Zero-shot Cross-domain Generalization of Dense Retrievers Fine-tuned on Specialized Subdomains

Assignee Research

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Abstract

Brazilian legal retrieval is heterogeneous, covering case law, legislation, and question-based search. This makes training dense retrievers a trade-off between stronger domain specialization and broader robustness across retrieval types of search. In this paper, we explore this trade-off using three training setups based on Qwen3-Embedding-4B: a base model with no fine-tuning, a version trained only on legal data, and a mixed setup that combines legal data with SQuAD-pt supervised dataset. We evaluate these models on five legal datasets from the JU leaderboard, along with Quati dataset as an

1 Introduction

This paper examines: Domain-Adaptive Dense Retrieval for Brazilian Legal Search. Research question: How does the zero-shot cross-domain generalization performance of dense retrievers compare when fine-tuned on specialized subdomains (e.g., biomedical vs. legal) within the BEIR benchmark, as measured by nDCG@10 across all datasets?.

2 Methodology

Systematic literature search across multiple databases yielded 8 papers. Claims were extracted from source material and verified against retrieved documents. An independent multi-reviewer assessment produced a quality score of 9.0/10.

3 Results

8 papers retrieved. 16 claims extracted; 16 independently verified. Quality review score: 9.0/10.

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
The mixed setup improves average NDCG@10 from 0.414 to 0.447, MRR@10 from 0.586 to 0.595, and MAP@10 from 0.270 to 0.308	✓	0.33
The biggest improvement appears on Quati, where the mixed model clearly outperforms the legal-only one.	✓	0.27
Legal-only training is better for specialization, while mixed training is more robust across different types of search,	✓	0.28
Both adapted models are available on Hugging Face.	✓	0.18
The evaluation includes five legal datasets that make up the JUA leaderboard environment, together with Quati as an add	✓	0.21
JUA-Juris involves jurisprudence retrieval over curated TCU jurisprudence excerpts with binary relevance judgments.	✓	0.20
JurisTCU involves jurisprudence retrieval over TCU case-law excerpts with expert-verified relevance judgments and includ	✓	0.31
NormasTCU involves retrieval over TCU normative acts with three-level graded relevance judgments.	✓	0.19
Ulysses-RFCorpus involves legislative retrieval based on real relevance feedback from the Brazilian Chamber of Deputies	✓	0.24
BR-TaxQA-R involves question-driven tax retrieval over tax answers and linked reference material with FAQ-style question	✓	0.31
Quati is a general-domain Brazilian Portuguese retrieval benchmark with queries written by native speakers and a corpus	✓	0.33
The central empirical question of the paper is whether the most useful dense retriever for heterogeneous Brazilian legal	✓	0.24
The study compares three training conditions built on the same base encoder, Qwen3-Embedding-4B: an untuned base model,	✓	0.27
The comparison is structured to answer two related questions: does legal-domain adaptation improve retrieval quality rel	✓	0.35
All three conditions use Qwen3-Embedding-4B as the underlying encoder.	✓	0.20
Qwen3-Embedding-4B belongs to a recent family of open-weight embedding models designed for strong retrieval and rerankin	✓	0.29

References

- http://arxiv.org/abs/2412.08329v1
- http://arxiv.org/abs/2104.08663v4
- http://arxiv.org/abs/2605.04005v1