Enhancing Multilingual Dense Retrieval Robustness via Cross-Lingual Typoed Positives in Contrastive Learning

Assignee Research

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Abstract

Dense retrieval has become the new paradigm in passage retrieval. Despite its effectiveness on typo-free queries, it is not robust when dealing with queries that contain typos. Current works on improving the typo-robustness of dense retrievers combine (i) data augmentation to obtain the typoed queries during training time with (ii) additional robustifying subtasks that aim to align the original, typo-free queries with their typoed variants. Even though multiple typoed variants are available as positive samples per query, some methods assume a single positive sample and a set of negative ones p

1 Introduction

This paper examines: Improving the Robustness of Dense Retrievers Against Typos via Multi-Positive Contrastive Learning. Research question: To what extent does the use of cross-lingual typoed positive examples in contrastive learning improve the robustness of multilingual dense retrieval models against adversarial character perturbations in the XOR-Typos benchmark, measured by MRR@10?.

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 8.3/10.

3 Results

10 papers retrieved. 10 claims extracted; 9 independently verified. Quality review score: 8.3/10.

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	✓	0.31
The original DR+DL work considers only the typo-free query as positive when computing the contrastive loss for query ret	✓	0.27
The proposed DR+DLM model considers the typo-free query and all its available typoed variants as positives for query ret	✓	0.21
Employing all available positives (typoed queries) at once using multi-positive contrastive loss outperforms sampling a	✓	0.23
The DR+DL+ST model uses a contrastive loss with a single positive for the query retrieval dual task (Lq_CE).	✓	0.23
The DR+DL+ST model considers multiple positives simultaneously to compute the KL-divergence losses (Lp_KL, Lq_KL).	✓	0.17
Statistical significant gains were obtained from models with multi-positive contrastive loss over their original version	✓	0.21
Current typo-robust dense retrievers use contrastive learning with a single positive sample and multiple negative ones f	✓	0.39
The standard contrastive loss LCE brings the positive sample closer to the anchor than any other negative sample.	✓	0.18
The proposed multi-positive contrastive loss LMCE is computed by averaging the log likelihood over all positive samples	×	0.13

References

- http://arxiv.org/abs/2511.19324v1
- http://arxiv.org/abs/2403.10939v1
- http://arxiv.org/abs/2205.02303v1