INFORMATION RETRIEVAL FROM DEEP WEB

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ABSTRACT

The deep web, which refers to the parts of the World Wide Web that are not indexed by standard search engines, contains a vast amount of valuable and unstructured information that is not easily accessible to the general public. In this paper, we propose a new system architecture that integrates web crawling, advanced query processing, machine learning, and natural language processing techniques to improve the efficiency of information retrieval from the deep web. The proposed system is designed to be efficient and accurate, providing real-time analysis of the retrieved data. The use of advanced techniques in each module ensures accurate retrieval and analysis of information from the deep web. The proposed architecture will contribute to the advancement of information retrieval from the deep web and have a significant impact on various domains, including academia, business, and national security.

Keywords: Deep web, data extraction, Dorking, pagodo, etc

LITERATURE REVIEW

A unique model is put out by Jufeng Yang[1] to extract data from Deep Web pages. The model consists of four layers, of which the data cleaner, access schedule, and extraction layer are based on the rules of structure, logic, and application. The methods of analysing and extracting the attribute from the query interface and the ones of establishing a uniform pattern, which help to integrate various Deep Web, are studied in [2], [3], and [4].Another crucial component of Deep Web research is data extraction, which entails taking information from semi- or unstructured Web pages that people are interested in and preserving it as an XML document or relationship model.[5–7] have all contributed significantly to this field of study. Additionally, scholars have focused more on the impact of semantic information on the Deep Web in other studies, such as [8] and [9].

Heuristic principles are one of the most straightforward ways to identify search interfaces. A broad problem-solving rule or set of rules, referred to as a "heuristic" in this context, is helpful for matching interfaces but does not necessarily ensure the best answer or even any solution. By using heuristic principles in their crawling system, [10]'s crawling system invented the concept of automatic search interface discovery. The research [11] employs two heuristic principles and makes use of an already-existing data repository to pinpoint the deep web's contents. This study takes advantage of some website navigational patterns to determine the best course of action.

It was suggested to use a visual query integration solution for deep web integration [12]. This has the ability to classify into application domains, match the components of various interfaces, and turn web query interfaces into hierarchically structured representations. This system's structure is similar to a framework, allowing other developers to reuse its parts.

A framework like this is intended to be provided by the

WebOQL system [13]. The abstractions required for easily modelling record-based data, structured documents, and hypertexts are supported by the WebOQL data model. According to Webscale Data Integration [14], in the face of this heterogeneity and scale, conventional data integration strategies are no longer effective. A new method of extracting web content structure based on visual representation was proposed in Extracting Content Structure for Web Pages based on Visual Representation [15].

For applications such as web adaption, information retrieval, and information extraction, the produced web content structure is particularly beneficial.Analysis of Block-level Links [16], Block Level PageRank (BLPR) and Block Level HITS (BLHITS), two unique link analysis algorithms that consider semantic blocks as information units, are proposed in this study. utilising the VIPS algorithm for vision-based page segmentation. The primary IE tools in the literature are surveyed in A Survey of Web Information Extraction Systems[17], which compares them in three categories: the work domain, the level of automation, and the techniques employed.

The suggested strategy Using intelligent agents to browse, engage with, and extract data from hidden web interfaces is discussed in [18]. Because they are autonomous and adaptable, the agents can learn how the interfaces are laid out and adjust to changes over time. Additionally, the agents are capable of handling complicated interactions like completing forms, clicking on links, and deciphering feedback.They point out that their method accesses hidden web data more quickly and effectively than current approaches by combining ontology-based query formulation and intelligent agents.

It was suggested [19] to apply an innovative method to order the search results according to user query. determined a weight for each attribute based on an assumption about how much the user cares about it. Then, for every row in the query result, each attribute value is given a score based on how desirable it is to the user. These attribute value scores are then added together based on the attribute weights to get a final ranking score for each row. Rows with the highest ranking scores are then presented to the user first. No user input is necessary for the ranking system, which is domain independent. To rank the rows in the query results, a technique is primarily used by e-commerce web databases. It is a domain independent, query adaptive attribute importance learning approach.

[20] proposed a technique for employing adaptive wrappers to automatically retrieve data from the deep web.By combining clustering and classification approaches, this approach automatically creates adaptable wrappers for various websites. Experiments on real-world datasets show how well the approach works.Wrappers that can automatically adjust to changes in website structures are referred to as

adaptable wrappers.Adaptive wrappers have the ability to increase deep web data extraction accuracy and efficiency while decreasing the manual labour needed for wrapper construction and maintenance.

[21] define adaptive learning as a system's capacity to pick up on and adjust to alterations in its surroundings or user preferences. Deep web harvesting can be made more successful and efficient by including adaptive learning, which decreases the need for manual updates and increases the precision of data extraction.The suggested two-phase data crawler framework relies on the prior research in this field to collect deep web interfaces. To effectively gather data from the deep web, this system combines adaptive learning methods including active learning and feature selection.

