Exploring Argument Retrieval with Transformers

Team no: 24

Buddha Teja (201IT115)
Aditya Hegde (201IT105)
Vishruth M (201IT167)
Samyak Jain (201IT125)

Outline of Presentation

I. Introduction
II. Problem Statement and Objectives
III. Original methodology
IV. Proposed methodology
V. Work done
VI. Observed Results
VII. Benchmarking against Base paper.
VIII. Conclusion
IX. Individual Contribution
X. References

Introduction

- Retrieving documents from the currently available massive volumes of data now is an extremely difficult operation. Search engines and information retrieval systems now play a vital role in rapidly and effectively responding to consumers' inquiries due to the exponential rise of diverse web services and digital material. The meaning gaps between the user's query and the documents returned, which frequently lead to lost pertinent information and ineffective searches, are one of the enduring problems with these systems.

- This project seeks to enhance the precision of document retrieval by leveraging the power of natural language processing. Specifically, it aims to expand user queries using the transformer decodings and encodings to generate contextually relevant arguments and improve document retrievals efficiency and effectiveness. By addressing the semantic gap between user queries and retrieved documents, this project promises to elevate the search experience, ensuring that users receive more pertinent and valuable information in a streamlined manner.

Problem Statement

- Improving the efficiency and effectiveness of argument retrieval using Query Expansion and Embedding techniques

Research Objectives

1. Expanding the Query to identify the undiscovered meaning.
2. Ranking the arguments based on the User Requirements
3. Evaluating the results for argument retrieval

Original Methodology

- [1] In this paper three query expansion techniques namely, GPT decoding, BERT encoding and USE encoding were used for the argument retrieval for the modified query, after employing pre-processing techniques for the efficient document retrieval

- [2] In this paper lemmatized document and lemmatized title as search fields along with the weighted query expansion with synonyms to get the new results.

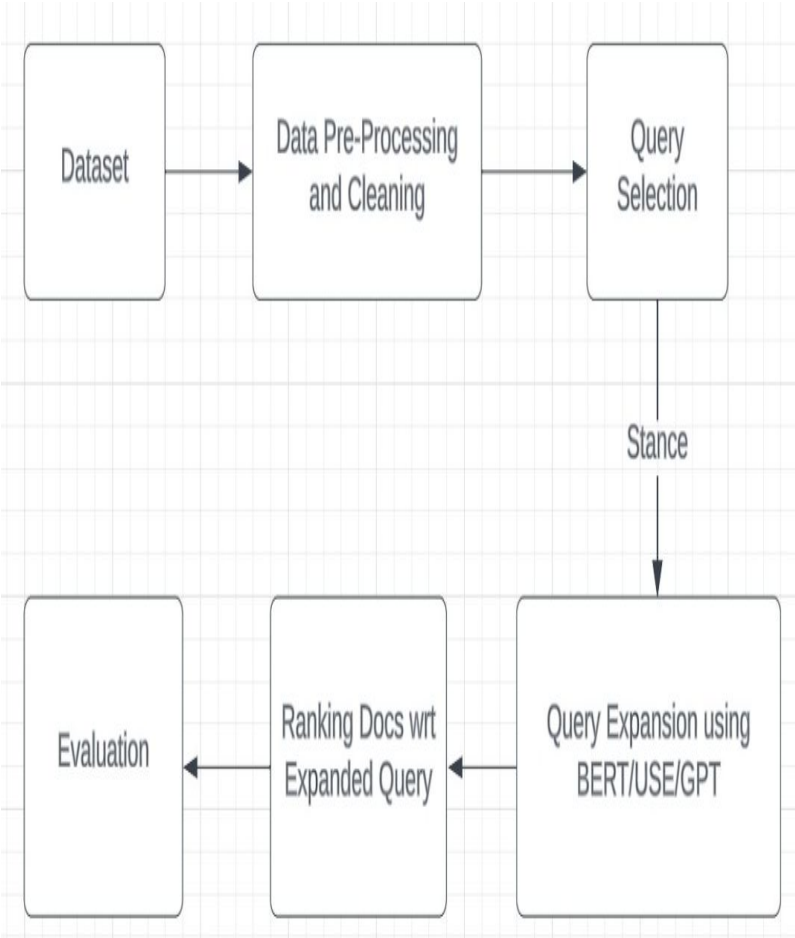
- [3] Here they proposed a pipeline where they used query expansion methods and merged query with their expanded query continued by use of scoring algorithms for ranking
- [4] Here In the retrieval process they extend the Lucene search core with an implementation of the DPH concept. This helped them improve the overall accuracy compare to the baseline model.

