Chapter 3.29
Information Retrieval in Virtual Universities

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ABSTRACT

Information retrieval in the context of virtual universities deals with the representation, organization, and access to learning objects. The representation and organization of learning objects should provide the learner with an easy access to the learning objects. In this article, we give an overview of the ONES system, and analyze the relevance of two information retrieval models for virtual universities. We argue that keywords based search (i.e., the Boolean model), though well suited for Web searches, is overly coarse for virtual universities. Instead, the vector model, on which our implemented search engine is also based on, seems to be more appropriate as it provides similarity measure (i.e., the learning object having the best match is presented first). We also compare the performance of four algorithms for computing the similarities (matching).

INTRODUCTION

Today people in all professions are faced with increasing demands. Technology develops in an ever-increasing speed, and the roles of people in work, society, and industry are shifting constantly. Keeping up with the pace of change requires continuous education and learning. Traditional campus-universities are trying to answer to this need of lifelong learning by building virtual universities, whilst facing competition from the commercial continuing education providers in the form of e-learning.

E-learning can be defined as information technology enabled and supported form of distance learning, in which the traditional restrictions of classroom learning have disappeared. The main tool of e-learning is a personal computer, and the Internet serves as the principal communication and distribution channel. The learners can participate in online Web-based courses and interact with both the peers, instructors, and the learning materials.

E-learning sets new requirements for universities: they have to build global learning infrastructures, course material has to be in digital form, course material has to be distributed, and learners must have access to various virtual universities.

As single virtual universities are independently created, they may provide very heterogeneous functionalities and user interfaces. Ideally, the learner should be able to access all the virtual universities in a similar way (i.e., the heterogeneity of various virtual universities should not burden the learner). How this goal can be achieved is the main topic of the ONES-project. Consequently, the main functions of the ONES system are to hide the distribution of e-learning portals, and to hide the semantic heterogeneity (i.e., problems arising from using same words in different meaning and vice versa).

In order to achieve these goals, the system will deploy many new technologies such as "one-stop portals," Web services, service oriented architecture, RDF-based annotation, ontology editors, and distance measures in searching learning objects.

In this chapter, we will restrict ourselves on the role of searches in the ONES-system. In particular, we will analyze the applicability of different information retrieval technologies. Our main argument is that the technology based on the Boolean model (Yan & Garcia-Molina, 1994), though well suited for searches in the Web, is not suitable for the emerging virtual universities. Instead, for virtual universities we have to develop methods, which allow learners to be more concerned with retrieving information about a subject than with retrieving data, which satisfy a given query. For example, a learner may be interested in courses dealing with object-oriented programming rather than in the courses where the term "java" or "C++" is stated.

When searching for information about a subject (e.g., object oriented programming) the search engine must somehow interpret the metadata of the learning objects and rank them according to a degree of relevance to the learner's query. The primary goal is to retrieve all the learning objects, which are relevant to a learner's query while retrieving as few non-relevant objects as possible. Unfortunately, characterization of the learner's information need is not a simple task. Furthermore, the difficulty is not only in expressing the information need but also in knowing how the learning objects should be characterized with the help of the metadata descriptions.

The rest of this chapter is organized as follows. First, in the second section we give an overview of the architecture of the ONES-system. In the third section we characterize virtual universities. In particular, we will give an overview of the e-learning environment, and specify what the notion of resource-based learning incorporates. Then, in the fourth section, the role of metadata and ontologies in virtual universities is illustrated. In addition, the usability of the Boolean and the vector model in a virtual university is analyzed. Especially, two interpretations of a hierarchical ontology in the context of the vector model, called *weighted leaves* and *multilevel weighting*, are introduced. Then, in the fifth section, the performance of four matching algorithms based on weighted leaves and multilevel weighting principles is compared. Finally, the sixth section concludes the chapter by summarizing the feasibility of the proposed ideas.

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