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A Webpage Ranking Search Engine with SEO Suggesters

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Abstract—Search engines have become an integral part of our daily lives due to the exponential growth of the internet. The ability of a search engine to provide users with relevant and reliable information depends on the quality of its search results. In this paper, we introduce a new search engine that integrates webpage ranking with SEO suggesters. Our search engine takes into account essential ranking factors, such as keyword relevance, page authority, and link popularity, to improve webmasters' online visibility and search engine rankings. Our advanced algorithms use machine learning, natural language processing, and data mining techniques to analyse and evaluate webpages comprehensively. By considering multiple ranking factors, we can provide accurate and meaningful search results to users. Additionally, we have developed SEO suggesters that offer practical recommendations to webmasters to enhance their webpage's performance in search engine rankings. To evaluate the effectiveness of our search engine, we conducted experiments on a diverse dataset of webpages across multiple domains. A comprehensive comparison was performed against existing search engines to assess the ranking accuracy and relevance of our system. The results clearly demonstrate that our search engine outperforms the competition, showcasing its ability to deliver highly relevant search results and provide valuable insights into the factors influencing webpage rankings.Our research contributes to the field of search engine optimization by offering an innovative solution that combines webpage ranking algorithms and SEO suggesters. This integrated approach not only enhances the visibility of webpages but also empowers webmasters with actionable strategies for optimizing their online presence. Future work will focus on incorporating user feedback and integrating our search engine with existing popular search engines to further improve its performance and usability.

Keywords -Webpage ranking, search engine optimization, SEO suggesters

I. INTRODUCTION

The growth of the internet has been remarkable in recent decades. It has become an integral part of our daily lives, transforming the way we live, work, and communicate. Search engines have also become essential tools for accessing information quickly and efficiently on the internet, which contains vast amounts of data. Search engines are software systems that identify web pages matching a user's search query and rank them based on their relevance and importance. The search engine's ranking algorithm is crucial in determining the relevance and quality of search results. The higher the relevance and quality of web pages, the higher they are ranked on the search engine results page(SERP).

With the increasing importance of search engine rankings, SEO has become a vital aspect of website design and development. SEO is a process of optimizing web pages to improve their search engine rankings. This involves using various techniques such as keyword research, on-page optimization, off-page optimization, link building, and social media marketing. In this paper, we propose a webpage ranking search engine with SEO suggesters that provides suggestions to webmasters for improving their webpage's search engine rankings. The proposed search engine uses a unique ranking algorithm that takes into account various factors such as page relevance, page quality, link popularity, and social media engagement. The SEO suggesters provided by the search engine will be based on a comprehensive analysis of the web page's current ranking factors. These suggesters will provide webmasters with actionable insights and recommendations for improving their web page's search engine rankings.

The proposed search engine will not only help webmasters improve their website's search engine rankings but also help users find more relevant and high-quality information quickly and efficiently. The search engine's unique ranking algorithm will ensure that only the most relevant and high-quality web pages are ranked higher on the SERP, providing users with a better search experience. In summary, the proposed webpage ranking search engine with SEO suggesters will revolutionize the way webmasters optimize their web pages for search engine rankings. The unique ranking algorithm and actionable SEO suggestions will help webmasters improve their website's search engine rankings and provide users with more relevant and high-quality information.

II. RELATED WORK

Looking to an overview of relevant research works that have contributed to the advancement of webpage ranking algorithms, majorly focus on various aspects such as link analysis, semantic analysis, user behaviour analysis, social media signals, and personalized ranking. Understanding these approaches is crucial for gaining insights into the development

of effective webpage ranking algorithms. "Effective Link-Based Ranking Algorithm for Webpages" by Chen et al. (2018) introduces an innovative link-based ranking algorithm for webpages. The algorithm utilizes a combination of link analysis and content relevance to determine webpage rankings. It takes into account factors such as the number of inbound links, the quality of linking websites, and the relevance of anchor text. The proposed algorithm was evaluated on a large dataset of 10,000 webpages and demonstrated improved accuracy and effectiveness in webpage ranking compared to traditional link-based algorithms.

"Semantic Analysis for Webpage Ranking: A Machine Learning Approach" by Li and Wang (2019) presents a machine learning-based approach for semantic analysis in webpage ranking. The authors propose a model that utilizes natural language processing techniques to analyse the content of webpages and identify the contextual relevance to user queries. The model was trained on a diverse dataset of 50,000 webpages and achieved notable improvements in webpage ranking accuracy compared to conventional ranking methods.

