The Hidden Web Crawlers: A Comparative Study of Evolutionary Crawling Methodology

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Abstract- A large amount of WWW data is still inaccessible to web search engine crawlers because it can only be requested when users fill out and submit forms. The Hidden Web refers to web data collection, which can only be accessed by the web browser through an interaction with the web- based search form and not simply through hyperlinks. Research on the Hidden Web was launched almost a decade ago to explore ways of accessing content in online databases usually hidden behind search forms. The main focus of the efforts in the area is to design hidden web crawlers that focus on learning forms and fill them with meaningful values. The paper provides an insight into the different Hidden Web crawlers developed to mention the advantages and shortcomings of each technique.
Keywords – WWW, Surface Web, Hidden Web, Deep Web, Crawler, search form, Surfacing, Virtual Integration.

I. INTRODUCTION

Greater part of the Internet clients rely upon the utilization of web indexes like Google, Yahoo, and Bing and so on to discover the data on the Web. The vast majority of these web crawlers give passage just to the Surface Web, which is a piece of the Web that can be found by following hyperlinks and downloading the depictions of pages for incorporating them in the internet searcher's file [1]. The outcomes given by the web crawler are situated in this duplicate of its nearby list. Maybe a significantly bigger measure of data is accessible in the Hidden Web, which is a piece of the WWW that can't be found by basically following the hyperlinks. A straightforward case of this substance incorporates the organized databases like item or online library indexes, satellite pictures that are offered via seek sites which can be gotten to by presenting a hunt shape. Another class of concealed Web content incorporates the dynamic information given by web applications which give constant data dependent on a specific client ask for like the online travel organizers or booking frameworks. A similar demand when issued at various occasions result in various data. Despite the fact that, these sites may give a hyperlink structure to the database things in order to suit Crawling by the crawlers intended for the surface web. In any case, this does not ensure that those web crawlers will have the current and refreshed data on costs and things in stock. Naturally, this noteworthy bit of the Web containing openly accessible data as electronic web databases is inadequately available by regular crawlers intended for broadly useful web crawlers. Hence, in the writing we have a significant class of crawlers that viably take a shot at recovering and getting to this concealed data in databases, named the Hidden Web Crawlers [3], [6], [12].

II. CHARACTERISTICS AND SCALE OF THE HIDDEN WEB

The Hidden Web gives access to tremendous and quickly developing information archives on the Web. A few creators have acquired approximations to its tremendous size: In 2001, an underlying investigation by Bergman showed the extent of the information in the Hidden Web to be around multiple times the span of the information in the Surface Web which included upwards of 43,000-96,000 sites offering access to 7500 terabytes of information [1]. Afterward, in 2004, Chang et.al. Utilized an irregular IP testing way to deal with measure the Hidden web content in online databases and uncovered that the majority of the information in such databases is organized [15]. Further in 2007, Ben He et.al. by dissecting the rate cover between the most generally utilized web crawlers, for example, Yahoo!, Google and MSN found the quantity of such destinations to 236,000-377,000 with just 37% of the accessible substance being recorded by these web search tools [16]. Along these lines, as per specialists, the shrouded Web shapes the biggest developing class of new data on the Internet and contains:

Nearly 550 billion documents
Content high relevant to every information need, market and domain
Up to 2,000 time's greater content than that of the Surface Web.
95% publicly accessible information not subject to fees or subscription.
More focused content than Surface Web sites.

III. ACCESSING THE HIDDEN WEB

A client gets to the information in the Hidden Web by issuing an inquiry through the pursuit frame (an interface given by the Web website), which thus gives a rundown of connections to significant pages on the Web. The client at that point takes a gander at the acquired rundown and pursues the related connects to discover intriguing pages. These pursuit frames have been structured basically for human utilization however fill in as the main passage point to the Hidden Web, in this way should be displayed and handled. There are two fundamental ways to deal with this end:

Surfacing alludes to the crawler's movement of gathering out of sight however much applicable and fascinating part of the information as could reasonably be expected and refreshing the hunt motor's record. The Hidden Web crawler needs to consequently process the inquiry shapes subsequent to downloading it frame the concealed site and present the filled frame in order to download the reaction pages which would then be able to be utilized with existing list structures of the internet searcher. This methodology has the principle preferred standpoint of best fit with the ordinary internet searcher innovation. In spite of the fact that pre-figuring the most applicable frame entries for all fascinating HTML shapes is a testing issue yet is a detached errand that can be taken away line by the crawler when dynamic, autonomous of the run-time attributes of the concealed web assets. Along these lines, the methodology is direct and is effectively pertinent.

