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An Approach to Improve Structure of Website for Effective User Navigation

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Abstract - *Design of website now a day's not a great issue many automation techniques are available to make websites without coding. Some hosting sites provide their drag n drop tools for website design also frameworks like Wordpress & Joomla provide coding less web development. The major task is to make website user friendly so user navigation can be made easy. This task is challenging goal and make major impact on purpose for which website is made. In this paper we are going to improve website user navigation with minor changes in website structure. For that purpose we use mathematical model which takes data set and weblog as input and generates a output that tell which new links to be added for effective user navigation. This output is a blueprint for web developer to make minor changes in web structure.*

Key Words: **Website design, User navigation, Mathematical model, Links, .**

1. INTRODUCTION

The internet becomes major part of human life. Internet is looked as source of information. Information is presented in the form of words, images, graphs, videos etc. The access to the information should be user friendly i.e. user navigation through website is effective. The website structure has great impact on user navigation. User navigation improvement is categorised into web personalisation and web transformation.

Web personalization involves making user navigation simplified for particular user or group of users. Web transformation involves making user navigation effective thought all users.

These two approaches are different from each other in many aspects. Web personalisation involves consideration of user profile data. Changes made maybe different for different users. Web transformation is different thing which involves consideration of aggregate user log data to have effective user navigation. Web personalization is computationally intensive & time consuming.

Web personalization requires past usage of each user web transformation does not require any past usage data of users. Web personalization approach is better for dynamic websites where frequency of data updating is more whereas transformation approach is suitable for static websites where frequency of data changes is minor.

There are many approaches were stated for web personalization some approaches automatically synthesize index pages to add links for pages having more frequency of visit. In other approach user profiles were studied to have cluster of user profiles which used to generate links dynamically for each user or group of users.

We propose an approach which improves user navigation by minimal changes to web site structure. This involves changing link structure of website with the help of mathematical model. We give web data structure & logs as input to the system to generate solution which has minor changes in the original web structure.

2. RELATED WORK

The complicated process of web design demands knowledge and skills in various domains. Even though web design criteria, guidelines and principles were suggested in the literature, few studies were found on how to enhance the effectiveness for a web design learning process. This study introduces a self and peer- assessment strategy on learning web design [1].

The development of policy to handle the increasingly diverse issues that arise from web content management is becoming a concern for academic institutions. An exploratory investigation that seeks institutional web Content manager perspectives from higher educational settings on current web publishing and hosting policy and issues is presented as a mixed-method research design, using both quantitative and qualitative methodologies, to investigate how field factors influence policy creation. [2].

Vaseeem Basha Shaikh and Shakeel Ahamed Pathan at Department of CSE, QUBA collage of engineering and technology, Nellore, India proposed a system for Speed Up Effective User Navigation through Website Structure Improvement. They used two evolution matrices and use them to access the performance of the improved website using the real data set. They found that heavily disoriented users are more likely to benefit from the improved structure than that of the less disoriented users [3].

In order to facilitate user's navigation in the web site's Oznur Kirmemis, Alkan and Pinar Karagoz present a new

model that construct smart access that will assist the web user for getting the target page easily. The solution combines clustering with navel algorithm called path search-BF, for the access path discovery from server logs [4].

Dipak Satao , Kiran Sonawane , Dhananjay Shinde , Vikas Pawane at Computer Department, Dr. D. Y. Patil Institute of Engineering and Technology, Pimpri, India had proposed system for Effective User Navigation through Website Structure Improvement. System works on weblog process the weblog to get user wise target pages and output's set of candidate links that need to redesign and re-link. [5].

Ranking the returned webpage's such that the useful ones appear in the top of the ranked list is a critical task in the web information retrieval. The role of ranking algorithms is thus crucial, select the pages that are most likely to satisfy the user's need, and bring them in the top positions. This paper covers the popular ranking algorithm used today by the search engines: HITS [6].

K Kishan, K. Pranav Kumar from CSE department, ARTI, Warangal, Telangana, India effective user navigation system which is based upon indegree and outdegree of the page node. They re-modify the web pages which are more frequent visited by users such that it can be accessed faster than other pages or fetch the page before it accessed by user manually [10]

X. Fang and C. Holsapple observed that a usage-oriented hierarchy or a combined hierarchy is a navigation structure associated with significantly higher usability than subject-oriented hierarchies, for both simple and relatively complex knowledge acquisition tasks [11].

