IEEE Transactions on Cognitive and Developmental Systems

CALL FOR PAPERS

for Special Issue on

Advancing Machine Intelligence with Neuromorphic Computing

IEEE TRANSACTIONS ON COGNITIVE AND DEVELOPMENTAL SYSTEMS

AIM AND SCOPE: Neuromorphic computing, which can also be called "Brain-inspired computing", is a new theme of computing methodology that uses neural spikes to represent the output of each neuron and communicate between the computing blocks. This technology has recently attracted great attention for achieving brain-like computing efficiency and human cognitive intelligence. As generally trained by spike-based learning schemes which mimic the biological neural codes, dynamics, and circuitry, and built on non-von Neumann computing architecture, neuromorphic computing systems have shown very high energy efficiency and emerged as an exciting interdisciplinary field with great potential for building a more powerful computing paradigm of machine intelligence in the next generation. In recent years, scientists and engineers have made great breakthroughs in the field of neuromorphic computing, including neuromorphic chips (e.g. TrueNorth, Loihi, and Tianjic), event-based cameras (e.g. DVS, DAVIS), spiking neural networks (SNNs), which have been applied in a wide spectrum of different sub-fields, i.e., computer vision, machine learning, intelligent robots, and unmanned systems. However, there are still many limitations and challenges in this field, such as requiring more powerful and efficient training algorithms that can absorb the research findings in neuroscience, and how to design neuromorphic-oriented computing architecture to advance machine intelligence. In addition, more real-world applications that can demonstrate the advantages of neuromorphic computing are urgently expected. Thus, there is an urgent need to gather ideas from researchers and communities to accelerate the development of this field.

This motivates the demand for a special issue on "Advancing Machine Intelligence with Neuromorphic Computing" to bring together the research advances in neuromorphic sensors, models, and learning algorithms (encoding, decoding, and training algorithms), as well as neuromorphic computing systems and their new applications. It is expected that the answers to these questions can be investigated in this special issue: 1) how can theories in computational neuroscience exert a positive influence on building more powerful neuromorphic models and training algorithms, 2) what are the present advances and future trends of techniques used in this field, 3) which techniques play an essential role in developing intelligent systems for real-world applications? It is believed that these questions are pretty interesting, and helpful for the entire community to explore more insightful opportunities and challenges in this field. This special issue aims to bring together research on neuromorphic computing but not limited to the topics involving the theory and algorithm, evaluation framework, computing architecture, and emerging applications, etc.

TOPICS: This special issue will provide a platform for researchers across all related fields to exchange ideas for pushing forward the boundaries of neuromorphic computing, and targeting the next generation of machine intelligence. All the related original researches that contribute to neuromorphic computing along with their applications are particularly welcome and encouraged. Topics relevant to this special issue include, but are not limited to:

- Spiking neural networks
- Brain-like/inspired models and algorithms
- Spiking information coding, decoding and learning
- Neuromorphic computing architecture
- Neuromorphic sensors and event-based vision
- Theories/models bridging neuromorphic computing and computational/cognitive neuroscience
- Spiking neural network for the robotics
- New applications of spike-based machine intelligence

SUBMISSION GUIDELINES: Manuscripts should be prepared according to the guidelines in "Submission Guidelines" of the IEEE Transactions on Cognitive and Developmental Systems in https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=7274989. Submissions should be made through the journal submission website: https://mc.manuscriptcentral.com/tcds-ieee, by selecting the Manuscript Type of "Advancing

Machine Intelligence with Neuromorphic Computing" and clearly marking "Advancing Machine Intelligence with Neuromorphic Computing" in the comments to the Editor-in-Chief. Submitted papers will be reviewed by domain experts. Submission of a manuscript implies that it is the authors' original unpublished work and is not being submitted for possible publication elsewhere.

GUEST EDITORS:

Guoqi Li, Professor, Institute of Automation, Chinese Academy of Sciences, China, guoqi.li@ia.ac.cn

Emre Neftci, Associate Professor, University of California, Irvine, USA, e.neftci@fz-juelich.de

Rong Xiao, Assistant Professor, Sichuan University, China, Email: rxiao@scu.edu.cn

Pablo Lanillos, Assistant Professor, Radboud University, The Nederlands, p.lanillos@donders.ru.nl

Kaushik Roy, Professor, Purdue University, USA, Kaushik.Roy@utdallas.edu

TIMETABLE:

The timetable to manage submission should refer to the following points:

Deadline for submissions: January 31, 2023

Final decision: June 30, 2023

Expected publication date: September 30, 2023