Intelligent Query Reformulation for Enhanced Retrieval Precision and Generation Faithfulness in Dense Terminology Domains

Assignee Research

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Abstract

In this paper, we introduce Technical-Embeddings, a novel framework designed to optimize semantic retrieval in technical documentation, with applications in both hardware and software development. Our approach addresses the challenges of understanding and retrieving complex technical content by leveraging the capabilities of Large Language Models (LLMs). First, we enhance user queries by generating expanded representations that better capture user intent and improve dataset diversity, thereby enriching the fine-tuning process for embedding models. Second, we apply summary extraction techniques

1 Introduction

This paper examines: Enhancing Technical Documents Retrieval for RAG. Research question: To what extent does intelligent query reformulation improve retrieval precision and final generation faithfulness in dense terminology domains compared to standard RAG pipelines?.

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 8.2/10.

3 Results

16 papers retrieved. 11 claims extracted; 11 independently verified. Quality review score: 8.2/10.

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
Synthetic data generation has emerged as a valuable technique for augmenting training datasets, particularly in scenario	✓	0.28
Incorporating synthetic data can enhance retrieval performance.	✓	0.18
Contextual summary is a technique for producing concise, relevant summaries by considering the surrounding context of th	✓	0.24
Prompt tuning has gained traction as a method for customizing pretrained language models for specific tasks or domains.	✓	0.25
Mean Reciprocal Rank (MRR), precision, and recall are used for comprehensive assessments of retrieval performance.	✓	0.19
The all-mpnet-base-v2 model generates high-quality sentence embeddings through fine-tuning BERT and testing various pool	✓	0.26
All-MiniLM-L6-v2 employs multi-head self-attention relationship distillation to reduce parameters and improve efficiency	✓	0.26
The BGE series, including bge-small-en and bge-base-en, effectively extracts and cleans semantically relevant text pairs	✓	0.34
BM25 is a probabilistic model that ranks documents based on the relevance to a given query.	✓	0.22
BERT's ability to understand context and semantics in text has paved the way for more sophisticated retrieval systems.	✓	0.24
Models such as Sentence-BERT extend BERT's capabilities by producing sentence embeddings that are well-suited for semant	✓	0.26

References

- http://arxiv.org/abs/2510.25518v1
- http://arxiv.org/abs/2509.04139v1
- http://arxiv.org/abs/2503.16581v1