Call for Papers
IEEE Signal Processing Society
IEEE SIGNAL PROCESSING MAGAZINE

Special Issue on Learning Algorithms and Signal Processing for Brain-Inspired Computing

Neural networks have become the de-facto standard tool to carry out supervised, unsupervised, and reinforcement learning, reaching super-human capabilities in a variety of pattern recognition and strategic tasks. Their emergence has built upon the unprecedented availability of computing power in data centers and cloud computing platforms. In contrast to artificial neural networks, the human brain is capable of performing more general and complex tasks at a minute fraction of the power required by state-of-the-art supercomputers. Insights from neuroscience reveal that the space-time computing capabilities of spiking neurons are among the main reasons for the energy efficiency of the brain. In particular, spiking neurons leverage sparse time-based information encoding, event-triggered plasticity, and low power inter-neuron signaling. As a result, brain-inspired neuromorphic signal processing and learning algorithms and hardware platforms have recently emerged as a low-power alternative to energy-hungry artificial neural networks. These systems implement networks of spiking neurons, or Spiking Neural Networks (SNNs), which consist of asynchronous distributed architectures that process sparse binary time series by means of local spike-driven computations, local or global feedback, and online learning. From a signal processing perspective, the specific features and constraints of neuromorphic computing platforms open interesting new problems concerning regression, classification, control, and learning.

The scope of the emerging field of brain-inspired signal processing, encompassing neuroscience, hardware design, and machine learning, makes it difficult for a non-expert to find a suitable entry point in the literature. It is the goal of this special issue to bring together key researchers in this area, with the aim of providing the readership of the IEEE Signal Processing Magazine with up-to-date and survey-style papers on algorithmic, hardware, and neuroscience perspectives on the state-of-the-art of this emerging field. Submissions of comprehensive overviews of methodological approaches to brain-inspired learning and computing, with a focus on applications of interest to the signal processing community, are encouraged. Please contact the Lead Guest Editor if you have any questions about whether your proposed article would fit the scope of this special issue.

Topics of interest include (but are not limited to):

- Spike-domain learning
- Spike-domain representation
- Spike-domain control and reinforcement learning
- Neuromorphic signal processing hardware platforms
- Insights from neuroscience to brain-inspired signal processing
- Information-theoretic perspectives on time encoding and spike-domain computing
- Probabilistic and Bayesian methods for Spiking Neural Networks
- Signal processing for time-domain encoding and decoding
- Statistical learning and complexity considerations

Submission Process

The Special Issue seeks to offer broad coverage of the field including most recent developments in both theory and applications. Submissions of comprehensive overviews of methodological advances are strongly encouraged, as well as papers dealing with new and emerging applications. All submissions will be peer reviewed according to the IEEE and Signal Processing Society guidelines. Submitted articles should not have been published or be under review elsewhere. Manuscripts should be submitted online at http://mc.manuscriptcentral.com/sps-ieee using the Manuscript Central interface, see http://www.signalprocessingsociety.org/publications/periodicals/spm/ for guidelines and information.

Important Dates

White papers (4 pages) due: October 1, 2018
Invitation notification: November 1, 2018
Manuscripts due: January 1, 2019
Acceptance notification: March 1, 2019
Revised manuscripts due: May 1, 2019
Final acceptance notification: July 1, 2019
Final manuscripts due: August 5, 2019
Publication due: **November 2019**

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