

Non-IID Federated Learning

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This issue features the technical theme on “Non-IID Federated Learning,” an important topic in addressing non-IIDness (independent and identically distributed) and other progress in distributed and federated learning.

The columns include on Editor’s Perspective, AI Expert, and AI Focus feature cover AI in COVID-19; AI for free, fair, and responsible sciences; and deep reinforcement learning for quantitative trading. Lastly, in addition to the contribution to a technical department on Affective Computing and Sentiment Analysis, the news department AI Community highlights the recent progress in AI chips.

COLUMN AND DEPARTMENT ARTICLES

The Editor’s Perspective column, “AI in Combating the COVID-19 Pandemic,” reviews the global AI research on understanding and managing the COVID-19 pandemic. Of over 300,000 publications on COVID-19 from 172 countries and regions, only about 36,000 are related to AI. The review summarizes the COVID-19 challenges facing AI, the progress and performance made by AI communities in the fight against COVID-19, and gaps and opportunities for AI communities to be prepared for a better battle of future epidemics, pandemics, extreme events, and disasters.

AI Expert features the contribution “The DAO to DeSci: AI for Free, Fair, Responsibility, and Sensitive Sciences” from the editor Fei-Yue Wang and his coauthors. They argue the transition from decentralized autonomous organizations based decentralized science to the science of team science for free, fair, and responsible sensitive sciences.

AI Focus presents the article “Deep Reinforcement Learning for Quantitative Trading: Challenges and Opportunities” by Bo An *et al.* Reinforcement learning, in particular, deep reinforcement learning, has garnered significant interest in areas including robotics and video games for complex sequential decision-making. Bo An *et al.* discuss their opinion on the challenges and prospects of applying reinforcement learning for quantitative trading.

The department Affective Computing and Sentiment Analysis presents the article “OntoSentNet 2: Enhancing Reasoning within Sentiment Analysis” by the editor Erik Cambria with his coauthors Ivan Donadello and Mauro Dragoni, extending their previous research on this specific design.

Lastly, in the news department AI Community, Guan-song Pang briefs readers on the recent progress in “The AI Chip Race.” He discusses the nature and significance of AI chips and progress made by giant tech companies and startups for constrained (e.g., GPU and TPU) and unconstrained (e.g., RISE-V-based processors) AI processors. He highlights the recent progress in Nvidia’s H100 GPUs building on existing GPU, Google’s TPU v4 on application-specific integrated circuits (ASICs), Intel’s Agilex M-Series field-programmable gate arrays), and Baidu’s Kunlun AI Chips, and Huawei’s Ascend 910 and Ascend 310 AI Chips. His brief also covers the associated ecosystems and relevant challenges.

NON-IID FEDERATED LEARNING AND FEATURE ARTICLES

This March/April issue also presents seven feature articles focused on Non-IID Federated Learning. Federated learning has emerged as a recent interest in machine learning to handle distributed learning tasks with heterogeneous local and global resources. An intricate nature and challenge in federated learning is to handle the *non-IIDness* of distributed and federated objects, tasks, and contexts. Non-IIDness is composed of explicit-to-implicit, local-to-global, and intra- and inter-entity couplings and interactions within and between local and global objects, resources, tasks, models, and evaluation objectives; and hierarchical heterogeneities such as distinct distributions and structures of data and tasks in local and global entities and contexts. In handling the federation of local and global data, models, and objectives, non-IID federated learning has to represent, model, and evaluate diversified non-IIDnesses in the distributed or cloud environments.

Three articles are selected on federated learning: 1) “Dynamic Sampling and Selective Masking for Communication-Efficient Federated Learning,” which controls the fraction of selected client models dynamically and selects parameters with top-k largest values of difference for

WELCOME NEW EDITORS

I am thrilled to introduce several new editorial board members to *IS*.

First, I'd like to thank Prof David Skillicorn from Queen's University, Canada, and Prof Sean Luke from George Mason University, USA for their editorial services to *IS*. Both retired from the *IS* editorial board after several years of service on the editorial board.

I am pleased to welcome **Prof Zhongfei (Mark) Zhang** from Binghamton University, State University of New York, USA and Dr Wei Liu, from Tencent, China, to join the editorial board as Associate Editors.

Zhang is a professor in the Computer Science Department, at Binghamton University, State University of New York (SUNY), USA. His research interests include machine learning, data mining, computer vision, and pattern recognition, and he has a specialty in multimedia/multimodal data understanding and mining. He has published over 200 papers and the very first monograph on relational data clustering. He serves as an editorial board member for several international journals, and has received many awards. He is an IEEE Fellow.

Liu is a Distinguished Scientist of Tencent and the Director of Multimedia AI Ads at Tencent's Data Platform. His research interests include fundamental research and technology development in deep learning, machine learning, computer vision, pattern recognition, information retrieval, and big data. He has published 260 peer-reviewed technical papers and 13 US patents. He serves on the editorial boards of *IEEE TPAMI*, *TNNLS*, and *TMLR*, and he is a Fellow of the IAPR, AAIA, IMA, RSA, and BCS, and an Elected Member of the ISI.

My welcome also goes to **Dr Can Wang** from Griffith University, Australia, who will lead a new Department on "AI and Behaviors" with her speciality in behavior informatics and analytics. Behavioral AI emerges as a new important area of AI to represent, discover, and manage behavioral intelligence of living systems and humans by leveraging methodologies and tools in behavioral sciences, behavioral economics, and finance. Behaviors are ubiquitous but hidden in existing information, process, data and governance management systems. I envisage this department will inspire attention and research on topics including behavior informatics, behavior computing, behavior modeling, behavior analytics, interaction modeling and learning, action recognition, event management, and next-best action and communication recommendation, as well as prediction for deep behavior insights and actionable behavior intelligence.

federated updating to improve communication efficiency by dynamic sampling and top-k selective masking; 2) "Robust Federated Learning with Noisy Labels," which introduces a federated learning scheme to allow the server to cooperate with local models by interchanging class-wise centroids for handling noisy labels; and 3) "Heterogeneous Federated Meta-Learning with Mutually Constrained Propagation," where a meta federated method with mutually constrained propagation addresses model heterogeneity for guaranteeing privacy and security.

Four additional articles feature various developments in machine learning and AI. The study in "A New SVDD Approach to Reliable and eXplainable AI" redesigns support vector data description (SVDD) to detect safety regions in a cyber-physical system with zero statistical error and provides rule-based knowledge extraction to make SVDD understandable. In "Robust Maximum Mixture Correntropy Criterion Based One-Class Classification Algorithm," the authors apply the maximum mixture correntropy criterion with multiple kernels to shallow and hierarchical one-class extreme learning for improving the learning robustness and

speed. In "Recognition Model of Sideslip of Surrounding Vehicles Based on Perception Information of Driverless Vehicles," a logical rule-based sideslip recognition model using the perception information of driverless vehicles assesses the sideslip driving status of the surrounding vehicles. Lastly, the article "A Type-2 Fuzzy Time Series Model for Pattern Similarity Analysis: A Case Study on Air Quality Forecasting" introduces a type-2 fuzzy intelligent system for air quality forecasting, where a dynamic time warping algorithm estimates the pattern similarity in long-range time series.

2022 AI'S 10 TO WATCH

In the previous issue, we launched the 2022 AI's 10 to Watch. Before concluding this editorial, I would like to invite you and your colleagues to consider nominees or self nominations for this prestigious award to recognize and honor the next generation of rising stars in our broad AI community.

I also welcome your special issue proposals to *IS*. I hope you enjoy the issue.