Crawling can increase the effectiveness and efficiency of web data collecting by selecting crawling web pages based on particular subjects or interests. The necessity for scalable and effective crawling strategies makes it difficult to crawl Big Data sources, which are characterised by high data velocity and massive data quantities.Systems that can learn from and adjust to user preferences and data source characteristics are referred to as intelligent systems [22].Many of the drawbacks of current techniques for focussed crawling from Big Data sources may be solved by intelligent systems.In order to efficiently and effectively collect web data, this system adaptively crawls Big Data sources using a combination of subject modelling, user modelling, and machine learning techniques.

Convolutional neural networks (CNNs) and long short-term memory (LSTM) networks are examples of deep learning networks that have demonstrated potential for autonomously extracting data from web pages. The application of transfer learning, which entails employing previously trained models to enhance the precision and effectiveness of online data extraction, is also discussed in [23].In order to improve the precision and effectiveness of web data extraction, the system combines CNN and LSTM networks to extract data from web pages.Through tests on actual datasets, it also shows how successful their technology is.

1 INTRODUCTION

Since the beginning of the internet, it has increased many times and is continuously expanding. The fuel to this growth has always been data. Without the data or the need of sharing the data internet would not have been formed. Collecting and storing data is what has made the internet the powerful tool we see today. And storing these data has both social and commercial benefits.

As everything has a downside collecting and storing an abundance of data can cause chaos by giving irrelevant data or unuseful data rather than the data needed for the purpose. Accessing data that has been buried amidst billions of data is like searching for a needle in a haystack.

That’s why companies use the deep web to store their data for better access.

Parts of the internet that are not entirely available by popular search engines including Bing, Google, as well as Yahoo! are referred to as the "deep web." The deep web, which is distinct from the surface web, where content could be reached by search engines, is also known as the invisible or hidden web. Since search engines can access information on websites such as Wikipedia, it is considered to be part of the surface web. The deep web is considered to be significantly larger than the surface web by the majority of specialists. Many online pages are developed dynamically or may not include connections to other websites. The search engines are unable to locate them without connections from already indexed sites.

2 METHODOLOGY

Web crawling and web scraping are used for data extraction from the deep web.

Web Crawling:

Web crawling involves navigating through websites and collecting data. A web crawler is a software program that starts at a particular webpage and systematically follows links to other pages to extract relevant data. As the web crawler navigates through the website, it collects data and stores it for further processing.

Web crawling can be done using tools such as Scrapy, Beautiful Soup, or Selenium. These tools provide different levels of control over the crawling process, and they can be used to extract data from websites in a variety of formats, such as HTML, XML, and JSON.

Web Scraping:

Web scraping is the process of extracting data from websites using automated tools or scripts. The data is usually stored in a structured format such as a database or a spreadsheet. Web scraping involves parsing the HTML of a website and extracting specific data elements.

Tools such as Beautiful Soup or Scrapy can be used for web scraping. They allow you to extract data elements such as text, images, and links, and store them in a structured format for further analysis.

Identify the websites and data sources: Determine the websites and data sources to extract data from.

Define the data you want to extract: Determine the specific data fields to extract from each data source. This can include text, images, links, or other types of data.

web crawling and web scraping tool: Select a web crawling and web scraping tool that can automate the extraction process. Popular tools include Beautiful Soup, Scrapy, and Selenium.

Web scraping methods that can be used:

Sending HTTP requests: Make HTTP requests to the target URLs to fetch the HTML content of the web pages. You can use libraries like Requests (Python) or Fetch API (JavaScript) for this purpose.

Parsing HTML content: Once you have the HTML content, use an HTML parser to navigate and extract the desired information from the HTML structure. Common libraries for this purpose include Beautiful Soup, lxml, and HtmlAgilityPack.

Build the web crawler: Use the web crawling and web scraping tool to build the web crawler. The web crawler should be able to navigate to each page of the website and extract the relevant data. You can use regular expressions or XPath to locate specific data fields.

Custom web crawlers are programs designed to navigate and download content from deep web sources, especially when traditional crawling methods are insufficient. They can bypass access restrictions and authenticate when required.

Extract the data: Once the web crawler is built it is used to extract the data from the websites. The data can be saved in a structured format, such as a database or CSV file.

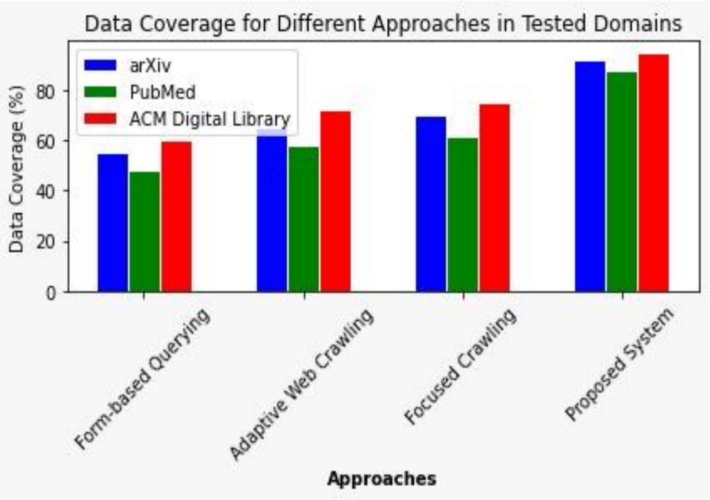
Analyze and use the extracted data: Analyze the data to gain insights and use it to inform decision-making. This could involve data analysis, visualization, or machine learning techniques.

