

## Chapter 44

# Semantic/Fuzzy Information Retrieval System

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### ABSTRACT

*In this paper, the authors present an overall description of their information retrieval system which makes a practical collaboration between Semantic Web and Fuzzy logic in order to have profit from their advantages in the information retrieval domain. Their system is dedicated for kids, for this reason the semantic/fuzzy collaboration materialized must be in the background of the information retrieval process because such category of users cannot certainly control semantic web technologies neither fuzzy logic commands. In this paper, the authors present the different services proposed by their system and how they use Semantic Web and Fuzzy logic to develop it. Evaluation tests of the system using universal measures show clearly its efficiency.*

### 1. INTRODUCTION

Retrieving relevant data through the giant amount of web documents represents a daily “challenge” for search engines users especially kids. It begins by a primitive question: “how to express my information need using a set of keywords” and it ends by “which document from the returned set is relevant to me”. To overcome such primordial issues, we present in this paper our information retrieval system dedicated for kids (having mental capabilities that allow them to surf web). Our information retrieval system materializes collaboration between two independent axes: Semantic Web and fuzzy Logic. The expression of the “Semantic Web” was invented by Tim Berners-Lee in 2001 (Berners-Lee et al. 2001); the essential idea is to allow the manipulation of semantic meaning of available data by web software agents via a

DOI: 10.4018/978-1-5225-5191-1.ch044

set of interoperable set of technologies. In a broader context, Fuzzy Logic formalized by Lotfi Zadeh in 1965 (Zadeh, 1965; 1989) is designed to treat cases where imprecision problems occurred. In this context, the fuzzy logic widens the possibilities of description of such problems and allows subsequently to have dedicated solutions for each description. The “human” reasoning of Semantic Web and Fuzzy Logic avails us to exploit them while the development of different services proposed by our information retrieval system. The rest of paper is organized as follows: in the next section we present background technologies employed to develop our system: Fuzzy Logic and Semantic Web. Section 3 presents our contribution; we define therein, two facets of our information retrieval system: option search dedicated for users and services non-transparent to them, those services are conceived to ensure the proposed option search, we enumerate in the same section, some related works and our system particularity. Section 4 presents results of evaluation tests of our system and its comparison with others information retrieval systems dedicated for kids and finally section 5 concludes the paper.

## **2. BACKGROUND TECHNOLOGIES**

### **2.1. Fuzzy Logic**

Fuzzy logic is a subset of artificial intelligence; it has an advantage over Boolean logic in that it is not limited to crisp values expressing a given statement, it reproduces complex human reasoning in order to arrive at realistic solution about the imprecise and fuzzy nature of real problems. Fuzzy reasoning is based on the application of a fuzzy rule set dedicated for a specific problem. Generally fuzzy rules have a common form: “if  $x$  is  $A$  and  $y$  is  $B$  then  $z$  is  $C$ ”. The application of fuzzy rules leads to the identification of a precise value representing the awaited solution of a problem. A fuzzy inference system (see Figure 1) consists of three major modules (Dernoncourt, 2011):

1. **The Fuzzification:** Define the fuzzy sets appropriately to the numerical values given as input. It converts numeric values to different degrees of membership to the fuzzy sets; for example, 14 years old person could be considered 70% adolescent and 30% kid.
2. **The Inference Engine:** covers all fuzzy rules of a particular domain, these rules are often provided by experts of the domain. The inference module combines and applies the rules on fuzzy sets found in the fuzzification module. The output of this module is the combination of some sub fuzzy sets which further limits the fuzzy sets defined in the first module. For example: if a person is a kid then the type of game proposed is primary.
3. **The Defuzzification:** Allows inferring a net and usable numerical value from the aggregation rules result. This value is taken from the combination of sub fuzzy sets already defined in the inference module. Many defuzzification methods are used to define the appropriate numerical value. We cite for instance Centroid, mean-of-maxima and Bisector. For example: If type of game is primary then the level proposed is 3.

#### **2.1.1. Semantic Web**

The Semantic Web is a set of technologies led by the World Wide Web Consortium W3C<sup>1</sup> providing a common semantic framework that allows data to be represented processed and reused automatically.

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