Chapter 11

Boosting Semantic Relations for Example Population in Concept Learning

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ABSTRACT

In this chapter, we discuss the advantages of expansion of learning objects through directed semantic relations (DSRs). We then propose an approach that can automatically construct the DSRs between learning objects and form a DSR graph. This approach addresses the problem to those learners with broad backgrounds. Also, we design two learning activities to show that how this DSR graph can be used to scaffold students’ semantic reasoning. The case study suggests relevant benefit of applying semantic technologies in educational context. This may implicate that this kind of relations can foster systematic thinking and complex domain knowledge inferences by complementing the raw chunks of data with different kinds of meaningful relations (e.g. feeding relation) and semantic associations.

INTRODUCTION

In the digital age, designing efficient multimedia learning objects is not as hard as before. One reason is that a lot of multimedia authoring tools have been developed for rapid learning material design, such as image editing software, video editing software, and multimedia presentation design tools, which are efficient and easy to use. Another reason comes from the original feature of digital contents: Easy to reuse and share. The advent of Web 2.0 further simulates this kind
of sharable and reusable process. For example, now even learners could easily create their own digital content by taking a picture and uploading to public sharable websites. This behavior could help learners provide each other with more authentic examples for understanding a concept. For example, when students start to learn the concept of RFID (Radio Frequency Identification) technology, if possible, they could use a mobile device to take a picture of their identification card equipped with RFID technology and upload the picture with self-added description of the application of RFID. Furthermore, students could share these pictures with each other so as to discuss deeply for RFID concept.

However, if an abundant amount of information provided on the E-learning system without properly compulsory and accurate check before publication, students may encounter a difficulty in finding out the suitable learning contents by themselves. From the aspect of the learning strategy, these contents also lacked the well-organized structure before presenting to students. Thus the information overload, the other side of the coin, may lead to a lower learning performance (Rouet, 2009).

In order to solve the issue of information overload, E-learning system usually provide two ways to support efficiently retrieval these published learning objects. The first one is keyword-based expansion. This expansion method first counts the number of keywords occurred to two metadata of learning objects. And then the learning objects with the largest number of common keywords are provided to students. However, the drawback of keyword-based expansion has lack of semantic linking. Some learning objects which do not have meaningful relation between them will also suggest to students.

The second expansion method is structure-based expansion. This expansion method first represents the structure-oriented relationships of particular domains, such as the family of animals. And then the E-learning system will provide the neighboring learning objects around the query learning object to students. The structure-based expansion can guide the learner to understand the ‘parent-child’ relation between two learning objects.

The above-described method is mainly to make students known the similarity and hierarchical relationships among learning objects. However, more complex knowledge exists and students need to reason, interpret, and comprehend them, for instance, the concept of Food Chain in an ecosystem domain (Le Heron & Sligo, 2005). For example, after instructing one organism to students, the teacher may give students another organism and conduct a feeding relation between them. And then the teacher will explain the definition of a food chain. Further, in order to help students understand this concept, they are also given many figures of organisms and asked students to construct a simple food chain between them (e.g. “grass → rabbit → fox,” “grass → mouse → snake” and “fish → bear”). In addition, the teacher can also show students a diagram of the food web and ask students to explain the meaning of this concept. With gradually instructing the organisms and the feedings between them, students will acquire the deep understanding of the concept of feeding relations in the ecosystem.

This kind of directed semantic relations (DSRs) (e.g. feeding relation) is another effective way for retrieving the learning objects to students. This expansion method differs from keyword-based expansion and structure-based expansion on the strength of connectivity between two learning objects. In the other word, DSR-based expansion offers learners a sequence of deep comprehensible paths through the complex domain knowledge, instead of keyword-based expansion which may generate a lot of irrelevant learning content and structure-based expansion which represent often simplified relation ‘parent-child’ between two learning objects. The E-learning system also can use the direct semantic relation to scaffold the learner semantic reasoning through the complex