

Improving the User-System Interaction in a Web Multi-agent System Using Fuzzy Multi-granular Linguistic Information

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Abstract. Nowadays, information gathering in Internet is a complex activity and Internet users need systems to assist them to obtain the information required. In an earlier studies [5, 6, 16] we presented different fuzzy linguistic multi-agent models for helping users in their information gathering processes on the Web. In this paper, we present a new fuzzy linguistic multi-agent model to access information on the Web that incorporates the use of fuzzy multi-granular linguistic modeling to improve its user-system interaction and be more user-friendly.

Keywords: Web, intelligent agents, fuzzy linguistic modelling.

1 Introduction

Information gathering on Internet is a very important, widely studied and hotly debated topic. One of the central problems in Internet is the growth of information to which Internet users are exposed. The exponential increase of Web sites and Web documents is contributing to that Internet users not being able to find the information they seek in a simple and timely manner. Users are in need of systems to help them cope with the large amount of information available on the Web [2, 18, 21, 22]. Examples of such systems include Web search engines, meta-search engines, multi-agent systems and information filtering systems [1].

A multi-agent system is one in which a number of agents cooperates and interact with each other in a distributed environment. On the Web the activity of a multi-agent system consists in to assist Internet users in information gathering processes by means of distributed intelligent agents in order to find the fittest information to their information needs. In a typical multi-agent system, the agents work together to achieve a global objective based on distributed data and control. Multi-agent systems have been widely used in Web applications [23, 25]. In the activity of a multi-agent system a basic aspect is an efficient communication among agents. The great variety of representations of the information in Internet

is the main obstacle to this communication, and the problem becomes more noticeable when users take part in the process. This reveals the need of more flexibility in the communication among agents and between agents and users [5, 29, 30]. To solve this problem we have applied satisfactorily the fuzzy linguistic approach [8, 9, 11, 31] in the development of different models of distributed multi-agent systems [5, 6, 16]. In these models the communication processes are improved by representing the information by means of linguistic labels. The drawback is that as the user queries as the relevance degrees of retrieved documents are assessed using the same linguistic label set with the same semantics. However, both concepts are different and have a different interpretation, and therefore, it seems reasonable and necessary to assess them with different linguistic label sets, i.e., by using multi-granular linguistic assessments [12, 15].

The aim of this paper is to present a new model of Web multi-agent system to access and retrieve information on the Web that incorporates in its activity the use of fuzzy multi-granular linguistic information to improve the user-system interaction. The communication among the agents of different levels and among the agents and users is carried out by using fuzzy multi-granular linguistic information, i.e., the different types of information that participate in the activity of the Web multi-agent system (query weights, user satisfaction degrees, relevance degrees, recommendations) are assessed with different uncertainty degrees, using several label sets with a different granularity of uncertainty. As in [16] we use the 2-tuple fuzzy linguistic representation [11] to model the linguistic information. To process the multi-granular linguistic information in the Web retrieval context we propose a method based on hierarchical linguistic contexts [12] as representation base of the multi-granular linguistic information. This new Web multi-agent model allows to represent the information in the retrieval processes with different levels of granularity. In such a way, the elements that participate in the retrieval processes are represented better and the user-system interaction is improved.

The rest of the paper is structured as follows. Section 2 reviews the fuzzy multi-granular linguistic modeling. Section 3 presents the new Web multi-agent model, and finally, some concluding remarks are pointed out.

2 Fuzzy Multi-granular Linguistic Modeling

In this section we present the fuzzy multi-granular linguistic modeling used to design the Web multi-agent model. So, we analyze the 2-tuple fuzzy linguistic approach [11], the concept of fuzzy multi-granular linguistic information and the fuzzy linguistic hierarchies [4] used in [12] to represent fuzzy multi-granular linguistic information.

2.1 The 2-Tuple Fuzzy Linguistic Approach

The 2-tuple fuzzy linguistic approach was introduced in [11] to overcome the problems of loss of information of other fuzzy linguistic approaches [8, 9, 10, 31].