D.F. Galletta et al. was found that a significant three-way interaction between all three factors indicating that these factors not only individually impact a user's experiences with a website, but also act in combination to either increase or decrease the costs a user incurs [12].

Two separate analyses support an assertion that attitudes mediate the relationship of the three factors on behavioral intentions. J. Palmer reported on a series of three studies that develop and validate Web site usability, design and performance metrics, including download delay, navigability, site content, interactivity, and responsiveness [13]. The performance metric that was developed includes the sub-constructs user satisfaction, the likelihood of return, and the frequency of use.

V. McKinney et al. developed theoretically justifiable constructs for measuring Web-customer satisfaction during the information phase [14]. By synthesizing the expectation-disconfirmation paradigm with empirical theories in user satisfaction, we separated Web site quality into information quality (IQ) and system quality (SQ), and proposed nine key constructs.

T. Nakayama et al. proposes a technique that discovers the gap between Web site designers' expectations and users' behavior [16]. The technique suggested how to apply quantitative data obtained through a multiple regression analysis that predicts hyperlink traversal frequency from page layout features.

Samadhan W. Jadhav, Prof. N. L. Bhale from Department of Computer Engineering, MCERC, Nasik, India proposed a system for "Methods of Website Structure Improvement for Effective User Navigation: A Review". System involves following modules:-1) Mathematical Programming Model 2) Pattern Based Restructuring 3) Pattern Identification 4) Page Classification Algorithm. They use queue model for simulation [17].

C. Yang et al. g introduced a joint model of Hierarchical Conditional Random Fields (i.e. HCRF) and extended SemiMarkov Conditional Random Fields (i.e. Semi-CRF) to leverage the age structure understanding results in free text segmentation and labeling. In this top-down integration model, the decision of the HCRF model could guide the decision-making of the Semi-CRF model [19]. Here proposed a novel framework called WebNLP, which enables bidirectional integration of page structure understanding and text understanding in an iterative manner.

J. Hou et al. presented two hyperlink analysis-based algorithms to find relevant pages for a given Web page (URL) [20]. The first algorithm came from the extended cocitation analysis of the Web pages. It is intuitive and easy to implement. The second one took advantage of linear algebra theories to reveal deeper relationships among the Web pages and to identify relevant pages more precisely and effectively.

3. SCOPE OF THE WORK

Our proposed techniques includes following three modules:

1. Analyzing the Web Architecture
2. Process user log
3. Obtaining optimized solution

1. Analyzing the Web Architecture

We put all web pages in one folder, the program access entire pages in the folder and convert them into XML pages. Further XML pages are parsed to obtain reference table matrix and web structure graph.

Reference table is N X N matrix R where N=number of pages in the dataset. Let $1 \leq i,j \leq N$ then

If there is link from page i to page j then R_{ij}=1otherwise R_{ij}=0.

Web structure graph has nodes and edges connecting nodes. Nodes are web pages; edges are hyperlinks between 2 pages. Web structure graph represented as G = (V,E) where V = (V1,V2,V3,.....VN). Vi represents a page, for $1 \leq i \leq N$.

E = {e_{ij} | the hyperlink from source page i to target page j }

Analysis of web architecture is used to grab the website structure and save it into reference matrix and graphical format for further processing.

2. Process User Log

User log consists of the following elements: client's IP address, user id, access time, request method (get or post), URL, protocol error code, number of bytes transmitted. We need only few part of this information, so we need to process user log to retrieve necessary information from it. The information obtained after processing contains sequences of web pages visited by the each user and amount of time user spends on this page.

3. Obtaining optimized solution

The optimized solution is obtained by providing web data set & weblog as input to the model which generates optimized reference table and optimized web structure graph. Reference table shows all links presents in the final solution in the table format.

User log data is processed to find mini sessions. Mini session calculation is done by finding the last visit page of each user. We consider the last page in the log details of user is last visit page of that user. The last visit page of users may be same or different. We define the last visit page as target which is more frequent last page of each user.

The next step is to find user wise target page. In the log details we also consider time spend on each page by user, the target for user is consider as the page on which user spends more time.

