A Conceptual Model for Information Navigation Structure of E-Commerce Websites

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Abstract. Information navigation structure is an important aspect of Web design in both business and informational Websites. For an e-commerce Website facilitating the buyers to navigate successfully is the key to keep up the sales. Poor navigation structure creates challenges to shoppers in finding what they want and results in losing the customer. In order to systematically study the navigation structure of e-commerce Websites, this paper proposes a conceptual model using exploratory research. This model uses methods from hyperlinks network analysis, webometrics and visualization to study the hyperlink structure of e-commerce Websites.

Keywords: Information navigation model, Hyperlink network analysis, Webometrics, E-Commerce

1. Introduction

Designing a good Website is one of the most important issues for the companies who want to be successful and capitalize on profits by promoting their products or services in a competitive market. A good Website can change online customer's perceptions about that company's image [1]. Therefore designing a high-quality Website becomes a challenging task. An important aspect of Website design is the navigation structure which guides the users to get the pages of their interest [2]. The study about the navigation structure has been carried out in various dimensions. For example the navigation pattern of a Website can be identified from the visitors' usage of a site, which would be recorded in a Web log file. This research area is called as Web Usage Mining [3, 4]. Since the Web log data is only available to the owner of the Website, the data may be difficult and costly to obtain. Moreover, if the evaluation is performed by third party intent of publishing comparative data between sites, full cooperation might not be given. Also data may be unavailable for reasons of user privacy or contract confidentiality [5, 6].

Another approach is called as Web Structure Mining which is based on the hyperlinks through which Web pages are interconnected [5-7]. Web structure mining aims at constructing models of Website structure in terms of page interconnections [7-9]. In contrast to Web Usage Mining, structural data are readily available to anyone capable of crawling Websites. They would seem to offer the potential for establishing the 'health' of a domain. For example, if a commerce company Website is highly inter-connected, then buyers are much more likely to find the information by traversing the hyperlink structure (navigation) of the site [5].

Hyperlink analysis provides Internet researchers with new analytical methods for the study of connected structures on the World Wide Web. Also it enables visualization of navigational elements, such as changes in the hyperlink structure of contents of a Website. This paper proposes a conceptual model for information navigation structure of e-commerce Websites from a detailed literature review.

2. Past Research Studies

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With the increasing importance of the Web for an ever-broader spectrum of human activities, many companies have extended their attention from conventional business to electronic business with the aim of attracting fast growing online consumers. While there have been numerous success stories, the amount of reported failures has been extremely high. There are many reasons for the failure of online business. Poor Website design and navigation structure is one among them. For an e-commerce Website navigating visitors successfully is the key to keep up the sales [10].

Lee and koubek [11] examined the effects of usability and Web design attributes on user preference for e-commerce Websites and the results indicate that organizational structure and layout had a greater effect on user preference than aesthetic aspects. [12] Studied the impact of Website navigation structures on Website usability and found that a good navigation structure of a Website is associated with significantly higher usability than subject-oriented structure. Another study investigated Website navigation architectures and their effect on Website visibility. Their primary conclusion is that navigation architecture used on a Website does impact its visibility to a search engine crawler [2].Therefore in order to improve the navigation structure, a systematic study of the navigational aspects of Website design is necessary [13, 5].

Earlier studies about Web structure show that, the hyperlinks which connect one Web page with another page or Website exhibit potentially useful information that are hidden in WWW. Though the hyperlink studies have been carried out across many disciplines and issues, their approaches can be largely divided into hyperlink network analysis (HNA) and Webometrics. HNA derives from Social Network Analysis and Webometrics, derives from information science. In HNA, the hyperlinks between Websites or Web pages are represented as social and communicational ties and used standard techniques from Social Network Analysis to study the network structure. Webometrics take up much simpler techniques combined with in-depth investigation into the validity of hypotheses about possible interpretations of the results. Both areas have the broad goal of extracting useful information about Web use and employ the general approach of using predominantly quantitative techniques to display or summarize hyperlink-based data [14].

