

Chapter 2

The Medical Semantic Web: Opportunities and Issues

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ABSTRACT

In this paper, the need for the right information for patients with chronic diseases is elaborated, followed by some scenarios of how the semantic web can be utilised to retrieve useful and precise information by stakeholders. In previous work, the author has demonstrated the automation of knowledge acquisition from the current web is becoming an important step towards this goal. The aim was twofold; first to learn what types of information exist in chronic disease-related websites, and secondly how to extract and structure such information into machine understandable form. It has been shown that these websites exhibit many common concepts which resulted in the construction of the ontology to guide in extracting information for new unseen websites. Also, the study has resulted in the development of a platform for information extraction that utilises the ontology. Continuous work has opened many issues which are discussed in this paper. While further work is still needed, the experiments to date have shown encouraging results.

INTRODUCTION

The prolonged course of illness from chronic diseases such as diabetes, hypertension, and asthma results in decreased quality of life for many people around the world. Chronic diseases also impose a huge burden on governments in terms of human resources and costs. Many patients have turned to the Internet to learn more about their chronic diseases, to buy products such as medical devices and medicine, to seek online consulta-

tion, to subscribe to newsletters, and even get information about classes, workshops and other activities, related to their conditions, that are close by. Chronic disease-related websites offer many valuable resources that can aid patients with their life-long management of their illness, but many patients may be unaware of such services. Most patients looking for information on the Internet turn to search engines normally with simple one- or two-keyword queries. After that they are faced with hundreds of thousands of HTML pages to

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browse. Many people end up just collecting the first few websites and may not obtain adequate results as expected. Most information is still buried or hidden away from casual users or patients.

The semantic web (Berners-Lee et al., 2001), once fully developed, will allow users, for example, to ask questions and obtain precise answers to questions such as the following:

- Where can I find an insulin pump with a capacity larger than 200 units and a weight of less than 120 grams?
- I need the cheapest book about Asthma with a chapter on alternative medicine.
- Is there any workshop on diabetes management in London next month that is intended for pharmacists?
- I need to know the types of food that lower blood pressure and contain low amounts of sugar.
- Where is the closest centre that provides asthma therapy for children?

A special software called Web Agent will interpret such questions into machine understandable queries that work like querying a database using the powerful SQL language. For example, the first question might be interpreted as follows: “SELECT insulin_pump WHERE capacity >200 AND weight <120 FROM some_table”. Some queries may not be so obvious such as the last one in the list above! In this case the web agent software must have some information saved about the user such as her/his address, age, browsing habits, etc. so agents can be personalised to adapt to users’ needs (Frkovic et al., 2008). These agents will certainly need to work with some form of search engines that traverse the semantic web collecting knowledge into a knowledge base or a database. This is also referred to as parsing and processing ontologies¹. There has been some limited research in this direction. Probably the most prominent example in this area was Google’s version for a search engine for the semantic web which they

called “Swoogle” (Li et al., 2004). In general, such issues are still open for more research.

The possibilities and the different ways of utilising the web with meaningful information being made available to machines become endless, and is also a fertile ground for further research. Patients with any type of disease can benefit from such a future web; however patients with chronic diseases will benefit the most, since most chronic diseases require life-long management. The current web does a great job in linking pieces of related information, displaying images, sounds, etc., in human-understandable ways. Of course, websites having good, understandable design enable information to be easily found and hyperlinks are easy to follow. Such a website does very well in relation to what it is intended to do, and that is to display information for users to read, listen to, or watch. However, since HTML tags are only meant for rendering information on the screen, machines can do very little with such meaningless symbols.

COMMON STRUCTURES: HYPOTHESIS AND ANALYSIS

It has been hypothesised that related websites exhibit common structures. To the author’s knowledge, such a hypothesis has never been addressed nor proved before. Based on the analysis made on the collection of chronic disease-related websites, it is suggested that related websites do exhibit common structures (Eljinini et al., 2006). This has been articulated clearly in Figures 1, 2, and 3 taken from Eljinini et al. (2006) where three sets of chronic disease related websites have been extracted and studied in depth.

An ontology has been built firstly for the domain of diabetes websites and then it has been edited to cover the asthma and hypertension-related websites. The methodology used in building the ontology is based on well-defined principles that have been presented by well-known research-

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