Virtual Data Integration which alludes to the production of an explicit virtual outline for every area and mapping the fields of the hunt shapes in that space to the qualities of the virtual blueprint. This empowers the client to question over every one of the assets in its space of intrigue just by filling a solitary hunt shape in the area. Pursuit frameworks utilizing such vertical diagram are called vertical web indexes. APIs are then used to get to Hidden Web sources at inquiry time and build the outcome pages based from the recovered reactions. As outside API calls should be made by the web index , the procedure depends on the execution of the Hidden Web sources, including access dormancy in this manner making it slower than customary Crawling or Surfacing .

The greatest test here is making and producing an interceded composition and the semantic mappings between individual information sources and the arbiter shape. The issue has been named as inquiry directing. Specifically, the inquiries on any web crawler ordinarily is a lot of catchphrases reformulating which requires distinguishing the applicable space of a question and properly directing the watchwords in the inquiry to the fields of the virtual outline that has been intended for the hopeful area. Also, the quantity of spaces on the Web is vast and exactly characterizing limits for an area is dubious making the plan of virtual schemata much all the more difficult.

In spite of the fact that exploration has been done in the region of creating web reconciliation frameworks however the innovative challenges associated with the combination approach manage us to pick the methodology of Surfacing as the way to progress and examined henceforth.

IV. APPROACHES FOR SURFACING THE HIDDEN WEB

The crawler to remove the substance in the Hidden Web needs to mimic the above depicted arrangement of steps that are being trailed by the human for example the crawler when furnished with the inquiry shape needs to create a question, issue it to the Web webpage, download the outcome record page, and pursue the connections to download the real pages. The creators in [12] have proposed the accompanying conventional calculation for any Hidden Web crawler.

```
STEP 1:  While (Resources available)
do
STEP 2: qi = SelectTerm()
//select a term to send to the site
STEP 3: R(qi) = QueryWebsite(qi)
/* where qi is the selected query & R(qi) is the result page for the query qi.*/
STEP 4: Download(R(qi));
STEP 5: End;
```

Fig. 1 Algorithm for crawling Hidden Web Site.

Creeping the Hidden Web includes two prime errands of asset revelation and substance extraction. The previous manages naturally finding pertinent Web destinations that contain an inquiry shape interface while the last manages acquiring the data from these locales by rounding out structures with important inquiries or catchphrases. Encircled by the crawler's confinement of assets and the enormous size of the Hidden Web, the regular way to deal with slither in the substance of the Hidden Web includes:

Breadth-Oriented Crawling: As the concealed Web contains a huge number of databases and hunt frames, an expansiveness arranged shrouded Web crawler centers around covering an ever increasing number of information sources as opposed to thoroughly creeping the substance inside one explicit information source. Hence, the real test in this sort of creeping is by all accounts finding the shrouded Web assets and investigating the returned outcomes for learning and understanding the interface required to mechanize the procedure of substance extraction.
Depth-Oriented Crawling: It centers around extricating the substance from an assigned shrouded web asset for example the objective is to procure the greater part of the information from the given information source. Presently, the essential test for the crawler is to effectively issue inquiries at the pursuit interface of the assigned database so as to reveal the database substance while bringing about negligible expense. In any case, the crawler should consequently produce promising questions to complete proficient creeping which is a critical undertaking. The issue is named as inquiry determination.
Maybe, the above methodologies are similarly encouraged by picking up an understanding into the kind of data being contained in any web database which might be sorted either as unstructured or organized. Unstructured databases for the most part contain plain-content archives which are not very much organized and give a straightforward catchphrase based hunt interface having an information control (content sort) where clients type a rundown of watchwords to fill it in. Fig. 2 demonstrates a case of such an inquiry interface.

