Information Sharing System on Open Education Materials for Computing Curriculum

Jun Iio*, Yuichi Sei*, Tomoharu Shimizu*, and Fumihiro Kumeno**
Mitsubishi Research Institute, Inc.*,
National Institute of Informatics / Nippon Institute of Technology**
{iiojun,ysei,hal90}@mri.co.jp, kumeno@nii.ac.jp

Abstract

We have collected information on courses whose educational materials are available on the Internet, and stored it into a database in a common format. In addition, we added keywords (tags) extracted from the course outlines. The course information has been arranged in categories consistent with J07, the computing curriculum standard defined by the Information Processing Society of Japan. The courses have been classified into appropriate categories in the database, and a prototype of a portal web site to access course information has been constructed. Users can access information on the site by using a tag cloud, directory, or a full-text search. We collected 151 records describing open education materials in the computer field. They cover almost the entire area of J07. We also show the trends in open education in this field, derived from the collection, as a tag cloud.

1. Introduction

The concept of OpenCourseWare (OCW) has been commonly shared by the public, and various kinds of educational materials are published as OCW by hundreds of universities all over the world. However, only a limited number of courses have been published as OCW in the information sciences and computer engineering field.

Meanwhile, many educational materials can be found on information technologies such as programming, networking, and databases on the Internet. They are not course-ware that has been officially released as OCW. Although they are not OCW, many of the materials are freely available on the Internet, and some of them are even reusable under free content licenses such as Creative Commons.

In order to establish clear paths to those educational resources, we have collected information on courses whose materials are available on the Internet, and stored it into a database in a common format.

We describe here the various categories and the method used to collect information. Then the results of collecting information, and an analysis based on the results are discussed. Finally, related work is reported, and a conclusion is given in the last section.

2. Gathering of Information

Before describing the method used to gather information it is necessary to explain the database structure, where the collected information was stored. A record in the database consists of a group of related fields: university, faculty, department, course name, year and semester, level, textbook, abstract, and titles of lectures.

2.1 Classification by J07

The course information has also been arranged by categories designed in J07[1], which is the computing curriculum standard defined by the Information Processing Society of Japan (IPSJ). J07 has five major areas, as indicated in Table 1. Each area has its own subcategories. The courses we collected were classified into

appropriate categories in the database.

Tab. 1 Categories defined in J07

	Category name	# of sub-categories
SE	Software Engineering	17
IT	Information Technology	12
IS	Information Science	27
CS	Computer Science	15
CE	Computer Engineering	16

2.2 Tag Cloud

In addition to this classification, keywords, which are called tags, extracted from course outlines were added to each record. Based on the tagging results, the technological trends in the collected courses are represented as a tag cloud.

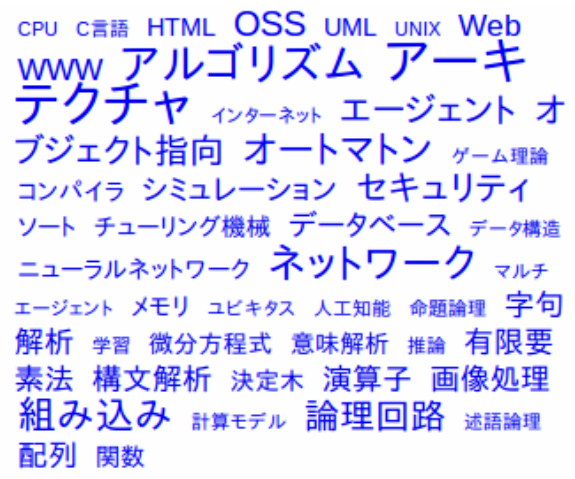

Fig. 1 Tag cloud of collected educational materials shown in our prototype system.

A tag cloud, which is sometimes called a word cloud or weighted list, is a visual representation of keywords. Tags are shown in alphabetical order in varying font sizes. The size represents the importance of each tag. Therefore, users can grasp the technology trends at a glance by viewing a tag cloud. (Shown in Figure 1)

2.3 Method of Collecting Information

In this subsection, the procedure for gathering information is presented. The work to gather information to develop a prototype was conducted from December 2010 to January 2011.

The information retrieval proceeded in the following order.

