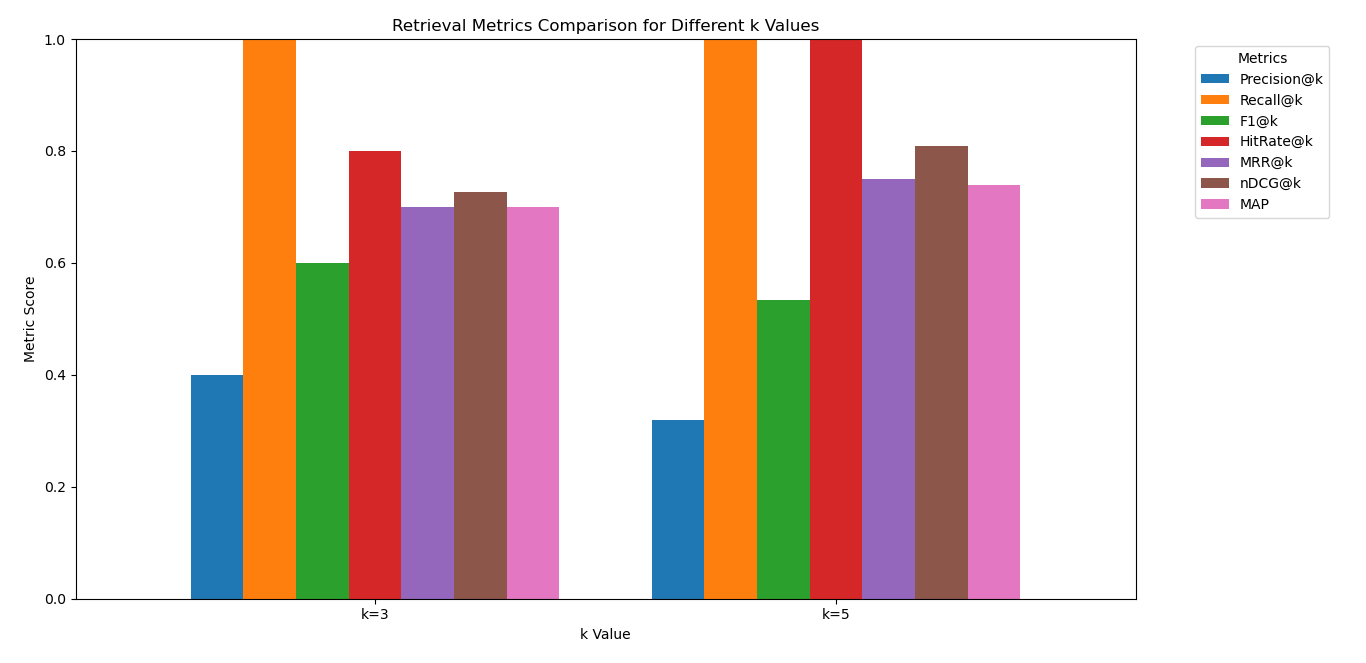
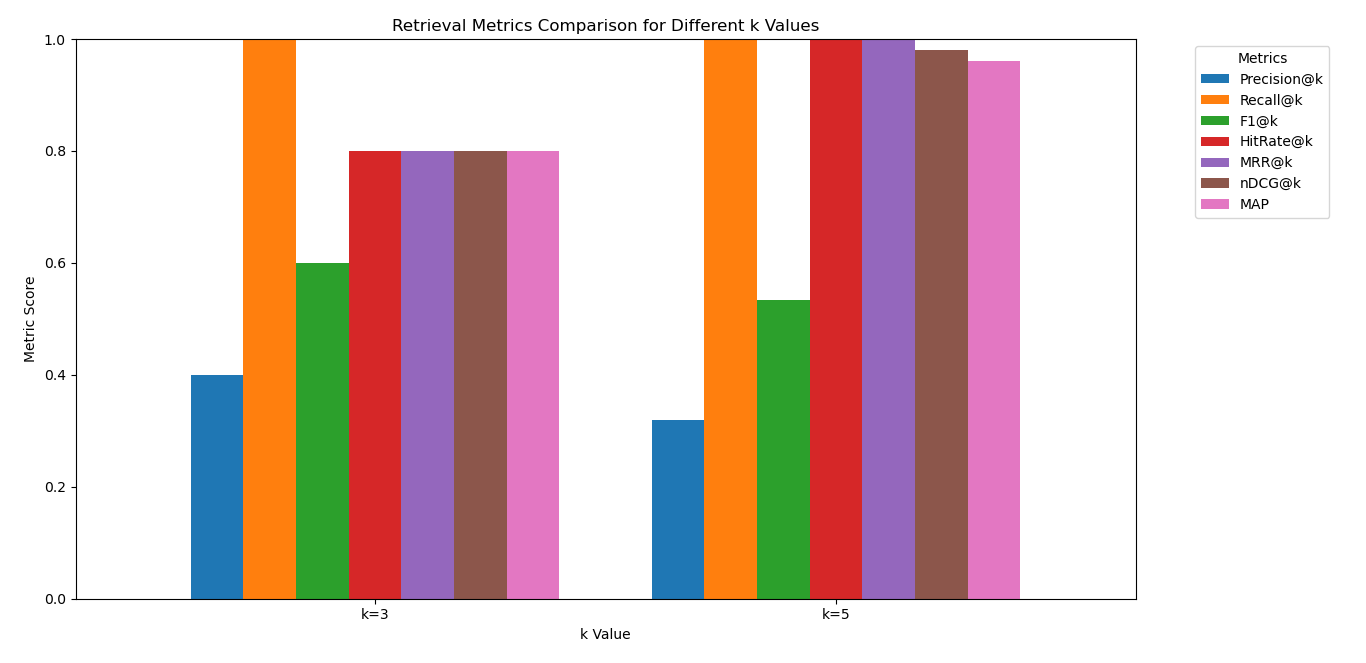
**METRICS**

The below are the plot that shows different metrics for different k values

**Without Reranking**

****

**With Reranking**

****

**Analysis**

| **Metric** | **With Reranking (k=3)** | **With Reranking (k=5)** | **Without Reranking (k=3)** | **Without Reranking (k=5)** |
| --- | --- | --- | --- | --- |
| **Recall@k** | 1.0 | 1.0 | High, not perfect | Slightly worse |
| **HitRate@k** | 1.0 | 1.0 | High | High |
| **Precision@k** | High | Slightly lower | Good | Noticeably lower |
| **F1@k** | High | Slightly lower | Moderate | Lower |
| **MRR@k** | Very High | Higher | Moderate | Slightly better |
| **nDCG@k** | Very High | Higher | Moderate | Slightly better |
| **MAP** | Very High | Higher | Moderate | Slightly better |
| **Performance Stability** | Very stable across k values | Very stable across k values | Drops as k increases | Drops more noticeably |
| **Overall Impact** | Strong precision and ranking quality | Improved ranking with high recall | Good recall, lower precision and ranking quality | Recall okay, ranking poorer |

* Reranking significantly boosts ranking-sensitive metrics like MRR@k, nDCG@k, and MAP, making retrieval not just about finding the relevant documents but ordering them better.
* Precision@k and F1@k are higher with reranking, especially at smaller k (k=3), showing reranking improves relevance at top positions.
* Without reranking, there is a steeper decline in metric performance as k increases (especially in Precision and F1), while with reranking, the performance remains robust and stable.
* Reranking leads to consistently high Recall@k and HitRate@k (perfect 1.0), whereas without reranking, even Recall@k slightly fluctuates.