Further we find the overall target page by adding the sum of time spends on each page by all users. This page is declared as target page.

We then display the time spend by each user on the target page.

We give the link to the target page from its previous page, the next page and the front page.

4. SYSTEM ARCHITECTURE

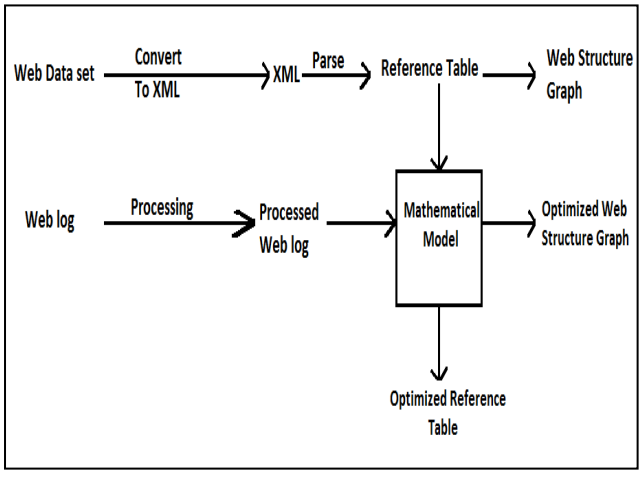

Fig: 1.System architecture

System architecture as shown in Fig.1 is involved processes as follows:-

1. Input web data set to system to obtain XML pages.
2. Each XML file is parsed and processed to obtain Reference table of current data set.
3. From reference table we generate Web structure graph.
4. Web log is processed to obtain processed web log as per system requirement.
5. Reference table and processed web log are provided to Mathematical Model.
6. Mathematical model generates optimal solution in 2 formats as graph & reference table.

5. MATHEMATICAL MODEL

Let U is the array of users details which contains pairs of visited page number and time spend on that page. For N users there are N elements in U.

$U = \{U_1, U_2, U3 \ldots., U_N\}$----------(1)

Let n=1 to N, I_n is the number of pages in the U_n.

$P(i,n) = i^{th}$ page of Un where $1 \le i \le I$ and $1 \le n \le N$ ---------- (2)

$T(i,n)$ = time spend on page $P(i,n)$.----------(3)

To find mini session we find most frequent page number in P(I,n)
for n = 1 to N.

Where P(I,n) is the last visited page by user Un.

We create an array LP of length N consist of P(I,n). i.e. LP is the array of last visited page of all users.

$LP = \{LP_1, LP_2, \ldots \ldots, LP_N\}$---------- (4)

Let $S_n = 1$ if ($LP_n == P(I,n)$) else $S_n = 0$;

Let $P(I,n)_C$ = number of occurrences of P(I,n) in LP.

$P(I,n)_C = \sum S_n$ (for $1 \le n \le N$)----------(5)

Let TPM target page considered for mini session then

$TPM=MAX(P(I,n)_C)$ (for $1 \le n \le N$)---------- (6)

Then mini session is considered for user log details for which last page is TPM.

Then we find user wise target page. Let $UWTP_n$ be the target page
of user U_n.

T_n=MAX{T(i,n} where $1 \le i \le I$ and $1 \le n \le N$.----------(7)

$UWTP_n$ = P(i,n) where T(i,n)=Tn for $1 \le i \le I$ and $1 \le n \le N$.---(8)

Next we find overall target page for all users in the log details.

Let K = number of pages in the data set. .----------(9)

GP_k = k^{th} global page. ----------(10)

X_k = 1 if(P(i,n)==GP_k) else X_k=0;

$T_k = T_k +$ X_k(T(i,n)----------(11)

Let T is array of T_k for $1 \le k \le K$ ----------(12)

The overall target page is TP = GP_k where T_k is MAX(T)----------(13)

We display users who visited the target page TP with time spend on that page.

Then we add links to target page from page GP_{k+1} ,GP_{k-1} and Home page to optimize user navigation.

6. CONCLUSION

In this paper we have proposed the mathematical model to improve effective user navigation through minor changes in the website structure. Our model is suitable for static informative websites where change of information is less frequent. Also we have controlled adding number of new links by path thresholds & time thresholds.

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