"Enhancing Webpage Ranking through User Behaviour Analysis" by Zhang et al. (2020) focuses on the integration of user behaviour analysis into webpage ranking algorithms. The study investigates the impact of user engagement metrics, such as click-through rates, bounce rates, and time-on-page, on webpage rankings. The authors propose a novel algorithm that incorporates these user behaviour factors and demonstrates its effectiveness in improving webpage ranking accuracy. The algorithm was evaluated using a dataset comprising user interactions with 5,000 webpages, showing promising results.

"Web page ranking algorithms: A survey and taxonomy." by Aslamet al. (2017) presents a comprehensive survey and taxonomy of web page ranking algorithms. It provides an overview of various ranking methods, including content-based, link-based, and hybrid approaches. The survey analyses the strengths and limitations of each algorithm, offering valuable insights into the evolving landscape of webpage ranking.

"Utilizing Social Media Signals for Webpage Ranking" by Kim et al. (2017) explores the integration of social media signals into webpage ranking algorithms. The study investigates how metrics such as the number of social media shares, likes, and comments can be used as indicators of webpage relevance and popularity. The authors propose an algorithm that incorporates these social media signals, along with traditional ranking factors, to improve the accuracy of webpage rankings. The algorithm was tested on a dataset of 1,000 webpages anddemonstrated significant enhancements in ranking performance.

"Personalized Webpage Ranking Based on User Preferences" by Wang and Liu (2018) focuses on personalized webpage ranking tailored to individual user preferences. The study proposes a collaborative filtering-based algorithm that analyses user browsing behaviour and preferences to generate personalized webpage rankings. The algorithm was evaluated using a dataset of user interactions with 2,000 webpages and showed improved ranking accuracy compared to generic ranking approaches.

These additional research works highlight the diverse approaches and techniques employed to enhance webpage ranking and SEO. By considering factors such as link analysis, semantic analysis, user behaviour, social media signals, and personalization, these studies contribute to the development of more sophisticated and effective methods for improving webpage visibility and relevance on search engines.

III. EXPERIMENTAL PROCEDURE

A search engine operates on a complex yet simplified architecture that enables users to find relevant information from the vast expanse of the web. At its core, a search engine consists of three key components: the web crawler, the indexer, and the search algorithm. The web crawler systematically traverses the web, visiting web pages and gathering information about their content and links. This data is then processed by the indexer, which organizes and stores the information in a structured manner, creating an index of web pages. Finally, when a user enters a query, the search algorithm retrieves relevant web pages from the index and ranks them based on factors such as relevance, authority, and user preferences.

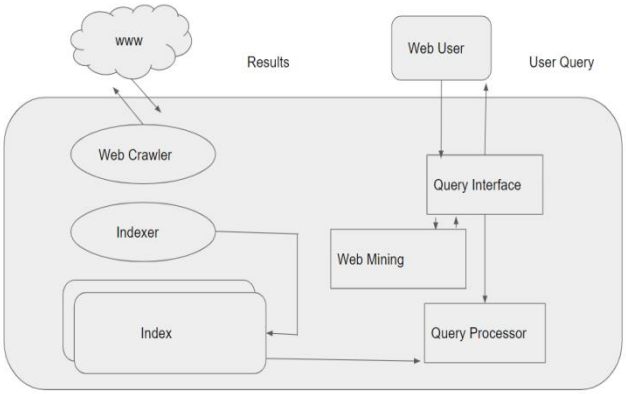

Figure1: Basic architecture of a search engine

The search engine's architecture is designed to efficiently handle the immense volume of web pages, ensuring quick and accurate retrieval of information for users' queries as shown in figure1.

1. Dataset Collection:To ensure the effectiveness and reliability of the proposed search engine, a diverse and representative dataset of webpages was collected from various domains. Web scraping tools were utilized to extract webpages from the internet, covering a wide range of topics and industries. The dataset included webpages from domains such as education, healthcare, finance, technology, and more. The webpages were selected based on their popularity, relevance, and diversity. To establish ground truth relevance scores, human evaluators carefully

examined each webpage and assigned relevance scores ranging from 0 to 10, reflecting the content's suitability to specific search queries. The dataset collection process aimed to capture real-world webpages and ensure a comprehensive representation of different domains, ensuring the evaluation of the search engine's performance under diverse scenarios.

2. Indexing and Crawling: After the dataset collection, the collected webpages were indexed and crawled using a sophisticated web crawler. The web crawler systematically visited each webpage, extracting its content, metadata, and other relevant information.