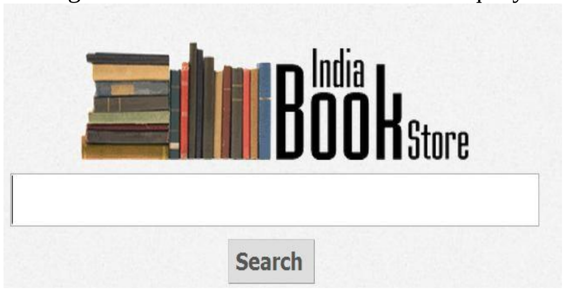


Fig. 2 Keyword-based Search Interface

Interestingly, organized databases give multi-quality hunt interfaces that have numerous question boxes relating to various parts of the substance. For instance, Fig. 3 demonstrates a multi-quality scan frame interface for an online book shop offering organized substance (title, writer, distributer, value, ISBN, number of pages) combined with an organized inquiry interface (ordinarily a subset of the substance characteristics like title, writer, ISBN, distributer).

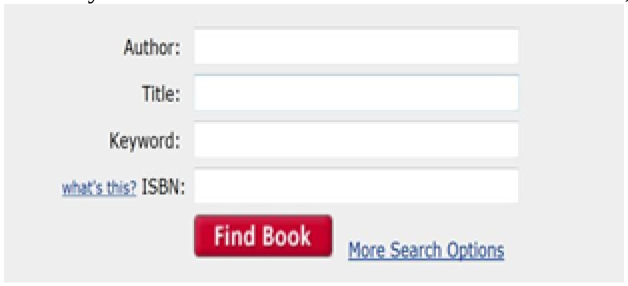


Fig. 3 A multi-attribute search form interface for an online book store

V. HIDDEN WEB CRAWLER

Crawling techniques have been studied since the advent of the Web itself but the research on Hidden Web crawlers emerged with pioneering work by Raghavan and Molina in 2001. They have focused on a design for extracting content from electronic databases. Since, then numerous depth- oriented Hidden Web crawlers for structured as well as unstructured databases have been framed and developed, a review of which has been presented in the section.

5.1 Depth-oriented Crawlers for structured databases

Raghavan in 2001 introduced the problem by presenting an operational model shown in Fig. 4 to describe the interaction that takes place between the crawler and the search form [3]. This model serves as a basis for their prototype hidden Web Crawler called the HiWE (Hidden Web Exposer), an outline of the architecture of which is given in Fig. 5. They have proposed a method for filling up search forms by raising potential queries that are either provided manually or collected from the query interfaces. The term form page is used to denote the page containing a search form and response page is used to denote the page received in response to a form submission.

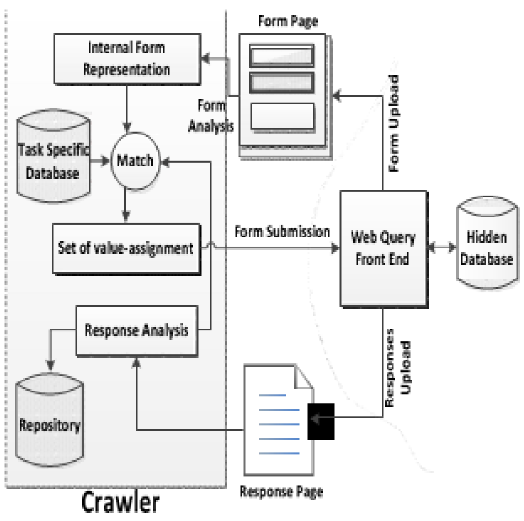


Fig. 4 Crawler Form Interaction

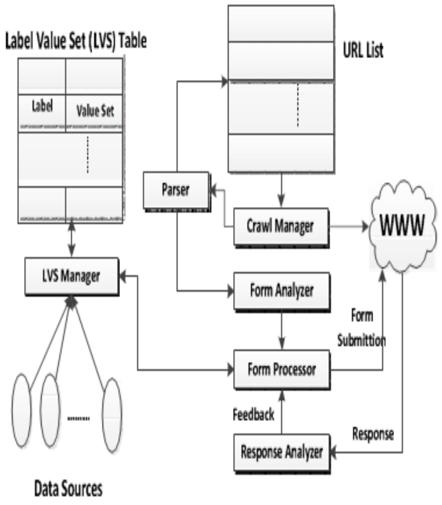


Fig. 5 Architecture of HiWE.

