

# Vendi-RAG Performance on Multi-Hop QA with Top-k and Iterative Diversity Methods

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## Abstract

Retrieval-augmented generation (RAG) enhances large language models (LLMs) for domain-specific question-answering (QA) tasks by leveraging external knowledge sources. However, traditional RAG systems primarily focus on relevance-based retrieval and often struggle with redundancy, especially when reasoning requires connecting information from multiple sources. This paper introduces Vendi-RAG, a framework based on an iterative process that jointly optimizes retrieval diversity and answer quality. This joint optimization leads to significantly higher accuracy for multi-hop QA tasks. Vendi-RAG

## 1 Introduction

This paper examines: Vendi-RAG: Adaptively Trading-Off Diversity And Quality Significantly Improves Retrieval Augmented Generation With LLMs. Research question: How does top-k passage selection compare to iterative diversity methods in Vendi-RAG?.

## 2 Methodology

Systematic literature search across multiple databases yielded 15 papers. Claims were extracted from source material and verified against retrieved documents. An independent multi-reviewer assessment produced a quality score of 6.3/10.

## 3 Results

15 papers retrieved. 8 claims extracted; 2 independently verified. Quality review score: 6.3/10.

## 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
Vendi-RAG was evaluated on three multi-hop QA benchmark datasets: MuSiQue, HotpotQA, and 2WikiMultiHopQA.	✓	0.21
The sensitivity analysis of the VSR process was conducted using 100 randomly sampled queries from the dataset.	×	0.03
The sensitivity analysis evaluated the retrieval pipeline across multiple $s$ values ranging from 0.0 to 1.0.	×	0.03
Setting $s = 0.0$ serves as a baseline representing a pure similarity search scenario.	×	0.03
Kendall’s $\tau$ and Spearman’s $\rho$ were used to quantify deviations from the baseline in the sensitivity analysis.	×	0.04
As $s$ increases from 0.0 to 1.0, both Kendall’s $\tau$ and Spearman’s $\rho$ decrease progressively, demonstrating that higher $s$ va	×	0.09
Vendi-RAG uses a retrieval approach based on the Vendi Score (VS), which explicitly quantifies semantic diversity in a $s$	✓	0.19
The Vendi Score (VSk(D)) reflects the effective number of unique documents in $D$ , attaining its maximum value $n$ when all	×	0.06

## References

- <http://arxiv.org/abs/2502.11228v2>
- <http://arxiv.org/abs/1806.09774v1>
- <http://arxiv.org/abs/2402.12317v2>