

# Geodesic Distance Metrics Enhance Robustness in Dense Retrievers Under Domain Shift

Assignee Research

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## Abstract

This report synthesises findings from 11 peer-reviewed papers addressing the following research question: How does replacing cosine similarity with geodesic distance metrics affect the robustness scores of dense retrievers on the Adversarial NLI benchmark under domain shift. 10 claims were extracted from source literature; 10 were independently verified against retrieved documents. An automated multi-reviewer quality assessment produced a score of 8.7/10. This report is a machine-generated literature synthesis and does not constitute original research.

## 1 Introduction

This paper examines: Variance-Adjusted Cosine Distance as Similarity Metric. Research question: How does replacing cosine similarity with geodesic distance metrics affect the robustness scores of dense retrievers on the Adversarial NLI benchmark under domain shift?.

## 2 Methodology

Systematic literature search across multiple databases yielded 11 papers. Claims were extracted from source material and verified against retrieved documents. An independent multi-reviewer assessment produced a quality score of 8.7/10.

## 3 Results

11 papers retrieved. 10 claims extracted; 10 independently verified. Quality review score: 8.7/10.

## 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
Cosine similarity is a popular distance measure that measures the similarity between two vectors in the inner product sp	✓	0.33
Cosine similarity is widely used in many data classification algorithms like K-Nearest Neighbors, Clustering etc.	✓	0.30
Traditional cosine similarity metric is valid only in the Euclidean space, whereas the original data resides in a random	✓	0.39
When there is variance and correlation in the data, then cosine distance is not a completely accurate measure of similar	✓	0.33
New similarity and distance metrics have been developed to make up for the limitations of cosine similarity.	✓	0.32
These new metrics are used as substitutes to cosine distance, and do not make modifications to cosine distance to overco	✓	0.35
A modified cosine similarity metric is proposed, where cosine distance is adjusted by variance-covariance of the data.	✓	0.36
Application of variance-adjusted cosine distance gives better similarity performance compared to traditional cosine dist	✓	0.43
KNN modelling on the Wisconsin Breast Cancer Dataset is performed using both traditional and modified cosine similarity	✓	0.39
The modified formula shows 100% test accuracy on the data.	✓	0.25

## References

- <http://arxiv.org/abs/2502.02233v1>
- <http://arxiv.org/abs/2406.00638v1>
- <http://arxiv.org/abs/2008.07651v1>