2.1. Hyperlink Network Analysis (HNA)

There has been little research on the structural properties of individual Websites in contrast to the entire Web. The examination of the graph structure of an individual Website can be used to calculate the mean diameter of the Website, and other metrics, that can then be used to infer properties regarding the navigability of the Website. [15] Investigated whether Websites exhibit structural similarities by examining 18 Websites which include governmental departments, commercial companies and university departments in different countries. Their study revealed that the internal link structure of the Websites is significantly different when measured with first and second order topological properties. It is properties based on the connectivity of an individual or a pairs of nodes. However, examination of a third-order property that consider the connectivity between three nodes that form a triangle, revealed a very strong correlation across Websites.

Tobias Escher et al [6] used structural metrics to assess the on-line presence of the foreign offices of Australia, the US and the UK. They compared the Websites using five dimensions: visibility, accessibility, extroversion, navigability and competitiveness and proposed that these dimensions might be further developed as indicators to improve the effectiveness and efficiency of their on-line presence. [5] Found statistical properties of the structure of Websites can be an informative measure of their quality. They developed a method for evaluating e-government Website using a range of techniques from Webometrics and social network analysis. They examined the structure of government audit office sites in Canada, the USA, the UK, New Zealand and the Czech Republic. They calculated the structural characteristics measures such as the connected components, the average distance between nodes, the distribution of paths lengths and the indegree and outdegree. Their results revealed that these measures are expected to correlates with the navigability of a Website and with its 'nodality' which is a combination of hubness and authority. Authoritativeness is indicated by number of links pointing to a site and hubness is determined by number of links pointing outside a site.

2.2. Hyperlink Analysis (Webometrics)

Extensive studies have been done about the hyperlink analysis in Websites of universities and research institutions. However there are only few studies done in governmental Websites and commerce Websites. The Webometrics indicators offer a wide range of opportunities for improving our knowledge of the academic system, how it is organized and works and better monitor the persons and organizations involved [16]. Studies about the number of hyperlinks pointing to a university Website found significant correlation between the total numbers of links targeting to the university's Websites and the research productivity of the university [17-20]. Onyancha and Ocholla [21] compared the performance of South African and Kenyan universities on the Web using hyperlink analysis. Webometirc analysis is performed to explore the communication characteristics of scientific knowledge in a national scholarly Web space comprising top ranking universities and government supported research institutions in South Korea found significant differences in scholarly communication activities as well as linking behaviour among different subspaces in addition to institutional differences [22]. Park examined e-science approaches in Korea using Webometrics analysis [23].

In contrast to the academic domain, there are very few hyperlink studies have been done in the dot com domain. [24] Explored hyperlink structure of electronic commerce Websites to determine the association between the Webometrics data and business performance measures as well as traffic ranking. The results show that there is an association between the Webometrics data and the company's business information as well as traffic ranking. This suggests that Webometrics data could be used as an indicator for evaluating the business performance of the company as well as the visibility of its Website to a target audience. Also earlier studies show that links pointing to a company Website correlate with the company's business information such as revenue, profit and research and development expenses [25, 26].

2.3. Taxonomy of Website Traversal Patterns and Structures

Another dimension for studying information navigation pattern is, to develop taxonomy of common Website traversal patterns and structures based on a survey of dot com Websites. [13] Examined 300 Websites which consists of Websites from various domains but mostly from dot com domain as it numerically dominates the Web. Their study establishes for the first time, taxonomy of Website traversal patterns and structures.

There are numerous studies which qualitatively analyse the usability of commerce Websites. However, there are very few researches have been done on the quantitative attempts to analyze the underlying link structure of commerce domains. An in depth literature review revealed that the efficiency of navigation within Websites becomes more critical as Website designers attempt to design sites with particular goals in mind while also allowing the user a degree of freedom. Earlier researches in the field of hyperlink network analysis show that, it is possible to identify the successful navigation pattern by analyzing the individual Website structure [5, 6 and 13]. Realizing the importance of the information navigation structure of e-commerce websites, this research paper proposes a conceptual model to systematically study the hyperlink structure. We are proposing this conceptual model with the motivation that one always can learn important lessons from the successful Website design, to avoid the mistakes which the established Websites would have conquered.We believe that such an undertaking will provide valuable information about e-commerce and ultimately could be used to aid the redesign of commerce Website and thus company's online presence.

