

## Chapter 8.9

# Dominant Meaning Approach Towards Individualized Web Search for Learning Environments

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### ABSTRACT

This chapter describes how we can use dominant meaning to improve a Web-based learning environment. For sound adaptive hypermedia systems, we need updated knowledge bases from many kinds of resource (alternative explanations, examples, exercises, images, applets, etc.). The large amount of information available on the Web can play a prominent role in building these knowledge bases. Using the Internet without search engines to find specific information is like wandering aimlessly in the ocean and trying to catch a specific fish. It is obvious, however, that search engines are not intended to adapt to individual performance.

Our new technique, based on dominant meaning, is used to individualize a query and search result. By dominant meaning, we refer to a set of keywords that best fits an intended meaning of the target word. Our experiments show that the dominant meanings approach greatly improves retrieval effectiveness.

### INTRODUCTION

The main goal of Web-Based Adaptive Tutoring Systems (WBATS) is to adapt information to the particular needs of individual learners. To meet their needs, we must enrich their knowledge

bases with information from many resources. We exploit the huge amount of Web information to build a system of this kind. Finding the right information at the right time, however, is a very time-consuming task; Web search engines present thousands of results, almost half of which are inappropriate (Pretschner & Gauch, 1999). Modern search engines attempt to take into consideration the structure of every document and set of words included within a Web document, but a semantic Web technique would find the meaning of each document (Berners-Lee, Hendler, & Lassila, 2001). Based on ontological terms, the content of each document would be meaningful. Note that the term user is often interchanged in this chapter with the term learner.

Individualization is one of the most powerful mechanisms for the semantic Web. Individualization and personalization are intimately related to each other. Researchers use them to customize the subject according to user interests. To be precise, they do so as a way of sharing information that satisfies the needs of individual users. Therefore, we can define Web individualization as “the process of adapting the topic and construction of a Web site to the individual needs of each user, taking advantage of the knowledge gained from his or her own behaviours and interests” (Eirinaki & Vazirgiannis, 2003). The goal of a Web individualization system is to “provide users with the information they want or need, without expecting them to ask for it explicitly” (Mulvenna, Anand, & Buchner, 2000).

In this sense, this chapter deals with a new technique, called dominant meanings (Razek, Frasson, & Kaltenbach, 2003d) and how it can be used to make individualized Web searches. How does it influence search results? The dominant meanings definition is known as “the set of keywords that best fit an intended meaning of a target word” (Razek, Frasson, & Kaltenbach, 2003a). This technique sees a query as a target meaning plus some words that fall within the range of that meaning. It freezes the target meaning, which is

called a master word, and adds or removes some slave words, which clarify the target meaning.

For example, suppose that the query is “Java.” The word “Java” has three well-known meanings: Java (computer program language), Java (coffee), and Java (Island). We use the learner’s context of interest and domain knowledge to individualize the context of this target word. We do that by looking for keywords in the user profile (the learner’s context of interest) to help in specifying the intending meaning. Because the target meaning is “computer program language”, we look for slave words in the user profile that best fit this specific meaning—words such as “computer”, “program”, “awt”, “application”, and “swing”.

In a major part of this chapter, we will try to solve answer the following problems: how to construct a method that allows us to find the dominant meanings from a document collection, how to select an intended meaning, and how select additional slave words. In short, we need to find a way of constructing this context and then using it to expand the query. We claim that individualizing the context of a search can significantly improve the results. Our idea is to represent the collection as a hierarchy of concepts. Each concept consists of some dominant meanings. And each dominant meaning is linked with a text fragment that defines it (Razek, Frasson, & Kaltenbach, 2003c). The more any query consists of dominant meaning, the more closely it is related to its search context.

For ranking documents, we have designed a semantic measure. This is what we call a “dominant meaning distance method.” The measure estimates distance between the original query and the collection of retrieved documents based on existing sets of dominant meaning.

We have applied this technique to a learning environment. Our confidence intelligent tutoring system (CITS) (Razek et al., 2002c) has been developed to provide a cooperative intelligent distance learning environment for a community of learners to improve online discussions. To be adaptive and dynamic, this CITS searches the Web and

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