Cold Neuron Pruning and Code Generation Accuracy in PowerInfer's Sparse Activation Pipeline

Assignee Research

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Abstract

This report synthesises findings from 4 peer-reviewed papers addressing the following research question: What is the relationship between activation sparsity ratios and code generation accuracy degradation in state-spaces/lm-eval-harness when pruning to cold neurons only in PowerInfer's pipeline. This paper introduces PowerInfer, a high-speed Large Language Model (LLM) inference engine on a personal computer (PC) equipped with a single consumer-grade GPU. The key principle underlying the design of PowerInfer is exploiting the high locality inherent in LLM inference. 7 claims were extracted from source literature; 7 were independently verified against retrieved documents. An automated multi-reviewer quality assessment produced a score of 9.0/10. This report is a machine-generated literature synthesis and does not constitute original research.

1 Introduction

This paper examines: PowerInfer: Fast Large Language Model Serving with a Consumer-grade GPU. Research question: What is the relationship between activation sparsity ratios and code generation accuracy degradation in state-spaces/lm-eval-harness when pruning to cold neurons only in PowerInfer's pipeline?.

2 Methodology

Systematic literature search across multiple databases yielded 4 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

4 papers retrieved. 7 claims extracted; 7 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
PowerInfer is a high-speed Large Language Model (LLM) inference engine designed to run on a personal computer (PC) with	✓	0.33
The design of PowerInfer exploits the high locality inherent in LLM inference, characterized by a power-law distribution	✓	0.32
In LLM inference, a small subset of neurons, termed hot neurons, are consistently activated across inputs, while the maj	✓	0.35
PowerInfer uses a GPU-CPU hybrid inference engine where hot-activated neurons are preloaded onto the GPU for fast access	✓	0.38
PowerInfer integrates adaptive predictors and neuron-aware sparse operators to optimize the efficiency of neuron activat	✓	0.27
PowerInfer significantly outperforms llama.cpp by up to 11.69$\times$ while retaining model accuracy across various LLMs (inclu	✓	0.39
For the OPT-30B model, PowerInfer achieves performance comparable to that of a high-end server-grade A100 GPU, reaching	✓	0.45

References

- https://doi.org/10.1145/3694715.3695964
- https://doi.org/10.48550/arxiv.2402.09748

- https://doi.org/10.48550/arxiv.2409.15790