3. Conceptual Model

This model studies the hyperlink structure of e-commerce Websites in two approaches; first one is applying the techniques from hyperlink network analysis and webometrics to identify the characteristics of the individual Websites. Second approach is to represent the hyperlinks graphically to visualize navigation structure. From these two approaches determine the common characteristics of the Websites by identifying the structural similarities. Analysis of the hyperlink network will enable us to identify the structural properties of the individual websites and thus the common properties of the Websites. By integrating the common navigation structures / patterns and the structural properties of the e-commerce websites, synergized navigation structure can be obtained.

Fig.1 illustrates the conceptual model emanated from the past research. This model is supposed to help the researchers and the practitioners to study the structural characteristics of individual Websites quantitatively and subsequently to discover the common characteristics that are shared among the Websites within the same industry and as well as among dot com domain itself. These statistical properties are then integrated with the common taxonomy of navigation structure identified from mapping the individual Websites graphically. This model tries to fill the research gap of non-availability of a comprehensive model to scientifically study the hyperlink properties and the navigation structure in e-commerce domain. It is also proposed to validate the model with hyperlink data of global e-commerce Websites. This work is towards contribution to the theory of practice where an e-commerce Web development cost could be considerably reduced and increasing the quality of Web navigation.
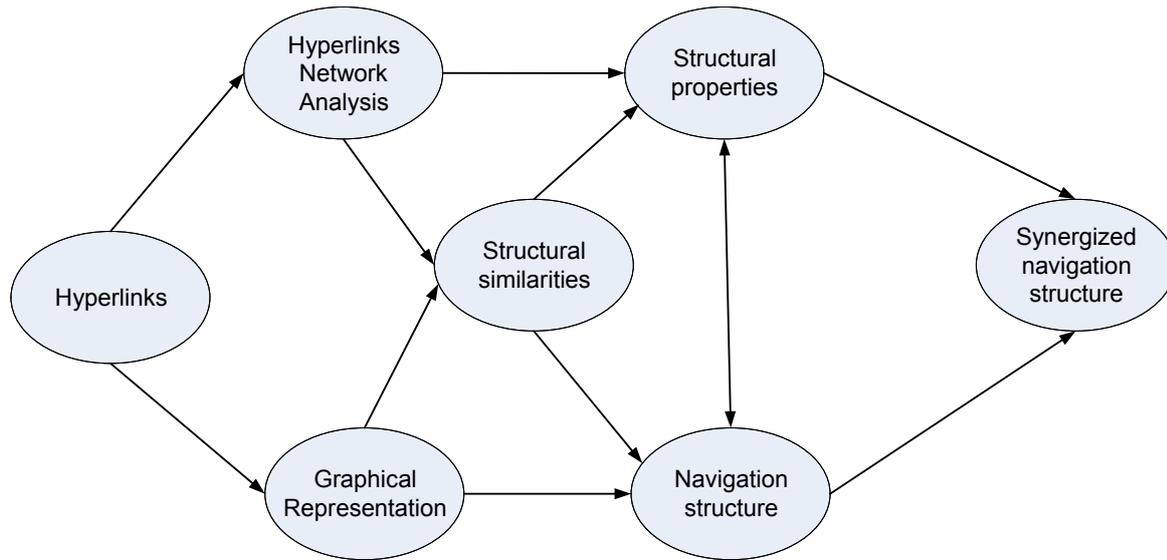
Fig. 1: Conceptual model of information navigation structure

4. Conclusions

This paper proposes a conceptual model to systematically study the information navigation structure of e-commerce Website using exploratory research. This model used approaches from, both hyperlink network analysis method, which analyzes the structural characteristics of the Web and the graphical representation of the Website to uncover the frequent navigation patterns and structures. We believe that a synergized navigation structure could be used by the Website designers, particularly the individuals and the novice entrepreneurs who cannot invest big budget for designing their Website. This will aid them with the guidelines for information navigation structure for e-commerce Website.

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