

Diverse Synthetic Misspellings Enhance Recall in Dense Retrievers via Multi-Positive Contrastive Learning

Assignee Research

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Abstract

This report synthesises findings from 16 peer-reviewed papers addressing the following research question: Does increasing the diversity of synthetic misspelling patterns during adversarial training improve the recall@10 metric for dense retrievers on user-generated query benchmarks containing typos. 10 claims were extracted from source literature; 4 were independently verified against retrieved documents. An automated multi-reviewer quality assessment produced a score of 5.8/10. This report is a machine-generated literature synthesis and does not constitute original research.

1 Introduction

This paper examines: Improving the Robustness of Dense Retrievers Against Typos via Multi-Positive Contrastive Learning. Research question: Does increasing the diversity of synthetic misspelling patterns during adversarial training improve the recall@10 metric for dense retrievers on user-generated query benchmarks containing typos?.

2 Methodology

Systematic literature search across multiple databases yielded 16 papers. Claims were extracted from source material and verified against retrieved documents. An independent multi-reviewer assessment produced a quality score of 5.8/10.

3 Results

16 papers retrieved. 10 claims extracted; 4 independently verified. Quality review score: 5.8/10.

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
Employing multi-positive contrastive learning on the robustifying subtask yields improvements in robustness against typo	✓	0.38
The original DR+DL work considers only the typo-free query as a positive sample when computing the contrastive loss for	×	0.13
The proposed DR+DLM model considers both the typo-free query and all its available typoed variants as positive samples.	✓	0.20
Employing all available positives (typoed queries) simultaneously using multi-positive contrastive loss outperforms samp	✓	0.25
The DR+DL+ST model uses a contrastive loss with a single positive for the query retrieval dual task (L_{q_CE}).	×	0.07
The DR+DL+ST model considers multiple positives simultaneously to compute KL-divergence losses (L_{p_KL} , L_{q_KL}).	×	0.08
Models using multi-positive contrastive loss achieved statistically significant gains ($p < 0.05$, two-tailed paired t-test)	×	0.07
Current typo-robust dense retrievers use contrastive learning with a single positive sample and multiple negative ones	✓	0.28
The standard contrastive loss function LCE brings a single positive sample closer to the anchor than any negative sample	×	0.10
The proposed multi-positive contrastive loss function LMCE computes the loss by averaging the log probabilities over mul	×	0.11

References

- <http://arxiv.org/abs/2204.00716v2>
- <http://arxiv.org/abs/2403.10939v1>
- <http://arxiv.org/abs/2205.02303v1>