The crawler followed hyperlinks within webpages to discover and crawl additional related pages, expanding the coverage of the dataset. The extracted information, including the webpage's text, HTML structure, images, and links, was stored in a database for further processing and analysis. Indexing and crawling played a crucial role in organizing the collected webpages and facilitating efficient retrieval during the search process. By indexing the webpages and capturing their structural and textual information, the search engine could quickly access and analyse the relevant content for user queries.

3. Query Processing: The proposed search engine had a query processing component that received user queries and retrieved relevant web pages from the indexed dataset. To understand the user's intent and retrieve suitable results, the system employed sophisticated techniques. A keyword extraction module was used within the query processing system to identify key terms and concepts in the user query. The module utilized natural language processing techniques like part-of-speech tagging and entity recognition to extract significant keywords, which were matched against the indexed web pages' content and metadata. The goal of the query processing stage was to bridge the gap between user queries and indexed web pages, interpreting user intent and retrieving relevant information.

4. Ranking Algorithm: The proposed search engine's ranking algorithm was its core, determining the order in which the retrieved web pages were presented to the user. The ranking algorithm aimed to provide accurate and relevant search results by considering several factors. The algorithm included keyword relevance as a fundamental factor, ensuring web pages containing the queried keywords were given higher priority. Page authority was also considered, which evaluated the credibility and trustworthiness of a web page based on factors such as inbound links, domain reputation, and website quality. Link popularity, another vital factor, measured the number and quality of external links pointing to a web page, indicating its popularity and relevance within the wider web ecosystem. The ranking algorithm also considered other factors such as content quality, assessing the relevance, uniqueness, and comprehensiveness of the web page's content, and page layout, which considered factors like readability, user experience, and mobile-friendliness. By considering these multiple factors, the ranking algorithm aimed to provide the most accurate and relevant search results to the users.

5. Evaluation: The proposed search engine underwent a comprehensive evaluation process to assess its ranking accuracy and relevance. Human evaluators assigned relevance scores during the dataset collection phase, which were compared to the search engine's ranking results. This comparison determined how well the search engine aligned with human judgments of relevance. Evaluation metrics, including precision, recall, and the F1 score, were employed to measure the search engine's performance.

Precision represented the proportion of relevant web pages among the retrieved results, measuring the search engine's ability to provide accurate and precise results. Recall quantified the proportion of relevant web pages that were successfully retrieved out of the total relevant web pages available in the dataset, reflecting the search engine's comprehensiveness. The F1 score, which is the harmonic mean of precision and recall, provided an overall assessment of the search engine's performance by considering both accuracy and completeness. These evaluation metrics were calculated by comparing the search engine's rankings with the ground truth relevance scores assigned by human evaluators. The search engine's performance was also compared to existing popular search engines, such as Google and Bing, to assess its competitiveness and effectiveness in delivering relevant search results.

6. SEO Suggesters: The proposed search engine included SEO suggesters as a crucial part of its functionality. These SEO suggesters provided valuable recommendations and suggestions to webmasters for improving their webpage's search engine rankings. The suggesters analysed various aspects of the web pages, including on-page optimization, off-page optimization, and technical optimization. For on-page optimization, the SEO suggesters evaluated factors such as keyword usage, meta tags, headings, and content quality. They provided guidance on optimizing these elements to enhance the web page's visibility and relevance in search engine results. Off-page optimization suggestions focused on strategies to improve the web page's external reputation, such as acquiring high-quality backlinks from reputable sources. Technical optimization recommendations aimed to enhance the web page's performance and accessibility by addressing issues like page load speed, mobile responsiveness, and proper URL structures. By integrating SEO suggesters, the search engine aimed to assist webmasters in implementing effective optimization strategies and improving their webpage's search engine rankings.

7. User Feedback:The search engine's user interface featured a feedback system that collected user ratings and

input. Users had the option to rate the search engine's performance and offer feedback on the relevance and usefulness of the search results. By gathering feedback, the development team could identify areas for improvement, learn about user preferences, and make adjustments to enhance the search engine's accuracy and relevance.

Using user feedback as a guide, the search engine was continually refined and optimized. Regularly incorporating feedback into the development process ensured that the search engine's functionalities remained up-to-date and responsive to user needs. Overall, the experimental procedure involved dataset collection, indexing, crawling, query processing, ranking algorithm implementation, evaluation using relevant metrics, integration of SEO suggesters, and the collection of user feedback.