They modeled the form as having elements of the types: text box, select list, text area, radio button or checkbox. The domain of an element is the set of values that can be entered into this form element. In addition, each element is associated with a descriptive text termed as “label” for which it first finds the four closest texts to the element and then chooses one of them based on a set of heuristics defined by taking into accounting the relative position of each textual label. The candidate assignments for a form are generated from the values in the Label Value Set (LVS) table, which consists of (L, V) pairs, where “L” is a label and “V” is a fuzzy/grade set of the values belonging to this label. HiWE does not exhaust all of the possible assignments for a form. Although the authors have used the simple measure of the fraction of non-error pages returned, to evaluate each input, they assume the multiple-inputs to be independent and try to select specific URLs from the Cartesian product of inputs. Once a candidate assignment has been submitted to a form, HiWE caches the resulting page to the repository to support user queries. The major challenge of their approach is dealing with the form elements with infinite domain.

In 2002, Liddle et al. described a method to detect form elements and fabricate a HTTP GET request using default values specified for each field [9]. The proposed algorithm as depicted by the flowchart in Fig. 6 is not fully automated like HiWE and takes user input when required. Though the approach also models HTML forms in the same way as HiWE but is much simpler. The major contribution of the work is retrieving all or at least a significant percentage of the data before submitting all the queries. Without exhaustively trying all possible queries, the approach still extracts sufficient data. In the first phase of the approach, a default query is issued after which the site is sampled to determine if the response retrieved from the default query is comprehensive and finally the queries are issued exhaustively till the specified threshold is achieved. They suggested the use of stratified sampling method to select the candidate assignments that are most likely to extract new information from the hidden web site. The essence of the stratified sampling method is to use all form elements evenly.

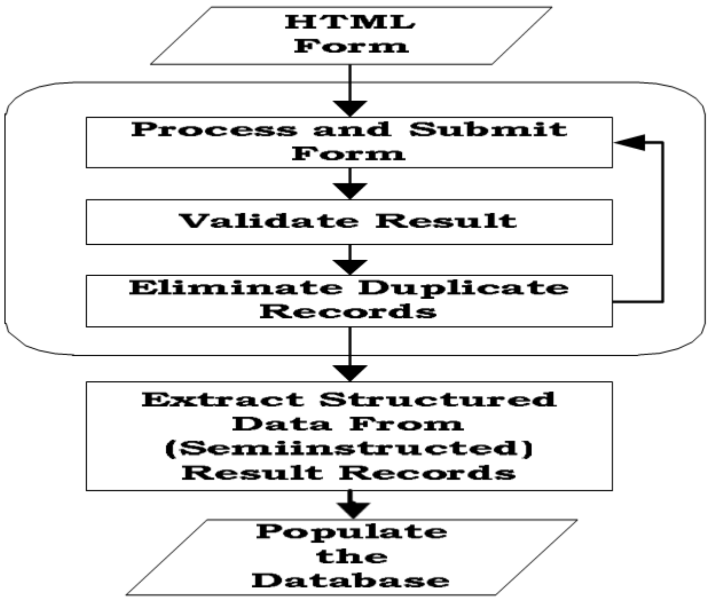

HTML Form
Process and Submit Form
Validate Result
Eliminate Duplicate Records
Extract Structured Data From (Semiinstructed) Result Records
Populate the Database

