

## Call for Papers

# Special Issue of IEEE Transactions on Multi-Scale Computing Systems: *Cognitive Computing with Emerging Technology*

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### Background and Scope

Over the last several decades, Dennard scaling and Moore's law have dramatically improved the capabilities of Von Neumann-style computing systems – where “memory” delivers instructions and data to a dedicated “processing unit”. However, as scaling limitations of 2-D ICs are becoming more apparent, there is a growing interest in innovations that will ensure that future computing systems continue to be exponentially-more-capable than the systems of today.

In particular, cognitive computing systems inspired by facets of the human brain such as unsupervised, autonomous and continuous learning, are emerging as a promising alternative. Research in this area often involves cross-disciplinary exploration at multiple scales, combining new materials and devices with novel architectural concepts and integration schemes. Targeting the broad device, circuit, and architecture, as well as nanotechnology research communities, this special issue seeks papers on innovative new concepts for such systems. High-risk high-reward type of ideas, rethinking system design at multiple scales, will be preferred to incremental research. While many of these systems will not rely on non-Von Neumann architectures, the call does not preclude massively parallel systems with conventional hardware components, where novel integration and/or packaging could enable new capabilities such as the high degree of connectivity and collective functions reminiscent of the neocortex and other natural systems.

Topics of interest include but are not limited to the following:

- Architectures for unconventional computing paradigms such as Bayesian frameworks, spike-and-fire learning rules, cellular neural networks, algorithms using sparse-data representations etc.
- Novel devices and associated topologies that behave as self-organized systems with complex dynamics that naturally generate solutions to certain classes of problems.
- Computing paradigms such as supervised learning and/or more general combinatorial optimization problems in relation to cognitive computing, and associated hardware systems enabling power/performance benefits over conventional CPU/GPU systems.
- Novel nanomaterials, nanodevices, circuits and manufacturing frameworks that enable key aspects of cognitive computing such as plasticity, reconfiguration and error tolerance.
- Novel integration, packaging concepts and technologies enabling ultra-high connectivity and at-scale computation – examples include interposer technologies, high bandwidth memory, and other concepts enabling true wafer-scale integration.
- Applications of cognitive and natural computing systems for real-life problems such as cyber security, text analytics, web knowledge synthesis, motion analysis and others.

- Embedding cognitive capabilities into every-day systems that are ultra-low power and area.

### **Submission Format**

The submitted papers must be written in English and describe original research which is not published nor currently under review by other journals or conferences. Extended conference papers should contain at least 50% new material and will pass through the normal review process. Author guidelines for preparation of manuscript can be found at the IEEE Transactions on Multi-Scale Computing Systems website (<http://www.computer.org/web/tmscs/author>).

For more information, please contact one of the Guest Editors.

### **Submission Guidelines**

Prospective authors are invited to submit their manuscripts electronically after the “open for submissions” date, adhering to the IEEE Transactions on Multi-Scale Computing Systems guidelines (<http://www.computer.org/portal/web/tmscs/author>). Please submit your papers through the online system (<https://mc.manuscriptcentral.com/tmscs-cs>) and be sure to select the special issue name. Manuscripts should not be published or currently submitted for publication elsewhere. Please submit only full papers intended for review, not abstracts, to the ScholarOne portal. If requested, abstracts should be sent by e-mail to the Guest Editors directly.

### **Important Dates**

- Paper submission: August 15, 2016 through October 15, 2016
- Acceptance notification: December 15, 2016
- Major revision: February 15, 2017
- Minor revision: March 15, 2017
- Final decision: April 15, 2017
- Final papers: April 20, 2017

### **Guest Editors**

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