FPGA and GPU Energy Efficiency in Batch-Ensemble Spiking Neural Networks for Tabular Data

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Abstract

This report synthesises findings from 14 peer-reviewed papers addressing the following research question: What is the energy efficiency ratio of FPGA-based versus GPU-based batch-ensemble SNNs during inference on standard tabular datasets. 17 claims were extracted from source literature; 0 were independently verified against retrieved documents. An automated multi-reviewer quality assessment produced a score of 3.0/10. This report is a machine-generated literature synthesis and does not constitute original research.

1 Introduction

This paper examines: NeuroCoreX: An Open-Source FPGA-Based Spiking Neural Network Emulator with On-Chip Learning. Research question: What is the energy efficiency ratio of FPGA-based versus GPU-based batch-ensemble SNNs during inference on standard tabular datasets?.

2 Methodology

Systematic literature search across multiple databases yielded 14 papers. Claims were extracted from source material and verified against retrieved documents. An independent multi-reviewer assessment produced a quality score of 3.0/10.

3 Results

14 papers retrieved. 17 claims extracted; 0 independently verified. Quality review score: 3.0/10.

4 Limitations

This report is a machine-generated literature synthesis and does not constitute original research. Automated retrieval and verification may introduce errors or omissions. Review scores reflect automated assessment, not human peer review. Readers should consult primary sources for authoritative information.

5 Extracted Claims

Claim	Verified	Confidence
NeuroCoreX supports 3-bit fixed-point resolution per synapse.	×	0.05
NeuroCoreX integrates models that may slightly increase logic complexity but could significantly reduce BRAM usage.	×	0.03
NeuroCoreX enables simulation of larger networks.	×	0.05
NeuroCoreX provides an efficient, accessible, and extensible platform for implementing biologically inspired, energy-eff	×	0.06
NeuroCoreX has a modular VHDL design.	×	0.05
NeuroCoreX supports real-time STDP learning.	×	0.07
NeuroCoreX has flexible connectivity.	×	0.08
SNN execution on NeuroCoreX aligns closely with software simulations in SuperNeuroMAT.	×	0.04
NeuroCoreX is an open-source tool.	×	0.14
NeuroCoreX is designed to emulate brain-like computation on reconfigurable FPGA hardware using a digital circuit approac	×	0.05
NeuroCoreX is built around three fundamental components: neurons, synapses, and an unspecified third component.	×	0.02
NeuroCoreX can support not just SNN-based AI workloads but also general-purpose computing workloads.	×	0.03
NeuroCoreX is programmable and configurable through a UART interface and a simple Python module.	×	0.10
NeuroCoreX is a valuable research tool for testing new theories of learning and network organization.	×	0.04
NeuroCoreX is a powerful educational platform for hands-on experience with neuromorphic hardware.	×	0.04
NeuroCoreX has an energy-efficient architecture.	×	0.07
NeuroCoreX is well-suited for low-power AI applications in areas such as autonomous systems, smart sensors, and scientif	×	0.02

References

- http://arxiv.org/abs/2506.14138v1
- http://arxiv.org/abs/2001.10696v5
- http://arxiv.org/abs/2302.00232v1