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ACM JETC Special Issue on Alternative Computing Systems

Guest Editors: Rasit O. Topaloglu (IBM) and Naveen Verma (Princeton)

"Error is viewed, not as an extraneous and misdirected or misdirecting accident, but as an essential part of the process…. Our present treatment of error is unsatisfactory and ad hoc." -J. von Neumann (1956).

Well before 1956, John von Neumann recognized and voiced repeatedly his conviction that handling errors is a critical aspect of computing. For over 50 years, the field of computing has relied on powerful methods such as defect minimization, design margining, abstraction, redundancy, backtracking, and virtualization at the technology, circuits, architecture, and software levels to avoid errors and exploit the scaling enabled by Moore's Law. However a drastic shift in the computing model may be due as traditional technology scaling itself poses risks to the continued advancement of computers; the memory gap is becoming more and more important, power is continuing to be a limiting factor, and variation- and reliability-induced errors in nanoscale technologies are getting more difficult to contain.

Recent research has looked into new computing models as a solution. These have particular relevance in the context of emerging applications, which are rapidly gaining prominence. Instead of focusing on exact computations from traditional input sources, more diverse inputs sources, often based on ensembles (of sensors, users, other computers), are enabling probabilistic or approximate models for computing towards high-level inferences. These models have several implications, such as reduced power or latency, particularly when they are considered in the context of emerging technologies. Generally speaking, such computing models have so far been shown to be applicable only in specific cases, however broader benefits are also possible. In brain-inspired computing, as an example, while substantial background including the decades of research in neural networks exists, recent advancements focus on general-purpose computing and emerging machine-learning methods.

While it is possible to study these computing models independent of applications, designing new computing models in a way that is explicitly driven by these upcoming applications would lead to more systematic advances. Further, it will also enable directed efforts on the application levels that are influenced by these computing models. With these goals, we are proposing an ACM JETC Special Issue where researchers from alternative computing, system design, and emerging applications areas can publish their insights towards the common goal of improving computer system designs.

Topics for the Special Issue

– System, architecture, design automation, test, and verification-aspects of approximate, stochastic, brain-inspired, or communication inspired, etc. computing systems,
– Design methodology and verification,
– Performance comparison of above systems with traditional ones,
– Full-system demonstrations and evaluations,
– Alternative computing system implementation on embedded-system platforms,
– System studies and analyses of computational, memory, and/or communication subsystems,
– Methods for bounding computation errors or quality,
– Applications exploiting alternative computing systems,
– Programming on alternative computing systems.

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Timeline

Submissions due	11/30/2015	Second revisions due	5/31/2016
First revisions due	2/15/2016	Publication date	1/1/2017