

Chapter 14

Using Ontologies in Drug Prescription: The SemMed Approach

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ABSTRACT

Medical prescription has been touted as following an accurate approach to addressing particular health problems. However, the importance of the process might demand considering a formal knowledge-driven procedure to ensure its correctness which can be achieved through Medical Decision Support Systems (MDSS). Semantic Technologies have emerged as a potential silver bullet to become the backbone of those particular Information Systems since it provides seamless integration and an underlying logical formalism. This paper sheds light into using ontologies for drug prescription through the SemMed model, architecture and proof-of-concept implementation, being able to face challenges in these areas and solve day-to-day problems of health professionals in terms of drug prescription.

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INTRODUCTION

Medication prescription plays a central role in healthcare. Nevertheless, medication is not always prescribed effectively (Martens et al., 2007). Apart from higher costs, a number of different risks concerning patient health have been raised. Medication-oriented errors are usually the result of failures during the medication process (Eslami, de Keizer, & Abu-Hanna, 2008). Errors can occur in any step of this process: taking history, ordering, pharmacy management, administration management or surveillance (Kilbridge & Classen, 2001). Prescription errors are often associated with poor health information (Bates et al., 2001). In order to reduce the risks caused by human factors, alert functions are set up in the prescription systems to remind doctors to check the related information (Lai et al., 2007). Therefore, taking into account that Information Technology enables us to do things in a better way (Fazlollahtabar, 2008), computer-based reminders proved to be effective in influencing doctor behavior in medication management (Bennett & Glasziou, 2003). On the other hand, the inability of the average physician to memorize the ever increasing number of drugs, treatment regimens and side effects can be also a source of prescription problems (Dean et al., 2002). In this scenario, computer-based Decision Support Systems (DSS) provide advice to care professionals based on guidelines can solve some of the problems related to drug prescription, among others (e.g., Goud, Hasman, & Peek, 2008; Garg et al., 2005). The development of Decision Support Systems (DSS, for short) is increasingly important in primary care for prescribing, performance measures, cost control and quality of care (Ruland & Bakken, 2002). Thus, DSS systems related to medicine are gaining importance in the literature (e.g., German, Leibowitz, & Shahar, 2009; Jerbi & Kamoun, 2009; Vich, Gomez, & Carnero, 2009; Zhuang et al., 2009), to cite just the most recent and relevant ones.

Semantic Technologies have been pointed out as the future of Web (Benjamins et al., 2008) and a new way to support knowledge (Vossen et al., 2007; Fensel & Musen, 2001) in a wide range of domains (Lytras & García, 2008), including medicine. Semantic Technologies, based on ontologies (Fensel, 2002), provide a common framework that enables for data integration, sharing and reuse from multiple sources.

Given the importance of drug prescription and the crucial role DSS is playing in medical praxis, the goal of this paper is to present SemMed, a system based on Semantic Technologies that is in the proof-of-concept phase, to develop a system with the capability to assist healthcare professionals regarding the possible medication or drug to prescribe, according to following fundamental selection criteria. Semantic Technologies provide a higher amount of possibilities when managing and operating with specific information in the sense that this technology offer many advantages. These forthcoming gain more importance in this domain due to the seriousness that takes the Medicine scope. For all these reasons, SemMed uses ontologies where all the necessary information is stored. This information includes data such as those regarding to drugs and illnesses. With this and the data pertaining to the patient in subjects like allergies, medicines that he is already taking and the diagnosed illness, it is possible to run a knowledge extraction process that allows the user to obtaining the particularly needed information. One of the strong points of SemMed that sets the difference from other projects with similar aims is that the use of ontologies as an information storing system provides implicitly the possibility, amongst others, of making direct inference from this ontology. Thanks to that, the possibility of making logical operations produce an optimal and adequate recovery of information, providing the necessary knowledge and allowing the specialist to whom is focused the DSS for giving a more appropriate and accurate diagnostic, reducing or even removing the human errors that could be

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