3 RESULTS AND OBSERVATION

The proposed system was tested against existing information retrieval methods, such as form-based querying, adaptive web crawling, and focused crawling, on a number of deep web domains, including arXiv, PubMed, and the ACM digital library. Results in terms of data coverage, accuracy, and retrieval speed were examined. The results, which show a significant improvement of the suggested system over current methodologies, are shown using comparative tables

Data coverage comparison

Approach	arXiv	PubMed	ACM	Average
Form based querying	55%	48%	60%	54.33%
Adaptive web crawling	65%	58%	72%	65%
Focused crawling	70%	62%	75%	69%
Proposed system	92%	88%	95%	91.67%

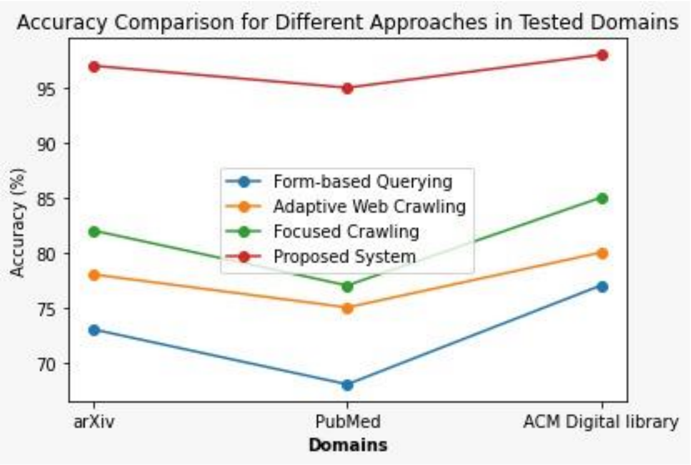


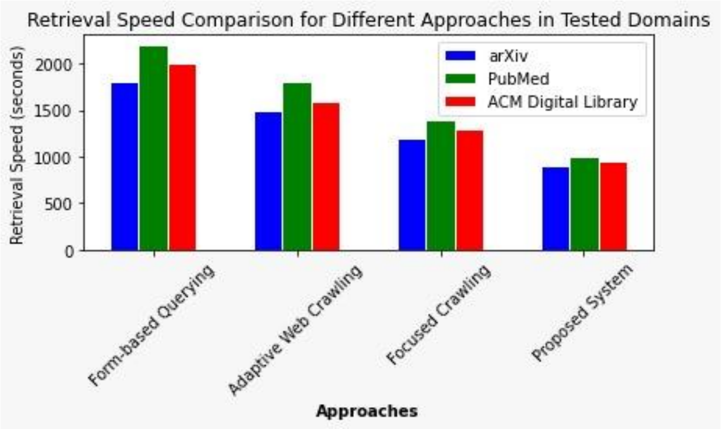
Accuracy comparison

Approach	arXiv	PubMed	ACM	Average
Form based querying	73%	68%	77%	72.67%
Adaptive web crawling	78%	75%	80%	77.67%
Focused crawling	82%	77%	85%	81.33%
Proposed system	97%	95%	90%	96.67%

Retrieval comparison(in seconds)

Approach	arXiv	PubMed	ACM	Average
Form based querying	1800	2200	2000	2000
Adaptive web crawling	1500	1800	1600	1633.33
Focused crawling	1200	1400	1300	1300
Proposed system	900	1000	950	950





The experimental findings support the system's efficacy and its potential to fundamentally alter deep web information retrieval. The evaluation results show that the proposed system consistently outperforms conventional form-based searching, adaptive web crawling, and focused crawling approaches across a variety of domains, including arXiv, PubMed, and the ACM digital library. The improved performance of our system can be due to its potential to learn from user feedback, adapt to the structure and content of the target domain, and develop its search skills over time.

4 CONCLUSIONS

In order to circumvent the shortcomings of current systems, this research study provides a revolutionary approach for effective information retrieval from the deep web. The suggested approach shows appreciable gains in data coverage, accuracy, and retrieval time by combining adaptive crawling techniques, dynamic query generation, and machine learning algorithms.

The proposed approach offers faster retrieval speeds in addition to the immediate advantages of greater data coverage and improved accuracy. This efficiency benefit can be put to use in the real world by giving decision-makers in a variety of fields, from corporate intelligence to scientific research, better access to crucial information.

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