Fig. 6 Flowchart of liddele approach

Wu et al. in 2006 focus on the core issue of enabling efficient crawling of structured databases on the Web through iteratively issuing meaningful queries [4]. They proposed a theoretical framework that transforms the database crawling problem into a one of graph-traversal by following “relational” links. In their method, the structured web database DB is viewed as a single relational table with n data records {t1, t2,…..tn} over a set of m attributes { a1, a2, …am}. All distinct attribute values occurring in DB are contained by the Distinct Attribute Value set (DAV). Based on a data source DB, an attribute-value undirected graph (AVG) can be constructed. Each vertex vi ϵ V represents a distinct attribute value avi ϵ DAV and each undirected edge (vi; vj) stands for the coexistence of the two attribute values avi and avj in a record tk. According to AV G, the process of crawling is transformed into a graph traversal in which the crawler starts with a set of seed vertices and at each iteration a previously seen vertex v is selected to visit, thus all directly-connected new vertices and the records containing them are discovered and stored for future visits. However the attributes chosen in different queries can be different. It has been assumed that records and their different attributes can be extracted from the result pages to maintain reasonable coverage.
Madhavan et al. in 2009 discusses the approach used by Google in filling Web forms [5].HTML forms usually offer more than one input and hence a layman’s strategy of enumerating the Cartesian product to identify of all possible inputs can result in a very large search space. They have presented an algorithm that appropriately chooses the input combinations so as to efficiently navigate the search space by including only those generated URLs which seem suitable for inclusion in the web search index. The first step of the approach contributes the in formativeness test for evaluating the query templates, i.e., combinations of form inputs. The basic idea of the in formativeness test is that all templates are probed to check which can return sufficiently distinct documents. The next step develops an algorithm that efficiently traverses the space of query templates to identify the ones suitable for surfacing. A template that returns enough distinct documents is deemed a good candidate for crawling. As a last step the approach contributes to an algorithm which predicts appropriate input values for the various form fields. They have described how the identification of typed inputs in web forms (e.g. zip codes, dates, prices) contributes to a better crawl.
In [7], a domain specific crawler for the hidden web, DSHWC that considers multi-input search forms has been developed. The working of DSHWC has been divided into several phases with the first one concerning the automatic downloading of the search forms. Phase 2 describes the most important component Domain-specific Interface Mapper that automatically identifies the semantic relationships between attributes of different search interfaces and guides the next step of merging the interfaces so as to form a Unified Search Interface (USI). The USI produced thereof is filled automatically and submitted to the Web. After obtaining response pages, the DSHWC stores the downloaded pages into Page repository that maintains the documents crawled/updated by the DSHWC along with their URLs. DSHWC [7] is a fully automated crawler which aims to obtain the response pages from Hidden Web by submitting filled search forms.

5.2 Depth-Oriented Crawlers for Unstructured databases

Lot of research has been done in automating the retrieval of data hidden behind keyword based simple search forms which has been reviewed in this section. Gravano et.al. in 2003 in their work in [14] presented a technique to automate the extraction of data from searchable text databases by taking a biased sample of documents that have been extracted by adaptively probing the database with topically focused queries. The queries have been automatically derived by using a classifier on a Yahoo! Like hierarchy of topics. The approach also evaluates the results and exploits the statistical properties of text thereof to derive frequency estimates for the words in extracted documents. The approach further suggested the use of focused probing for the classification of databases into a topic hierarchy. They have attempted to automatically categorize Hidden Web Databases by using a rule-based document classifier during probing.

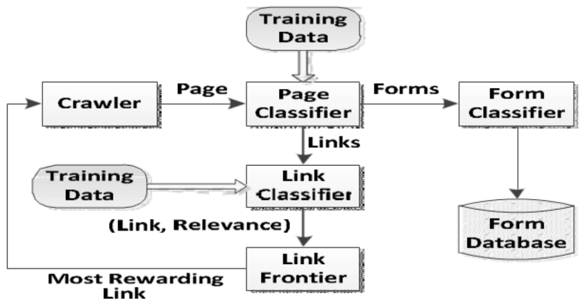
In 2004, Barbosa and Freire in [6] claimed that assigning the values to fields of certain types like radio buttons, combo box is a bit easier than dealing with those that accept free form text as input like text boxes as these form elements actually expose the set of all possible values that can be input and automatically submitted by the crawler. They proposed a two phase algorithm to generate textual queries. The first stage involves creating a sample of data from the website and automatically discovering keywords which are associated weights based on the generated sample. This results in high recall; it then uses these keywords to build queries that siphon the results from the database in its second phase. To siphon, it uses a greedy algorithm so as to retrieve as much contents as possible with minimum number of queries, it iteratively selects the term with the highest frequency from the term list, and adds it to a disjunctive query if it leads to an increase in coverage. They have evaluated their algorithm over several real Web sites and obtained promising results in the preliminary stage itself. The results clearly indicated that their approach is effective in obtaining coverage of over 90% for most of the sites considered.

