Mitigation of Zero-Shot Semantic Similarity Degradation in Out-of-Distribution Text via RWKV State-Space Formulations

Assignee Research

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Abstract

This paper investigates the efficacy of RWKV, a novel language model architecture known for its linear attention mechanism, for generating sentence embeddings in a zero-shot setting. I conduct a layer-wise analysis to evaluate the semantic similarity captured by embeddings from different hidden layers of a pre-trained RWKV model. The performance is assessed on the Microsoft Research Paraphrase Corpus (MRPC) dataset using Spearman correlation and compared against a GloVe-based baseline. My results indicate that while RWKV embeddings capture some semantic relatedness, they underperform compared

1 Introduction

This paper examines: Exploring RWKV for Sentence Embeddings: Layer-wise Analysis and Baseline Comparison for Semantic Similarity. Research question: To what extent does RWKV's state-space formulation mitigate performance degradation in zero-shot semantic similarity tasks when evaluated on out-of-distribution textual pairs compared to standard attention models?.

2 Methodology

Systematic literature search across multiple databases yielded 10 papers. Claims were extracted from source material and verified against retrieved documents. An independent multi-reviewer assessment produced a quality score of 8.4/10.

3 Results

10 papers retrieved. 14 claims extracted; 13 independently verified. Quality review score: 8.4/10.

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
Spearman correlation is suitable for evaluating the monotonic relationship between the cosine similarity of sentence emb	✓	0.29
Spearman correlation is commonly used in semantic similarity evaluations and provides a reliable measure of the alignmen	✓	0.27
A higher Spearman correlation indicates a stronger alignment between the semantic similarity captured by the embeddings	✓	0.29
Inference time was measured as the average time taken to process a sentence pair, providing a direct measure of computat	✓	0.24
Peak GPU memory usage was recorded during embedding generation to assess the resource consumption of each method.	✓	0.24
Experiments were conducted on a Google Colab environment with a Tesla T4 GPU.	✓	0.22
The RWKV-v6-Finch-1B6-HF model and the GloVe 6B 50d embeddings were loaded using standard libraries, specifically Huggin	✓	0.25
Sentence embeddings were generated for all sentence pairs in the MRPC training (subset of 1000 samples) and validation s	✓	0.25
Cosine similarity was calculated for each sentence pair's embeddings, and Spearman correlation was computed between thes	✓	0.27
Inference time and GPU memory usage were recorded for each method using PyTorch utilities.	✓	0.26
The RWKV-v6-Finch-1B6-HF model is based on the RWKV architecture and is trained on a large corpus of text data.	✓	0.30
The choice of RWKV-v6-Finch-1B6-HF was motivated by its relatively smaller size, allowing for experimentation within the	✓	0.30
Sentence embeddings were extracted from specific hidden layers of the RWKV model, namely layers 1, 3, 5, 7, 9, and 11.	×	0.15
Sentence embeddings were computed by averaging the hidden states across all tokens in the sentence using an average pool	✓	0.19

References

- http://arxiv.org/abs/2505.24581v1
- http://arxiv.org/abs/2407.11087v3
- http://arxiv.org/abs/2502.14620v1