IEEE Design&Test

Aim and Scope

tinyML encapsulates and nurtures the fast-growing branch of ultra-low power machine learning technologies and approaches dealing with machine intelligence at the very edge of the cloud. These integrated "tiny" machine learning applications require "full-stack" (hardware, system, software, and applications) solutions including machine learning architectures, techniques, tools, benchmarks, and approaches capable of performing on-device analytics. A variety of sensing modalities (vision, audio, motion, environmental, human health monitoring, etc.) are used with extreme energy efficiency, typically in the single milliwatt (and below) power range, to enable machine intelligence right at the boundary of the physical and digital worlds. We see a new world with trillions of distributed intelligent devices enabled by energy efficient machine learning technologies that sense, analyze, and autonomously act together to create a healthier and more sustainable environment for all! The tinyML ecosystem is fueled by (i) emerging commercial applications and new systems concepts on the horizon; (ii) significant progress on algorithms, networks, and models down to 100 kB and below; and (iii) current low-power applications in vision and audio that are already becoming mainstream and commercially available. Over the last few years, the tinyML ecosystem has grown significantly in terms of research, innovation and products. Several stakeholders from academia, industry and policymakers emerged as key leaders in this field. The objective therefore of this special issue, is to bring together the key stakeholders of the tinyML ecosystem, in presenting the state of the art in tinyML research and innovation, through a set of contributed manuscripts that detail advancements in research and innovation, identifying key challenges and opportunities, and provide their vision on how the overall ecosystem's dynamics should shift.

Topics of Interest:

The special issue aims to encapsulate the complete design and test of tinyML systems across the full stack; emphasis however is on the concept of _"tiny"_, i.e. _tiny (in size, resources, energy, mobility) systems that are capable of sensing, analyzing, predicting and classifying, potentially learning, and potentially controlling their environment, while consuming orders of magnitude energy less than "traditional" edge AI devices such as mobile phones._

This special issue seeks original manuscripts addressing design and test of tinyML systems across the ecosystem (and encourages their intersections):

- ***tinyML Datasets – Impact on design and test***: *Public release of new datasets to tinyML; frameworks that automate dataset development; survey and analysis of existing tiny datasets that can be used for research, design and test of tinyML systems.*
- ***tinyML Applications***: *design and test issues involving: novel tinyML applications and emerging use cases; discussions about real-world use cases; user behavior and system-user interaction; survey on practical experiences.*
- ***Algorithms for design and test of tinyML systems:*** *Federated learning or stream-based active learning methods; deep learning and traditional machine learning algorithms; emerging algorithms for low-footprint computing; pruning, quantization, optimization methods; security and privacy implications.*
- ***Design and Test of tinyML Systems***: *Profiling tools for measuring and characterizing performance and power; design space exploration frameworks; solutions that involve hardware and software co-design; characterization of tiny real-world embedded systems; in- and near-sensor processing, design, and implementation; heterogeneous computing platforms.*
- ***tinyML Software***: *Interpreters and code generator frameworks for tinyML systems; compilers and optimizations for efficient execution; software memory optimizations; neural architecture search methods.*
- ***tinyML Hardware:*** *MCU and accelerator architecture design and evaluation; circuit and architecture design for digital, analog and in- or near-memory processing; ultra-low-power memory system design; emerging hardware architectures for the extreme edge; power management, reliability, security, performance.*
- ***tinyML Evaluation:*** *Measurement tools and techniques; benchmark creation, assessment and validation; evaluation and measurement of real production systems.*

The special issue particularly welcomes and encourages the submissions from industry or collaborative works between industry and academia.

Please send your questions about the scope to the guest editors.

Submission Guidelines:

Prospective authors should follow the submission guidelines for IEEE Design & Test. All manuscripts must be submitted electronically to IEEE Manuscript Central at https://mc.manuscriptcentral.com/dandt. Indicate that you are submitting your article to the special issue on Design and Test of Multi-Chip Packages. Manuscripts must not exceed 5,000 words, including figures (with each average-size figure counting as 200 words) and a maximum of 12 references (30 for surveys). This amounts to about 4,000 words of text and a maximum of five small to medium figures. Accepted articles will be edited for clarity, structure, conciseness, grammar, passive to active voice, logical organization, readability, and adherence to style. Please see IEEE Design & Test Author Information at: https://ieee-ceda.org/publication/ieee-design-test-dt/author-info.

Schedule:

- Submission Deadline: May 1st, 2024
- Notification First Round: July 31st, 2024
- Revision Submission: September 30th, 2024
- Final Notification: November 1st, 2024
- Final Version Due: December 1st, 2024

Guest Editors:

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