(1) Choose search keywords
(2) Find the pages providing educational materials freely used by third parties
(3) Fill in a record of the database
(4) Add a page to the portal site
(5) Classify the pages according to J07 and add tags depending on the course content

The search keywords were selected from two groups. One group (A) was a keyword list defined by IPSJ for the submission of papers. We considered that it could cover the whole area of the computing curriculum. The other group (B) was a set of special terms containing "course materials," "presentation slides in the lecture," and other words associated with uploading materials onto the Internet servers. To find educational materials efficiently, two keywords, one each from group A and group B, were input together into the web search engine.

Note that the pages found as a result of the web search were carefully examined, especially in regard to licensing and whether publication is allowed.

3. Database on Information Collected

To create an index for the open education materials for the computing curriculum, we constructed a prototype of the portal web site for the information collected. There are three ways to access course information from the top page of the portal. The first one is to use the tag cloud previously described. The second is to use a directory in accordance with the J07 categories. The last one is to carry out a full-text search.

3.1 Prototype of Web-portal

The prototype of the web portal for open education materials was constructed based on the WordPress[2] system. WordPress is an open-source content management system commonly used on the Internet.

Figures 2 and 3 are screenshots of the prototype. The former shows a list of titles and their abstracts. User can click on the title to see a detailed explanation of the page content. After the page transition, the latter page comes up with course information.

Fig. 2 Screenshot of prototype (1); the page showing university name, registration date, categories, and abstract.

Fig. 3 Screenshot of prototype (2); the page showing course details.

At the top right of both figures there is a search field. This provides a full-text search function to find an appropriate course without using the categories or keywords previously defined.

An important point of this system is that the database in the system does not have any educational materials itself. This web portal only contains information on the materials, and it can only address the location where the education materials exist. After users of this system find the appropriate information, they have to click on a link embedded in the page to obtain the educational material.

3.2 Results of Collection

We conducted a thorough investigation over the Internet using the keywords most targeted for the computing curriculum, and as a result found 151 records, which we have stored in the database of the prototype system. These records cover almost the entire area of J07.

Table 2 lists the top seven categories[1]. This suggests that programming, basic architecture, and algorithms are considered to be significant and are frequently taught at Japanese universities.

Tab. 2 Top seven categories that have a large number of records in the database

# of classified	Categories
27	IT:PF Fundamental Programming
25	CE:PRF Programming
22	SE: Data Structure and Algorithm
19	CS:AR Architecture and Structure
19	CS:CN Computational Science and Numerical Computation
19	IS:1.2 Algorithm and Data Structures
18	IS:1.3 Programming Languages

Furthermore, 844 tags were added to the 151 articles. This means that each article is labeled with about five to six keywords. “Architecture” is the most frequently as-

[1] Note that an article can be classified into multiple categories. Hence, the total number of categories is not equal to that of articles.

signed tag. The top ten tags are listed in Table 3.

Tab. 3 Top ten tags frequently assigned to articles

# of assigned	Tag(s)
12	architecture
9	algorithm
8	network
7	embedded, automata
6	OSS, agent, security, logic circuit, object-orientation

4. Related Work

Many universities provide their courses as OCW. For example, Massachusetts Institute of Technology (MIT) launched MIT OCW[3] in 2002, where presently provides over 2,000 courses. S. E. Carson reports that site visitors are highly satisfied with the materials[4]. Open Learning Initiative[5] offered by Carnegie Mellon University (CMU) provides Open & Free Courses. Students can access the course materials, and can track their progress by creating their free accounts.

Several organizations collect open education materials from many sources and provide them on the Internet. Open Courseware Consortium[6], which is a worldwide community of hundreds of universities and organizations, provides over 6,000 courses from more than 60 sources. In Connexions[7], anyone can create their courses by creating their accounts and uploading educational materials. Connexions has more than 1,000 courses and they are used by 2 million people per month.

Although there are many web sites which provide open education materials, there are only a limited number of courses in the information sciences and computer engineering field. Moreover, most web sites do not provide efficient search strategies to access course information. Hence, we have tried to provide open educational materials in the information sciences and computer engineering field, with several effective access methods, by a grass root approach.

5. Conclusion

We conducted Internet searches to find information on educational materials for a computing curriculum that can be freely used by third parties. As a result, we collected 151 records describing open education materials in this field, and they cover almost the entire area of J07. These results and the trends of open education in this field were discussed in this paper.

We are now working to prepare a production environment of the web portal for the open education materials. We believe that it will be a great help for students and educators alike in the information science and/or computer engineering field.

References

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