ISSN: 2277-9655
(I2OR), Publication Impact Factor: 3.785
(ISRA), Journal Impact Factor: 2.114

IJESRT

INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY

THE CONCEPTION OF INTEGRATING MUTITHREDED CRAWLER WITH PAGE RANK TECHNIQUE :A SURVEY

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ABSTRACT

Web Crawler also well-known as "Web Robot", "Web Spider" or merely "Bot" is software for downloading pages from the Web by design. Contrasting what the name may propose, a Web crawler does not in reality stir around computers connected to the Internet –as viruses or intelligent agents do– but only sends requests for documents on Web servers. The input to this software is starting or seed page. As the volume of the World Wide Web (WWW) grows, it became essential to parallelize a web crawling process, with the intention of finish downloading pages in a rational amount of time. Web crawler which employs multi-processing to permit multiple crawler processes running in concurrent manner. There are a lot of programs out there for web crawling but it required a WebCrawler that allowed trouble-free customization. In this paper we have discussed on crawling technique and how Page Rank can increase the efficiency of web crawling.

KEYWORDS: WWW, Bot, Spider.

INTRODUCTION

Web crawler is a web service that assists users in their web navigation by automating the task of link traversal, creating a searchable index of the web, and fulfilling searchers' queries from the index. That is, a web crawler automatically discovers and collects resources in an orderly fashion from the internet according to the user requirements. Different researchers and programmers use different terms to refer to the web crawlers like aggregators, agents and intelligent agents, spiders, due to the analogy of how spiders and crawlers traverses through the networks, or the term (robots) where the web crawlers traverses the web using automated manner.

Internet would have not become so popular if search engines would not have been developed. Starting in 1994, a number of search engines were launched, including AltaVista, Excite, Infoseek, Inktomi, Lycos, and of course the evergreen, Yahoo and Google. Most of these search engines save a copy of the web pages in their central repository and then make appropriate indexes of them for later search/retrieval of information. User interface, Query engine, Indexer, Crawlers and Repository are the basic components of search engines.

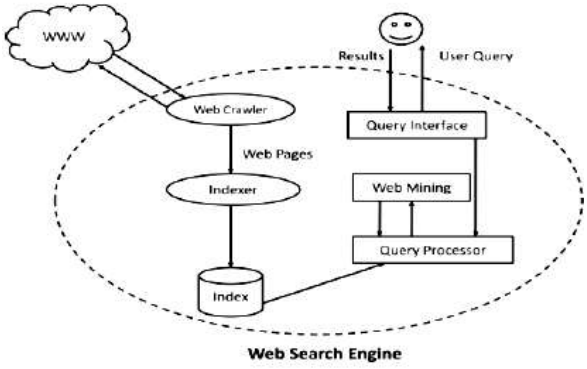

Fig. 1: Working of Search Engine

ISSN: 2277-9655
(I2OR), Publication Impact Factor: 3.785
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The remainder of this paper is organized as follows: Section 2 provides a brief review of the web crawlers and page rank and illustrates literature survey. In Section 3, we drew the attention towards problems in existing systems. In section 4 finally, we concluded our work.

BACKGROUND

A crawler also popularly known as spider or robot is a program which visits Web servers spread across the world irrespective of their geographical locations, downloads and stores Web documents on a local machine mostly on behalf of a Web Search Engine. A web crawler is a program that retrieves and stores web pages from the Web. A web crawler starts off by placing an initial set of URLs in a seed queue. The web crawler gets a URL from the seed queue, downloads the web page, extracts any URLs in the downloaded page, puts the new URLs in the seed queue, and gets the next URL from the seed queue. The web crawler repeats this crawling process until it decides to stop.

