Estimating Query Performance Through Rich Contextualized Query Representations

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Abstract

The state-of-the-art query performance prediction methods rely on the fine-tuning of contextual language models to estimate retrieval effectiveness on a per-query basis. Our work in this paper builds on this strong foundation and proposes to learn rich query representations by learning the interactions between the query and two important contextual information, namely (1) the set of documents retrieved by that query, and (2) the set of similar historical queries with known retrieval effectiveness. We propose that such contextualized query representations can be more accurate estimators of query performance as they embed the performance of past similar queries and the semantics of the documents retrieved by the query. We perform extensive experiments on the MSMARCO collection and its accompanying query sets including MSMARCO Dev set and TREC Deep Learning tracks of 2019, 2020, 2021, and DL-Hard. Our experiments reveal that our proposed method shows robust and effective performance compared to state-of-the-art baselines.

Keywords

Information Retrieval, Query Performance Prediction, Query Difficulty, Contextualized Query Representations

Our paper[1], Estimating Query Performance Through Rich Contextualized Query Representations, was accepted in the short paper track of The 46th European Conference on Information Retrieval (ECIR 2024).

Our methodology introduces a cross-encoder architecture to fine-tune a language model that can capture semantic relationships between queries and their retrieved documents, as well as the performance of past queries in a shared embedding space. This approach is based on the assumption that the performance of a query tends to correspond with the performance of its similar queries. To evaluate our model, we conducted extensive experiments on the MS MARCO dataset and TREC Deep Learning Tracks (2019-2021, DL-Hard). Our results demonstrate that our approach significantly outperforms existing QPP methods, including state-of-the-art supervised models like BERT-QPP and qpp-BERT-PL, across multiple correlation metrics such as Pearson (ρ), Kendall (τ), and Spearman (ρ), our approach consistently outperforms competitive baselines, demonstrating both robustness and reliability across various datasets. These findings underscore the importance of incorporating contextualized query representations for improving QPP accuracy and provide a foundation for further research in this area.

References

[1] S. Ebrahimi, M. Khodabakhsh, N. Arabzadeh, E. Bagheri, Estimating query performance through rich contextualized query representations, in: European Conference on Information Retrieval, Springer, 2024, pp. 49–58. doi:10.1007/978-3-031-56066-8_6.

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