Original Methodology

- The Argument Retrieval of the documents is done by using both Query Expansion(BERT and GPT-2) and Embedding(USE) Techniques
- The modified query(query+stance) is defined and feed to model for query expansion
- GPT-2 expanded the query upto 100 tokens by auto regressively generating the text. BERT is used in predicting the possible word for the considered masks and then used in expanding the query
- USE is used in embedding the query and argument into a 512-dimensional space and their intermediate distance is used as a dis-similaity measure
- The documents similarities are measured with the queries and are ranked in a list of 5,10 and tested against the TIRA evaluation platform

Proposed Methodology

- We have worked on ranking the document w.r.t a single modified query and then aggregated it
- We have also used weight based ranking for the documents instead of plain ranking of the documents
- We have also induced some possible changes that were required in the query expansion of BERT
- We have tried different ranking functions for the query,document pairs
- We have defined an evaluation metric to understand on how good our AR pipeline is



Work done

- We have done the required data pre processing and visualization
- data is stored efficiently for dynamic retrieval
- We have manually improved the query
- We have used BERT and GPT-3 for query expansion
- We have implemented the sentence embeddings using the USE
- We have also worked on various similarity functions for the ranking of documents w.r.t queries
- We have manually collected the data required for GPT expansion
- We have defined our own evaluation metric on which the arguments that are generated are tested

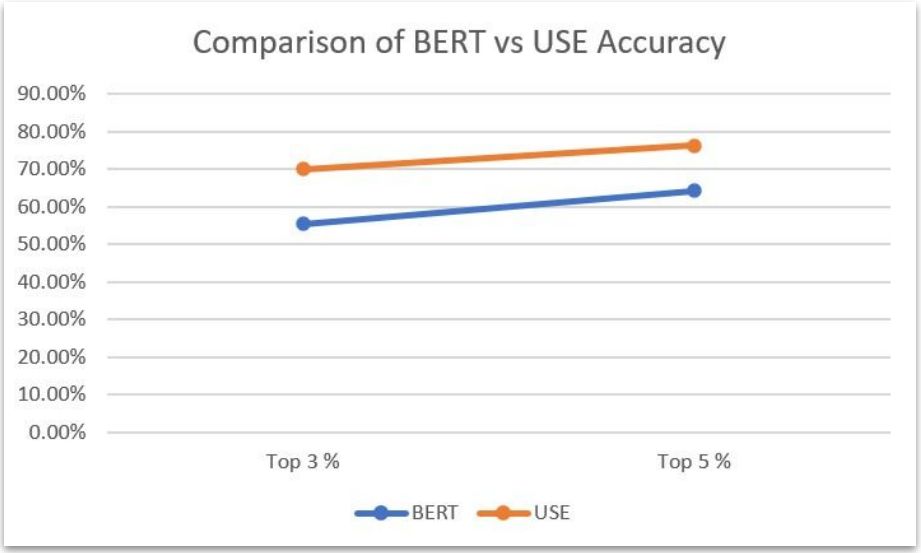
Results obtained with proposed methodology

Queries	% in Top 3	% in Top 5
250	59.37%	70.31%
500	53.62%	62.32%
1000	53.40%	60.22%

BERT Accuracy

Queries	% in Top 3	% in Top 5
250	76.56%	82.80%
500	67.39%	73.18%
1000	66.11%	72.08%

USE Accuracy



Comparison with Base paper's results

We could observe that the results are better while using the USE model than BERT model significantly for the dataset sizes that we have verified on which are around 250,500 and 1000 queries.

The base paper results for the USE were the lowest while BERT being next to the GPT, we could make use of USE for our data by extracting the semantic meaning of the query and thus improving the accuracy.

Conclusion

We have worked on different query expansion and Sentence embedding algorithms and evaluated the real-time argument retrieval performance for an online debate dataset.

We have experimented with algorithms on how exactly they impact the documents based on their parametrics like the size, number of queries related to them.

We could see that for our dataset the USE(Universal Sen- tence Encoder) model significantly outperformed the other models like BERT(Bi-directional Encoder Representation from Transformers)

Individual Contribution

- Buddha Teja :- Query Expansion + Sentence Embedding + Paper[1]
- Aditya Hegde :- Data Pre processing + Paper[4]
- Samyak Jain :- Ranking Functions + Paper[2]
- Vishruth M :- Evaluation & Result Analysis + Paper[3]

References

Base Paper

- [1] Christopher Akiki and Martin Potthast, ”Exploring Argument Retrieval with Transformers”, Notebook for the Touch´e Lab on Argument Retrieval at CLEF 2020.

- [2] Ekaterina Shirshakova, Ahmad Wattar , ”Thor at Touch´e 2021: Argument Retrieval for Comparative Questions” Notebook for the Touch´eLab on Argument Retrieval at CLEF 2021

- [3] ThiKim Hanh Luu, Jan-Niklas Weder, “Argument Retrieval for Comparative Questions based on independent features” Notebook for the Touch´e Lab on Argument Retrieval at CLEF 2021

- [4] Maximilian Bundesmann , Lukas Christ , and Matthias Richter , “Creating an Argument Search Engine for Online Debates” Notebook for the Touch´e Lab on Argument Retrieval at CLEF 2020