Living, and the Web of Everything; the third paper can be identified in Web of People, Web of Trust, and Web of Data; the fourth paper can be identified in Web of People, Web of Data, and Web of Agents; the fifth paper can be identified in Web of Data and the Web in industry; the sixth paper can be identified in Web of Trust, Web of People, and the Web in society and smart living; the seventh paper can be identified in Web of Data; and the eighth paper can be identified in Web of Things. Hence, we call for more communications of researchers within the WI field, and global interactions with researchers from different backgrounds for collaboration, co-intelligence and co-creation. Let us embrace the future intelligence society within a better interconnected space.

### **Declaration of competing interest**

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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