In 2005, Ntoulas et.al in their work [12] have provided a theoretical framework for analyzing the process of generating queries for a document collection that support single-attribute queries by examining the obtained results. The approach defines three policies for choosing the queries: a random policy where queries are randomly selected from a dictionary and serves as baseline for comparison, a generic policy based on the frequencies of keywords in any generic document corpus and an adaptive policy that learns from the collection downloaded so far. The process starts by learning a global picture starting with a random query, downloading the matched documents, and learning the next query from the current documents. This process is repeated until all the documents are downloaded. They compared their adaptive method with two other query selection methods: the random method (queries are randomly selected from a dictionary), and the generic-frequency method (queries are selected from a 5.5-million-web-page corpus based on their decreasing frequencies). The experimental result shows that the adaptive method performs remarkably well in all cases.

Though much research focuses on the design and development of depth oriented hidden web crawlers but few have also focused on the issue of discovering relevant hidden web resources in a domain. This section presents a brief overview of some of the most cited works in this direction of hidden web crawlers.

5.3 Breadth Oriented crawlers

In 2003, Bergholz et.al [10] focused on automatically discovering the entry points into the Hidden Web. They implemented a domain-specific crawling technique that starts out on the Surface Web using a general-purpose search engine to identify Hidden Web resources relevant in a domain. The crawling techniques to detect query able pages have been implemented and a method that help to assess whether a query able page is an HW resource or not has been developed. In their paper a Hidden Web crawler that discovers potentially interesting pages, analyzes and probes them to determine which pages can serve as Hidden Web resources has been described. Also, Experiments have been conducted to show that the number of Hidden Web resources is highly domain dependent, which can be found with little crawling effort. Their techniques perform well in both the domain-specific and random mode of crawling. The current crawler also combines the syntactic analysis of HTML forms with the query probing and show excellent results for full-text document search which comprises of a major portion of the Hidden Web but fails for a small fraction of the Hidden Web relevant to multi attribute form.



Barbosa and Freire in [11] in 2005 presented a form focused crawler (FFC) to automatically locate web forms based on topics. The architecture of FFC has been presented in Fig. 7. The crawler combines the use of a page classifier and a link classifier that have been trained for focusing its crawl on a particular topic by taking into account the contents of pages and patterns in & around the hyperlinks paths to a web page. The authors first make use of a backward search strategy to analyze and prioritize links which are likely to lead to a searchable form in one or more steps. The frontier manager is another major component of the FFC framework and is used to select the next target link for crawling based on their reward values decided by the current status of the crawler and the priority of the link in the current crawling step. The FFC also uses a form classifier to filter out useless forms. If a form is found searchable by the form classifier, it is added to the form database if not already present in it.
In 2006 Barbosa and Friere in [13] addressed the limitations of the FFC by presenting a new framework ACHE (Adaptive Crawler for Hidden-Web Entries) whereby crawlers adapt to their environments and improve the behavior by learning from previous experiences. Given a set of Web forms that are entry points to online databases, ACHE aims to efficiently and automatically locate other forms in the same domain.