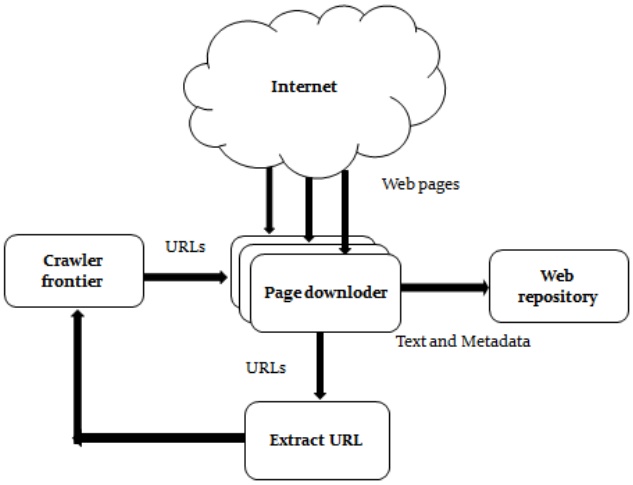

Fig. 2: Working of Search Engine

Working of Web Crawler

Figure 2 shows the generalized architecture of web crawler. It has three main components: a frontier which stores the list of URL's to visit, Page Downloader which download pages from WWW and Web Repository receives web pages from a crawler and stores it in the database. Here the basic processes are briefly outline.

Crawler frontier

It contains the list of unvisited URLs. The list is set with seed URLs which may be delivered by a user or another program [16]. Simply it's just the collection of URLs. The working of the crawler starts with the seed URL. The crawler retrieves a URL from the frontier which contains the list of unvisited URLs. The page corresponding to the URL is fetched from the Web, and the unvisited URLs from the page are added to the frontier [17]. The cycle of fetching and extracting the URL continues until the frontier is empty or some other condition causes it to stop. The extracting of URLs from the frontier based on some prioritization scheme [15].

Page downloader

The main work of the page downloader is to download the page from the internet corresponding to the URLs which is retrieved from the crawler frontier. For that, the page downloader requires a HTTP client for sending the HTTP request and to read the response. There should be timeout period needs to set by the client in order to ensure that it will not take unnecessary time to read large files or wait for response from slow server. In the actual implementation, the HTTP client is restricted to only download the first 10KB of a page. [8].

Web repository

It use to stores and manages a large pool of data "objects," [12] in case of crawler the object is web pages. The repository stores only standard HTML pages. All other media and document types are ignored by the crawler [21]. It is theoretically not that different from other systems that store data objects, such as file systems, database management

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(I2OR), Publication Impact Factor: 3.785
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systems, or information retrieval systems. However, a web repository does not need to provide a lot of the functionality like other systems, such as transactions, or a general directory naming structure [12]. It stores the crawled pages as distinct files. And the storage manager stores the up-to-date version of every page retrieved by the crawler.

Types of Web Crawler

Focused Web Crawler
Focused Crawler is the Web crawler that tries to download pages that are related to each other [4][21]. It collects documents which are specific and relevant to the given topic [7][14]. It is also known as a Topic Crawler because of its way of working [4][17]. The focused crawler determines the following – Relevancy, Way forward. It determines how far the given page is relevant to the particular topic and how to proceed forward. The benefits of focused web crawler is that it is economically feasible in terms of hardware and network resources, it can reduce the amount of network traffic and downloads [11]. The search exposure of focused web crawler is also huge [2] [9].

Incremental Crawler
A traditional crawler, in order to refresh its collection, periodically replaces the old documents with the newly downloaded documents. On the contrary, an incremental crawler incrementally refreshes the existing collection of pages by visiting them frequently; based upon the estimate as to how often pages change [21]. It also exchanges less important pages by new and more important pages. It resolves the problem of the freshness of the pages. The benefit of incremental crawler is that only the valuable data is provided to the user, thus network bandwidth is saved and data enrichment is achieved [22][27].

Distributed Crawler
Distributed web crawling is a distributed computing technique. Many crawlers are working to distribute in the process of web crawling, in order to have the most coverage of the web. A central server manages the communication and synchronization of the nodes, as it is geographically distributed [2]. It basically uses Page rank algorithm for its increased efficiency and quality search. The benefit of distributed web crawler is that it is robust against system crashes and other events, and can be adapted to various crawling applications [23].

