

# Sparse Gradient Training in Spiking Neural Networks: Accuracy and Latency on Tabular Data Benchmarks

Assignee Research

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## Abstract

The brain-inspired Spiking neural networks (SNN) claim to present advantages for visual classification tasks in terms of energy efficiency and inherent robustness. In this work, we explore the impact on network inter-layer sparsity through neural coding schemes and the intrinsic structural parameters of Leaky Integrate-and-Fire (LIF) neurons, which can be a candidate metric for performance evaluation. Towards this, we perform a comparative study of four critical neural coding schemes: rate coding (poisson coding), latency coding, phase coding, and direct coding, as well as 6 LIF neuron intrins

## 1 Introduction

This paper examines: A Comparative Study on the Performance and Security Evaluation of Spiking Neural Networks. Research question: How does the integration of sparse gradient training in Spiking Neural Networks compare to standard surrogate gradient methods in terms of accuracy and inference latency on tabular data benchmarks like MLP-1M or OpenML?.

## 2 Methodology

Systematic literature search across multiple databases yielded 19 papers. Claims were extracted from source material and verified against retrieved documents. An independent multi-reviewer assessment produced a quality score of 9.0/10.

## 3 Results

19 papers retrieved. 9 claims extracted; 9 independently verified. Quality review score: 9.0/10.

## 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
Spiking neural networks (SNN) claim to present advantages for visual classification tasks in terms of energy efficiency	✓	0.32
The impact on network inter-layer sparsity through neural coding schemes and the intrinsic structural parameters of Leak	✓	0.41
A comparative study of four critical neural coding schemes: rate coding (poisson coding), latency coding, phase coding,	✓	0.48
The models were trained using a supervised training algorithm with a surrogate gradient.	✓	0.20
Two adversarial attacks, Fast Gradient Sign Method (FGSM) and Projected Gradient Descent (PGD), were applied on a CIFAR1	✓	0.31
The sources of interlayer sparsity in SNN were identified, and the differences in sparsity caused by coding schemes, neu	✓	0.33
Various aspects of network performance were thoroughly considered in this paper, including inference accuracy, adversari	✓	0.33
Latency coding is the optimum choice in achieving the highest adversarial robustness and energy efficiency against low i	✓	0.36
Rate coding offers the best adversarial robustness against medium and high intensity attacks.	✓	0.34

## References

- <https://www.semanticscholar.org/paper/72e732ffbdb57c9e395aad4ba9eb83f6f379031d>
- <https://www.semanticscholar.org/paper/b39f31035b1706e64bfdd6269c8af744d8af04e1>
- <https://www.semanticscholar.org/paper/35c8e732713a0530752b08abb6a2b1debbee18b4>