

Special Issue on Energy and Data Efficiency in Artificial Intelligence

Call for papers

The current era of artificial intelligence (AI) is characterized by the scaling of data and computational resources as the primary driver of emergent capabilities in AI models. However, this trend faces fundamental constraints on data availability and computing power. Recent breakthroughs suggest an alternative path forward—leveraging novel statistical and information-theoretic tools to enhance reliability and data efficiency, while enhancing intelligence per joule and per data point/token via hardware-software co-design principles. Understanding the fundamental limits of AI through the lens of information and physical principles, such as Landauer's principle, is crucial for developing sustainable and efficient learning systems. This special issue aims to advance theoretical and algorithmically motivated approaches to optimizing AI performance while reducing reliance on extensive data and energy resources.

Topics include, but are not limited to:

- Information-theoretic limits of energy-efficient AI
- Multi-task, transfer, and meta-learning for reducing data requirements
- Semi-supervised learning and digital twins for efficient model adaptation
- Low-precision and approximate computing for energy-efficient AI
- Probabilistic and stochastic computing architectures
- Neuromorphic computing and biologically inspired learning systems
- Fundamental bounds on computation and memory under physical constraints
- Coding-theoretic approaches to energy-aware machine learning
- Trade-offs between energy, data, and generalization performance

Survey papers on relevant topics will also be considered. Potential authors are encouraged to inquire with the Guest Editors regarding suitability.

Guest Editors

Bipin Rajendran (King's College London) – Lead guest editor
Osvaldo Simeone (King's College London) – Lead guest editor
Irem Boybat (IBM)
Tianyi Chen (Rensselaer Polytechnic Institute)
Siddharth Garg (NYU)
Yaniv Romano (Technion)

Important Dates

Manuscript Submission Deadline: Continuous submission until November 15, 2025

First Notification: February 15, 2026

Acceptance Notification: March 30, 2026

Final Manuscript Due: April 15, 2026

Publication Date: Each accepted manuscript will be published on IEEE Xplore after finishing its peer-review with a final deadline for publishing the complete special issue by June 1, 2026

Manuscript Submission Website: <https://mc.manuscriptcentral.com/jsait-ieee>