Parallel Crawler
Multiple crawlers are often run in parallel, which are referred as Parallel crawlers [24]. A parallel crawler consists of multiple crawling Processes [24] called as C-procs which can run on network of workstations [25]. The Parallel crawlers depend on Page freshness and Page Selection [20]. A Parallel crawler can be on local network or be distributed at geographically distant locations [2].Parallelization of crawling system is very vital from the point of view of downloading documents in a reasonable amount of time [25].

Page Rank

PageRank[8] is a link analysis algorithm to measure the page relevance in a hyperlinked set of documents, such as the World Wide Web. This algorithm assigns a numerical weight to each document. This numerical weight is also called PageRank of the document. The PageRank of a web page represents the likelihood that a person randomly clicking will arrive at this page. The PageRank algorithms requires several iterations to be executed. At each iteration, the values will be better approximated to the real value. In its simplest form, PageRank uses the next formula for each web page at each iteration:

$$PR(u) = \sum_{v \epsilon Bu} PR(v)/L(v)$$

In Topic Sensitive PageRank [4], several scores are computed: multiple importance scores for each page under several topics that form a composite PageRank score for those pages matching the query. During the offline crawling process, topic-sensitive PageRank vectors are generated, using as a guideline the top-level category from Open Directory Project (ODP). At query time, the similarity of the query is compared to each of these vectors or topics; and subsequently, instead of using a single global ranking vector, the linear combination of the topic-sensitive vectors is

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weighed using the similarity of the query to the topics. This method yields a very accurate set of results relevant to the context of the particular query. With Topic Sensitive PageRank a set of ranking vectors are computed, as opposed to the single PageRank vector generated using standard PageRank. These vectors are biased using a set of representative topics, to capture the notion of importance with respect to a topic, indirectly specified through a user query and if available through user context also. Some of the related survey papers have been illustrated in the following table:-

S. No.	*Author*	*Title*	*Findings*
1.	A. Heydon and M. Najork. Mercator	"A scalable, extensible web crawler."	The work in this describes the general architecture of a Web crawler and studies how a crawler works. It describes the architecture of the Compaq SRC crawler and its major design goals. Some of these studies briefly describe how the crawling task is parallelized
2.	L. Page and S. Brin.	"The anatomy of a large-scale hypertextual web search engine."	It describes a crawler that distributes individual URLs to multiple machines, which download Web pages in parallel. The downloaded pages are then sent to a central machine, on which links are extracted and sent back to the crawling machines.
3.	J. Cho and H. Garcia-Molina	" Synchronizing a database to improve freshness"	Web crawlers need to update the downloaded pages periodically, in order to maintain the pages up to date. The studies in this discuss various page revisit policies to maximize the "freshness" of the downloaded pages. Studies how a crawler should adjust revisit frequencies for pages when the pages change at different rates.
4.	S. Chakrabarti, M. van den Berg, and B. Dom.	"Focused crawling: A new approach to topic-specific web resource discovery"	Since many crawlers can download only a small subset of theWeb, crawlers need to carefully decide what page to download. By retrieving "important" or "relevant" pages early, a crawler may improve the "quality" of the downloaded pages. The study in this category explore how a crawler can discover and identify "important" pages early, and propose various algorithms to achieve this goal.
5.	Md. Abu Kausar and V. S. Dhaka	"An Effective Parallel Web Crawler based on Mobile Agent and Incremental Crawling"	In this paper, a novel incremental parallel Web crawler based on focused crawling is proposed, which can crawl the Web pages that are relevant to multiple pre-defined topics concurrently. Furthermore, to solve the issue of URL distribution, a compound decision model based on multi-objective decision making method is introduced.
6.	Qiuyan HUANG	"Novel Incremental Parallel Web Crawler based on Focused Crawling"	This paper describes an incremental crawler downloads customized contents only from the web for a search engine, thereby helps falling the network load. This network load farther will be reduced by using mobile agents. It is reported in the previous literature that the 40% of the current Internet traffic and bandwidth utilization is due to these crawlers.
7.	Nidhi Grover, Ritika Wason	Comparative Analysis Of Pagerank And HITS Algorithms	In this paper, author has compared two popular web page ranking algorithms namely: HITS algorithm and PageRank algorithm. The paper highlights their variations, respective strengths, weaknesses and carefully analyzes both these algorithms using simulations developed for both.
8.	Trupti V. Udapure, Ravindra D. Kale, Rajesh C. Dharmik	Study of Web Crawler and its Different Types	In this paper author has given The overview of different crawling technologies has been presented in this paper. When only information about a predefined topic set is required, "focused crawling" technology is being used. Compared to other crawling