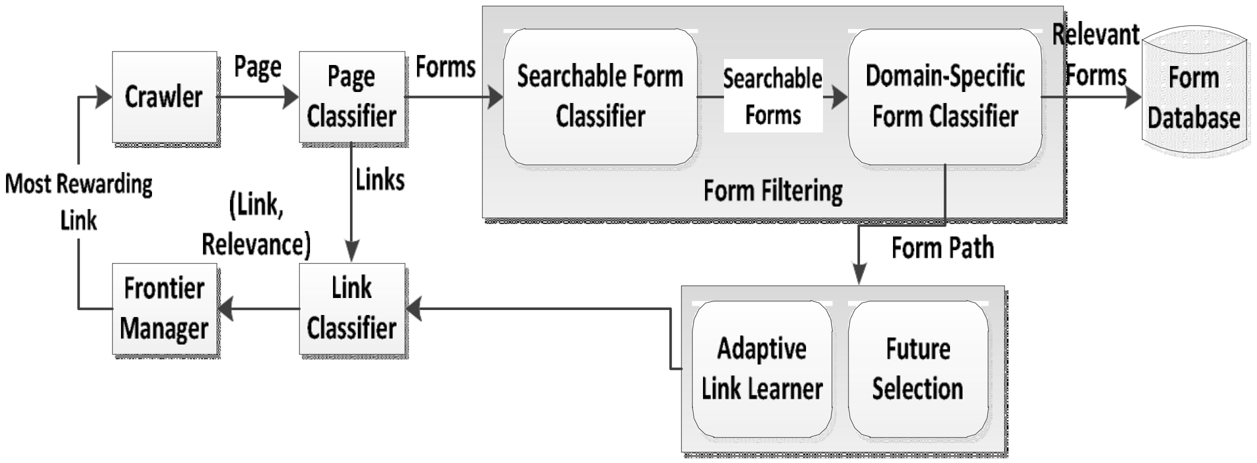


Fig. 8 ACHE Architecture

In addition to FFC, the ACHE comprises of two more classifiers: the searchable form classifier (SFC) which classifies the retrieved form as searchable or non-searchable and the domain-specific form classifier (DSFC) which checks whether the form belongs to the target domain. ACHE also employs a component called the adaptive link learner that dynamically learns features automatically extracted from successful paths by the feature selection component and updates the link classifier.
To achieve a notable progress in this fragment of Hidden Web crawling requires additional efforts for extending the current crawlers. In the next section we provide a comparison of the above discussed crawlers.

VI. COMPARISON

Hidden Web crawlers are designed to automatically parse, process and interact with search forms. The tasks are automated by different crawlers in different ways which forms the focus of this study. A detailed comparison of the various Hidden Web crawlers that have been used in this study are been outlined in Table 1.

Descriptive Criteria	Year	Focused Perspective	Database type	Technique	Strength	Limitation
Raghavan et.al.[3]	2001	Depth- Oriented crawler for content extraction	Multi- attribute or structured	Text similarity to match fields and domain attributes. Partial page layout and visual adjacency for identifying form elements Hash of visually important parts of the page to detect errors	Significant contribution to label matching process Updates the user provided task description by learning information from the successful extracts of crawling.	ignores forms with fewer than 3 attributes Require significant human input thus performance highly depends on the quality of input data 3) not scalable to hidden web databases in diversified domains.
Liddle et.al. [9]	2002	Depth- Oriented crawler for content extraction	Multi- attribute or structured	Stratified Sampling Method (avoid queries biased toward certain fields) Fields with finite set of values, ignores automatic filling of text field Concatenation of pages connected through navigational elements	domain-independent approach accounts for duplicate results identified by computing hash values	Do not consider detection of forms inside result pages. Detection of record boundaries and computes hash values for each sentence poses huge resource requirements.
Garvano et.al. [14]	2002	Depth- Oriented crawler for content extraction	document based or unstructur ed	use of topically focused queries adaptive query probing	1) facilitates design of meta-search engines 2) used to categorize hidden web databases	1) Query chosen only by using hierarchical categories as in Yahoo! and does not consider flat classification
Bergholz et.al. [10]	2003	Breadth- oriented	unstructur ed	domain specific crawling Query prober to recognize and	1) Efficient at discovering unstructured hidden web resources as uses the	Only deal with full text search forms. Initialized with pre-classified
		crawler for resource discovery	databases in a domain	assess the usefulness of the HW resource.	combination of syntactic elements of HTML forms and query probing technique.	documents and relevant keywords
Barbosaet.al . [6]	2004	Depth- Oriented crawler for content extraction	document based or unstructur ed	1) Considers candidate query based on its frequency of appearance in each round	Simple and completely automated strategy Automatically creates sufficiently accurate description	No assurance of acquiring new pages