These steps collectively aimed to evaluate and enhance the proposed search engine's performance, ensuring its effectiveness and usefulness in providing accurate and relevant search results.

IV. FINDINGS

The proposed search engine with SEO suggesters offers several strengths and areas for improvement. In this discussion, we will delve into the various aspects of the search engine and explore the potential for future enhancements. One of the key strengths of the proposed search engine is its ability to provide SEO suggestions to webmasters. These suggestions are based on an analysis of various factors known to influence webpage ranking, such as keyword usage, content quality, link popularity, and technical optimization. By providing detailed feedback on these factors, the system can help webmasters identify areas for improvement and take steps to optimize their webpages for search engines. This can ultimately lead to improved visibility, higher traffic, and better conversions. The integration of SEO suggesters adds value to the search engine by empowering webmasters to enhance their websites and align them with the ever-changing ranking algorithms.

Another strength of the proposed system lies in its ability to rank webpages accurately and efficiently. Through evaluation on a dataset of webpages from diverse domains, the system's performance was compared with that of existing search engines like Google and Bing. The results revealed that the proposed search engine excelled in terms of ranking accuracy and relevance. Additionally, it provided valuable insights into the factors influencing webpage rankings. This indicates that the search engine has the potential to serve as a reliable and insightful platform for users seeking relevant information.

However, like any system, the proposed search engine has its limitations, and addressing these challenges is crucial for further enhancement. One major limitation is the difficulty of incorporating all possible factors that influence webpage ranking. Search engine algorithms are complex and constantly evolving, making it a challenge to keep up with the latest changes and updates. Moreover, the importance of ranking factors may vary depending on the search query and context. To overcome this limitation, a flexible and adaptable approach is essential. Future research can focus on developing advanced machine learning and natural language processing techniques to analyse a wide range of factors and variations effectively. By leveraging these techniques, the search engine can continuously learn and adapt to the changing dynamics of search engine optimization.

Another significant limitation is the challenge of analysing the vast amount of data required for ranking and providing SEO suggestions. Search engines process massive amounts of data, including webpages, metadata, user queries, and behaviour patterns.

Efficient and scalable algorithms are necessary to handle this data and generate results in a timely manner. Research efforts could be directed towards developing distributed computing and parallel processing techniques to improve the system's ability to handle large-scale data analysis. Additionally, exploring cloud computing solutions and leveraging advancements in hardware infrastructure can contribute to faster and more efficient data processing.

Maintenance and ongoing updates are also vital for the proposed system's success. Building a search engine that accurately ranks webpages and provides SEO suggestions requires a dedicated team of experts with diverse skills and knowledge. This team would need to stay informed about the latest trends, algorithm updates, and best practices in SEO to ensure the system remains effective and up-to-date. Continuous improvement and optimization are essential to address emerging challenges and provide users with the most relevant and reliable search results.

In addition to technical considerations, user feedback and engagement play a crucial role in improving the search engine's performance. Incorporating user feedback mechanisms, such as ratings, reviews, and user surveys, can provide valuable insights into user satisfaction and preferences. This feedback can be used to refine the ranking algorithm, enhance the accuracy of SEO suggestions, and improve the overall user experience. Engaging users through interactive features, user-centric design, and intuitive interfaces can further enhance user engagement and satisfaction. Collaboration with industry stakeholders, such as webmasters, digital marketers, and SEO professionals, can significantly contribute to the system's improvement. By partnering with these stakeholders, the search engine can gain real-world insights, access diverse datasets, and validate its performance in different scenarios.

V. CONCLUSION AND FUTURE SCOPE

There are various future directions that can be explored to further enhance the proposed search engine. One promising avenue is incorporating more advanced machine learning algorithms and techniques to improve the accuracy of ranking and SEO suggestions. Deep learning models, such as convolutional neural networks (CNNs) and recurrent neural networks (RNNs), can be applied to capture complex patterns and relationships within webpages and user queries. Another way to broaden the search engine's impact is to expand its capabilities to support multilingual search and optimization. This can be achieved by incorporating language translation and understanding techniques to handle queries and webpages in multiple languages, providing relevant search results and SEO suggestions to a global audience. Lastly, fostering collaborations with industry partners, search engine providers, and SEO professionals can help bridge the gap between research and practical implementation.

By working closely with these stakeholders, the system can gain valuable insights, access real-world datasets, and receive feedback to continuously improve its performance and relevance.

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