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			technology the Focused Crawling technology is designed for advanced web users focuses on particular topic and it does not waste resources on irrelevant material.
9.	Pooja Sharma Deepak Tyagi Pawan Bhadana	Weighted Page Content Rank for Ordering Web Search Result	In this paper we focused that PageRank and Weighted PageRank algorithms are used by many search engines but the users may not get the required relevant documents easily on the top few pages. With a view to resolve the problems found in both algorithms, a new algorithm called Weighted Page Content Rank has been proposed which employs Web structure mining as well as Web content mining techniques. This algorithm is aimed at improving the order of the pages in the result list so that the user may get the relevant and important pages easily in the list.

In spite of this enormous amount of effort because of the commercial value of the developed applications, it is still not easy to obtain robust and customizable crawling software. There also exists a significant body of literature studying the general problem of parallel and distributed computing. Some of these studies focus on the design of proficient parallel algorithms.

PROBLEM IDENTIFICATION

A search engine is the most popular information retrieval tool. For making efficient IR tool there is need of valuable and swift crawler which having the following objectives:

1. It should download & explore web documents from WWW as much as possible.
2. It should bring high quality documents so that the user gets the required pertinent information within satisfactory time.
3. The documents must be displayed in the order of their relevance with regard to the user query.
4. As the web documents are very much active in nature, search engine should update its repository as frequently as possible. The ideal case would be of synchronizing updation of repository with the web document's tangible change frequency.

To assure the first objective i.e. to cover the Web as much as possible, nowadays search engines do not depend on a single but on multiple crawlers that execute in parallel to achieve the target. While working in parallel, crawlers still face many challenging problems such as overlapping, quality and network bandwidth that need to be addressed.

Overlap: download the same page multiple times.

→ Need to coordinate between the processes to minimize overlap.
→ To save network bandwidth and increase the crawler's effectiveness.

Quality: download "important" pages first.

→ To maximize the "quality" of the downloaded collection.
→ Each process may not be aware of whole web image, and make a poor crawling decision based on its own image of the web.
→ Make sure that the quality of downloaded pages is as good for a parallel crawler as for a centralized.

Communication bandwidth: to prevent overlap and improve quality.

→ Need to periodically communicate to coordinate.
→ Communication grows significantly as number of crawling processes increases.
→ Need to minimize communication overhead while maintaining effectiveness of crawler.

There are some advantage of parallel crawler which are as follows:
Scalability:

→ Due to enormous size of the web, it is imperative to run a parallel crawler.
→ A single-process crawler simply cannot achieve the required download rate.

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Network-load dispersion:

→ Multiple crawling processes of a parallel crawler may run at geographically distant locations, each downloading "geographically-adjacent" pages.
→ It can disperse the network load to multiple regions.
→ Might be necessary when a single network cannot handle the heavy load from a large-scale crawl.

Network-load reduction:

→ A parallel crawler may actually reduce the network load.
→ If a crawling process in Europe collects all European pages, and another in north America crawls all north American pages, the overall network load will be reduced, because pages go through only "local" networks.

Search engines employ ranking algorithms to meet second and third objectives mentioned above. Though back link count helps in professionally displaying the documents in the order of their relevance, it fails to bring quality documents.

CONCLUSION

World Wide Web (WWW) is an enormously powerful resource. It contains a enormous amount of related and unrelated information. Hence, there is a great prerequisite to have algorithms that could list relevant web pages accurately and efficiently on the top of few pages. In spite of the vast amount of both theoretical and practical research on information retrieval, the search problem is still far from being solved. Crawlers are being used more and more often to collect Web data for search engine, caches, and data mining. In this work, we aimed to put just another small brick into the wall of research on web crawling.

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