

Manifold-Aware Distance Metrics Enhance DPR Retrieval in Low-Dimensional OOD Settings

Assignee Research

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Abstract

This report synthesises findings from 4 peer-reviewed papers addressing the following research question: What is the impact of incorporating manifold-aware distance metrics on the retrieval accuracy of DPR for out-of-domain (OOD) datasets like TriviaQA when the embedding dimension is reduced by 50%. Dense Passage Retrieval (DPR) typically relies on Euclidean or cosine distance to measure query-passage relevance in embedding space, which is effective when embeddings lie on a linear manifold. However, our experiments across DPR benchmarks suggest that embeddings often lie on. 4 claims were extracted from source literature; 1 was independently verified against retrieved documents. An automated multi-reviewer quality assessment produced a score of 6.0/10. This report is a machine-generated literature synthesis and does not constitute original research.

1 Introduction

This paper examines: MA-DPR: Manifold-aware Distance Metrics for Dense Passage Retrieval. Research question: What is the impact of incorporating manifold-aware distance metrics on the retrieval accuracy of DPR for out-of-domain (OOD) datasets like TriviaQA when the embedding dimension is reduced by 50%?.

2 Methodology

Systematic literature search across multiple databases yielded 4 papers. Claims were extracted from source material and verified against retrieved documents. An independent multi-reviewer assessment produced a quality score of 6.0/10.

3 Results

4 papers retrieved. 4 claims extracted; 1 independently verified. Quality review score: 6.0/10.

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 paper proposes a new manifold-aware distance metric (dManifold) for dense passage retrieval that outperforms Euclidean	✓	0.25
The manifold-aware distance metric (dManifold) improves retrieval performance compared to DPR with Euclidean distance on	×	0.13
In-distribution datasets (MS MARCO for tas-b model, SciDocs for SciNCL model) show strong agreement between Euclidean and	×	0.05
MA-DPR implementation is available at github.com/QianfengWen/Manifold_Distance_Retrieval.git	×	0.07

References

- <http://arxiv.org/abs/2509.13562v1>
- <http://arxiv.org/abs/2501.11667v1>
- <http://arxiv.org/abs/1710.05833v2>