					of document therefore, can be used in other resource discovery systems. Leads to high coverage.	ineffective for search interfaces that fix the number of returned results simple approach therefore raises security issues
Ntoulas et.al. [12]	2005	Depth- Oriented crawler for content extraction	document based or unstructur ed	1) Incremental adaptive method 2) frequency estimation based on already downloaded documents 3) greedy algorithm that tries to maximize the 'potential gain' in every step.	Combination of policies (random, generic and adaptive) for choosing appropriate queries. use of multiple frequency estimators -independent and zipf's law based	Query distribution does not make sure to adapt to the attribute values set of the database. Memory requirements for calculating potential gain are huge. Assumed constant cost for every query which does not hold in real situations.
Barbosa et.al. [11]	2005	Breadth- oriented crawler for resource discovery	structured & unstructur ed databases	Link classifier to focus search on a specific topic use of a stopping criteria to avoid unproductive searches	1) Highly efficient in retrieving searchable forms focused for a particular topic	1) Manually selecting a representative training set is difficult so creating the link classifier is time consuming
Alvarez et.al. [16]	2006			set of domain definitions each one of which describes a data- collection task use of heuristics to automatically identify relevant query forms	System can be extended for discovering relevant resources. Handles client side as well as server side hidden Web Experimentally proved effective for collecting data.	No defined threshold for associating form elements and attributes in the domain definitions hypothetical assumption of having at least one label associated with every form element which does not hold true for most of the bounded form elements (drop down boxes)
Ping Wu et.al. [4]	2006	Depth- Oriented crawler for content extraction	Multi- attribute or structured	Models each structured database as a distinct attribute -value graph Set the graph to crawl the database (set-covering problem)	issues only meaningful queries as tuned with domain knowledge overcomes limitation of greedy methods	1) Query results in each round must be added to the graph thus involves huge cost of resources
Barbosa et.al. [13]	2007	Breadth- oriented crawler for resource discovery	unstructur ed databases	Greedy algo derived by the weights associated to keywords in the collected	Improved harvest rates as crawl progresses retrieves homogeneous set of	configuring the crawler to start initially needs more

				data Issue queries using dummy words to detect error pages	forms Automated and adaptive thus eliminates any bias arising out of learning process.	effort than manually configured crawlers works only for Single keyword-based queries
Madhavan et.al. [5]	2008	Depth- Oriented crawler for content extraction	Multi- attribute or structured	1) Evaluate the query templates by defining the in formativeness test.	1) efficiently navigates the search space of possible input combinations	1) No consideration to the efficiency of deep web crawling
Komal Bhatia et.al. [7]	2010	Depth- Oriented crawler for content extraction	Multi- attribute or structured	Domain Specific Interface Mapper to create unified query interfaces for a domain calculation of re-visit frequency based on probability of change of web page	Multi-strategy interface matching use of mapping knowledge base to avoid repetition for minimizing the mapping effort Enhances the scope of developing a specialized search engine for the Hidden Web.	Indexing technique was not specified for storing pages in the repository Defined the performance only for crawling while the efficiency of schema matching and merging procedures over variety of query interfaces has not been quantified.
Sonali Gupta et.al [8]	2013	Depth- Oriented crawler for content extraction	document based or unstructur ed	Creates a domain representation that is stored in domain specific data repository. uses a domain specific classification hierarchy for query term identification	Achieves high coverage with just a small number of queries makes use of domain specific data repositories and thus can be extended to other domains Can be fully automated if integrated with semantic web technologies.	Requires human effort for an initial start of the crawler. domain-specific

VII. CONCLUSIONS

Hidden Web crawlers enable indexing, analysis and mining of hidden web content. The extracted content can then be used to categorize and classify the hidden databases. The paper discusses the various crawlers that have been developed for surfacing the contents in the Hidden Web. The crawlers have
also been differentiated on the basis of their underlying techniques and behavior towards different kind of search forms and domains. As each of the discussed crawlers have their own strengths and limitations, much more needs to be explored in the area for better research prospective.

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