Chapter 51
Knowledge Representation Using Fuzzy XML Rules in Web-Based Expert System for Medical Diagnosis

Priti Srinivas Sajja
Sardar Patel University, India

ABSTRACT

The Web is a huge repository of information for large spectrum of decision making and advise. To effectively utilise it, there is a need for knowledge-based techniques. This chapter proposes a novel technique of knowledge representation using a fuzzy eXtensible Markup Language (XML). XML is an efficient tool to represent content; however, it lacks management of uncertainty and vagueness. The proposed technique serves dual advantages such as making the application Web-enabled and imparting benefits of uncertainty and intelligence. This chapter presents the general structure of fuzzy XML rule, DTD model, and the generic architecture of Web-based expert systems using fuzzy XML knowledge base for a variety of applications in different areas. To demonstrate the architecture proposed, an abdomen pain diagnosing system for appendicitis is discussed with sample rules along with a decision tree for the case.

INTRODUCTION

Modern communication and computing technologies have great influence on our lives. Internet and Web have become very essential and important for nearly everyone on this planet. As we all know, the Internet provides a platform for pool of information that people can create and use. Such Web of information is ubiquitous and we all have accepted the Web as a very large repository of information and acting as a key driving force for large spectrum of decision making and advisory. During the past few years, the Web has evolved at an exponential rate. Unlike earlier read only version of the Web, the Web now has become read, write and execute type of Web. Since Web is for everybody and contributed by everybody, majority content of the Web has become unstructured. Because of its ability to store and deliver large

DOI: 10.4018/978-1-5225-1908-9.ch051

pool of information of any format, the Web can take care of acquiring, disseminating and presenting the information on request on a distributed platform. However, it is observed that the Web content is poorly organized and accessed randomly by different clients simultaneously. For effective utilization of the Web resources, it is needed to organise the Web content into homogeneous and structured information pool. Considering the size of the Web and nature of the Web (read, write and execute), it is practically impossible to organize the Web in the required form. That is, we cannot cover the whole earth with leather, but we can always wear a pair of shoes! In similar way, instead of ordering the Web content, the Web resources can be used in knowledge oriented manner. Further, whatever new knowledge is created that should follow some standard so that the electronic knowledge is easy to access and in machine readable form. Use of knowledge based system such as an expert system not only enables the intelligent decision support for prescribed domain, but also effectively manages the Web content. For this purpose, this chapter proposes a novel technique of knowledge representation using a fuzzy eXtensible Markup Language (XML) besides managing the Web resources using a generic multi-tier architecture. XML is a very efficient tool to represent information on the Web and Semantic Web. XML can represent given content using user defined customised tags; however, it lacks management of uncertainty and vagueness. The popularity and applications of XML can be strengthened by the application of fuzzy logic. The proposed fuzzy XML technique serves dual advantages such as making the application Web enable and imparting benefits of uncertainty and intelligence. The chapter proposes a structure of XML rule and tags along with DTD (Document Type Definition) model. The chapter also presents generic architecture of web based expert system using fuzzy XML knowledge base, which can be used for variety of applications in different areas. As fuzzy logic is a major constituent of this architecture, it is also used to strengthen user interaction. With the help of fuzzy logic component, user can interact with the system in more friendly and casually. To enable such facility, use of fuzzy membership functions and fuzzy user profile are considered along with the fuzzy XML representation.

Major advantages of the proposed architecture are:

1. Generic nature of the architecture;
2. Enabling the expert knowledge widely available using facility of the Web;
3. Making the expert system more compatible;
4. Making the expert system more user friendly and easy to use;
5. Managing vague and uncertain content at different levels; and
6. Documenting one or more experts knowledge as a user guide on a central place like the Web.

To demonstrate the utility of the architecture proposed, an abdomen pain diagnosing system with a case of appendicitis is discussed with sample rules from its knowledge base. The architecture specific to the abdomen pain diagnosing system, characteristics of the abdomen pain, methods available to diagnose abdomen pain and decision tree, and sample fuzzy XML rules for the domain are presented in this chapter.

The proposed architecture is generic and can be applied to variety of other areas. The only change required is the domain knowledge representation in fuzzy XML form. In future an interactive editor can be designed that acquires knowledge and forms fuzzy XML rules based on the acquired knowledge.

The chapter is organized as follows. Section 2 of this chapter introduces XML as an efficient tool for the Web information representation. Section 3 presents literature survey and discusses work done so far in the domain of XML, fuzzy XML and in the medical diagnosing. This section also presents common observations and limitations of the referred work at the end. Section 4 proposes a fuzzy XML concept