Chapter 10
Intelligent Semantics Approaches for Adaptive Web

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ABSTRACT

Intelligent semantic approaches (i.e., semantic web and software agents) are very useful technologies for adding meaning to the web. Adaptive web is a new era of web targeting to provide customized and personalized view of contents and services to its users. Integration of these two technologies can further add to reasoning and intelligence in recommendation process. This chapter explores the existing work done in the area of applying intelligent approaches to web personalization and highlighting ample scope for application of intelligent agents in this domain for solving many existing issues like personalized content management, user profile learning, modelling, and adaptive interactions with users.

1. INTRODUCTION

The quantum of information accessible from World Wide Web (WWW) is increasing exponentially over time. Retrieval of desired information from WWW has become a tedious and difficult task like finding a needle in the hay stack. So, there is a continually growing demand for more sophisticated techniques in web information retrieval. Further, current web has taken up a face and shape of a knowledge provider rather than just an information dissemination medium with the introduction of technologies like Data Mining (DM), Semantic Web (SW) and Multi-Agent Systems (MAS) (Singh, 2012). As the volume of data collected by various enterprises increase, the need for analysing the data efficiently rises sharply. DM has emerged as a cutting-edge technology with the related advancements in database technology for business intelligence through on-line analytical processing tools on data warehouses. These techniques are also applied on relational, transactional, object-oriented, spatial, temporal and text databases. This technique is found very useful in business viz. telecommunication industry, banking and finance, biomedical and DNA analysis, agriculture and retail industry. Further, many other types of data like web content, images, video, social networking data and blogs came into picture. This change has led to the

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emergence of Web Mining (WM) and Web Personalization (WP). WM may be defined as the use of DM methods to find patterns from the Web (Kosala & Blockee, 2000). Based on types of web data, researchers have categorized the WM into three type namely web content, structure and usage mining. These methods were found very useful in the development of adaptive/personalized web. Further, there has been tremendous growth and evolution in e-business, e-commerce, e-banking, scientific research, e-learning, social networking, web communities, blogs and other sectors which have necessitated the need for personalized information delivery from the web based on user interest and context. So, WP is emerging as the most cutting-edge technology in future web applications. The four main phases (Anand & Mobasher, 2005) of a WP system are user profile extraction, pattern discovery, recommendations and evaluation which are described in detail in section 2. WP phases can be enhanced by using SW and intelligent Software Agents (SA) for the retrieval of better knowledge oriented recommendations. Many researchers have reviewed the existing work done in this area. Kobsa (2001) has given a detailed study on generic user modeling system. Carmagnola, Cena & Jena (2011) have reviewed the work done on solving the user interoperability issue across multiple websites. Malik & Fyfe (2012) have studied in detail the contributions made in all the phases of WP. Ghorab, Zhou, O’Connor and Wade (2013) have surveyed the work done for various stages of personalized information systems. Chen, Wu and Cudré-Mauroux (2012) have surveyed the state of the art on applying computational approaches into SW applications. Singh and Sharma (2017) have reviewed of existing intelligent technologies for personalized information retrieval from web and proposed a framework for semantic web information retrieval. Singh and Sharma (2015) have explored the scope of applying SW and SA technologies for WP. This chapter extends their work by: (1) describing in details the each of WP phases; (2) including privacy and security concerns; and (3) updating the contents with latest research work done in this area. The next section describes the Adaptive/Personalized Web in brief.

2. ADAPTIVE WEB: AN INTELLIGENT FACE AND MIND OF WEB

Adaptive/Personalized Web may be defined as the ability of a system to provide a customized view of the Web by performing various actions for a single or group of users (Anand & Mobasher, 2003). It can deliver a wide variety of facilities to the users in the form of greetings, bookmarking, granting personalized rights, modifying web site structure, tailored offers & services and adapted web search results by applying statistical methods, DM, text mining, WM, SW and ontologies etc. (Figure 1).

WP relies on the collection, analysis and modelling of various types of web data including web access log files, client-side information in the form of cookies, browser cache, proxy server logs, click-stream data, site structure, domain ontology, explicit user profiles and location specific information. WP is achieved through the implementation of all the phases of a typical data mining cycle. Mobasher et al., (2001). There are four phases of a WP system namely learning, pattern discovery, recommendations and evaluation as shown in Figure 2.

Learning phase is mainly concerned with the creation of a user profile through modelling. User Modelling (UM) is referred to as gathering and exploiting the information about preferences, interests and behaviour of the individual user for creating user adaptive websites. Some important characteristics parameter considered for user profiling are background information, interests and preferences, goals, emotional state, context etc. A user profile may be constructed by explicitly collecting the information
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