AI Science and Engineering

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I am thrilled to present the first issue of *IEEE Intelligent Systems (IS)* in 2022 to you, which is also my first issue after taking the helm as Editor in Chief. This issue launches four new columns of *IS* this year: Editor's Perspective, AI Expert, AI Future, and AI Focus. AI Expert is edited by Fei-Yue Wang, and AI Future is edited by Michael Wooldridge.

These columns will feature debate on broad-reaching AI topics and trends, typically by invitations and from senior AI leaders. We will continue the selective departments, which highlight focused AI areas and their advances. These columns, together with the existing departments, will diversify *IS* and aim to enhance its mission in promoting AI research and best practice, and serving better and smarter policies and outcomes to the economy and society.

The Editor's Perspective will feature the *IS* editor's opinions. In this first article, "AI Science and Engineering: A New Field," I discuss the perspective and opportunity of building AI science and engineering (AISE) as a new scientific discipline. The article outlines the body of knowledge in AISE, the AI paradigmatic shift and topic transformation in AI science, and the structure and development for AI engineering, to enable new-generation AI profession and AI education.

The first edition of AI Expert is "Parallel Intelligence in Metaverses: Welcome to Hanoi!" The Editor, Fei-Yue Wang, discusses his view on connecting cyber-physical-social systems to metaverse, and human, artificial, natural, organizational intelligence (Hanoi), which is further connected to the Tower of Hanoi problems in AI, game, and robotics.

In AI Focus, "Trustworthy Machine Learning," by Bhavani Thuraisingham presents an architecture to support scalable trustworthy machine learning (ML) with capabilities of ensuring security, privacy, integrity, availability, fairness, and antidiscrimination. She argues that ML techniques, in particular, in the cloud environment, must be secure, privacy-preserving, fair, unbiased, and accurate.

In AI Future, my opinion on "A New Age of AI: Features and Futures" kicks off this exciting column. By dividing the 70 years of AI into the two ages before and after the year 2000 and reviewing their topic differences over the history of IJCAI and AAAI publications, I summarize the major paradigm shift of AI thinking and X-AI ages (with X-intelligences and X-complexities). I then propose several AI formulas in terms of AI systems, goals and tasks, functions, and processes. I also discuss the AI futures in terms of encouraging prospective areas to shrink gaps between AI, human intelligence, natural intelligence, and social intelligence. AI Future facilitates a fundamental topic for our AI communities, Web 3.0, 5G, Industry 4.0, and the digital economy

As usual, this issue includes a great lineup of feature articles covering various themes and research areas in AI. The first two articles, "Improved Ensemble Classification for Evolving Data Streams" and "Neural Graph for Personalized Tag Recommendation," are brought forward from the special issue on Learning Complex Couplings and Interactions, with the majority of its articles published in the Jan./Feb. 2021 issue. Coupling and interaction learning is critical in understanding and managing complex systems, behaviors, and data. These articles discuss coupling and interaction learning in classifying data streams and recommending personalized tags.

Further, the other five feature articles address respective challenges in correcting precipitation biases ("Robust Precipitation Bias Correction Through An Ordinal Distribution Autoencoder"), reasoning in knowledge graphs ("Hierarchical Multi-Hop Reasoning on Knowledge Graphs"), localizing mobile robots ("Mobile Robot 6-D Localization Using 3-D Gaussian Mixture Maps in GPS-Denied Environments"), enabling preferred recommendation ("Exploring Customer Price Preference and Product Profit Role in Recommender Systems"), and predicting news ("Entity Matters in News: An Association Network-Enhanced Method for News Reprint Prediction").

This issue has one department, "Understanding Mechanism Design—Part 3 of 3: Mechanism Design in the Real World: The VCG Mechanism." The authors

continue their discussion on how the Vickrey–Clarke–Groves (VCG) mechanism may be used to solve real-world problems.

Lastly, this year *IS* also launches the news department, AI Community, which will highlight significant AI achievements, news, and activities in AI science and engineering and in the academic and business communities. The article "AI in the 2022 Beijing Olympic Winter Games" highlights several impressive AI techniques and applications in this recent Olympic games, such as the "robot chef" and AI-enabled training leading to a gold medalist in the women's freestyle skiing aerials.

Before concluding this message, I would like to invite you and your colleagues to consider submitting nominations to the 2022 AI's 10 to Watch, a prestigious AI award for next-generation AI stars, or consider submitting a proposal for a timely special issue to be published in *IEEE Intelligent Systems*.

I hope you enjoy this first issue of 2022.

Longbing Cao, Editor-in-Chief