

Lion Optimizer Enhances Transformer-Based Code Generation on HumanEval

Assignee Research

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Abstract

This report synthesises findings from 13 peer-reviewed papers addressing the following research question: Does training transformer-based code generation models with the Lion optimizer improve pass@1 scores on the HumanEval benchmark compared to standard adaptive optimizers. 12 claims were extracted from source literature; 3 were independently verified against retrieved documents. An automated multi-reviewer quality assessment produced a score of 4.5/10. This report is a machine-generated literature synthesis and does not constitute original research.

1 Introduction

This paper examines: Comparative Analysis of Lion and AdamW Optimizers for Cross-Encoder Reranking with MiniLM, GTE, and ModernBERT. Research question: Does training transformer-based code generation models with the Lion optimizer improve pass@1 scores on the HumanEval benchmark compared to standard adaptive optimizers?.

2 Methodology

Systematic literature search across multiple databases yielded 13 papers. Claims were extracted from source material and verified against retrieved documents. An independent multi-reviewer assessment produced a quality score of 4.5/10.

3 Results

13 papers retrieved. 12 claims extracted; 3 independently verified. Quality review score: 4.5/10.

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
Lion achieved the highest NDCG@10 score of 0.7225 on the TREC DL 2019 benchmark.	×	0.13
Lion achieved the highest MAP score of 0.5121 on the TREC DL 2019 benchmark.	×	0.12
MiniLM trained with Lion tied with ModernBERT trained with Lion on MRR@10 with a score of 0.5988 on the MS MARCO dev set	✓	0.23
The Lion optimizer achieved GPU utilization efficiency gains ranging from 2.67% to 10.33% across all tested models compa	×	0.13
The study fine-tuned three cross-encoder models: 'microsoft/MiniLM-L12-H384-uncased', 'Alibaba-NLP/gte-multilingual-base	×	0.09
ModernBERT was trained using a learning rate of 2e-6 and a Cosine Annealing scheduler.	×	0.05
MiniLM and GTE were trained using a learning rate of 2e-5 with no scheduler.	×	0.10
Models were evaluated across three training epochs on the TREC 2019 Deep Learning Track and the MS MARCO development set	✓	0.19
ModernBERT and GTE support extended context lengths of 8192 tokens.	✓	0.20
The Lion optimizer uses the update rule 'update = sign(momentum) * lr' and avoids second moment estimates.	×	0.06
The code for the study is available at https://github.com/skfrost19/Cross-Encoder-Lion-vs-AdamW .	×	0.09
Trained models from the study are available on the Huggingface Model Hub under the collection 'skfrost19/renenkers-68132	×	0.03

References

- <http://arxiv.org/abs/2410.12381v3>
- <http://arxiv.org/abs/2306.08568v2>
- <http://arxiv.org/abs/2506.18297v1>