

## CHAPTER 5

### Applications

#### 5.1 Introduction

Frequent superset mining can be used in many areas, such as bioinformatics, E-learning, and so on. In this chapter, we introduce one of the applications of frequent superset mining in E-learning system to assist teachers, students, and even parents under such a distance-learning environment.

The traditional learning activities consist of three major parts, encouraging motivation, teaching, and assessment. Taking a one hour regular lesson as example, teachers have to spend about five minutes to encourage the learning motivation of students. Then the teaching activity starts and continues for about 30 to 40 minutes, and finally the assessment activity commences. In the first part, teachers have to know what kind of topics the students maybe interested in, and when the teaching activity starts, teachers have to know which knowledge the students have already had. That information is important for teachers, and can be acquired by collecting the personal learning record. The assessment part is to estimate the achievement of students. In the earliest period, this stage was to **measure** that how much concept the students understand after class. Later, it turned into **evaluation**. Nowadays, we use the term “assessment”, rather than measurement or evaluation. In theory, the assessments of learning achievement include not only the examinations, but the behavior

during learning activities, such as the quality of participation, discussion, collaboration, and so forth.

In order to carry out the learning activities successfully, we always hope that there are not too many students in a class, because teachers can control the atmosphere of class more easily. Furthermore, teachers can pay attention to the progress of every student, and adjust the schedule of classes timely.

## **5.2 Online Learning**

Urdan et al. considered the learning areas of distance learning can be represented in Figure 5.1 [17]. From this diagram, E-learning, online learning, and computer-based learning are all subsets of distance learning. They also think that e-learning is to spread content through all electronic media, such as the Internet, audio or video tapes, CD-ROM, and television. The term e-learning is the same with technology-based learning. However, online learning means web-based learning or Internet-based learning, and it uses Web as the communication that contains animations, simulations, audio, video, and graphics. In fact, both of them are supersets of computer-based learning, which uses the computers as the communication media.

In this chapter, we discuss the situation of online learning environment. There are three organizations instating the standards of online learning, or named web-based learning. They are IMS (Instructional Management System), IEEE LTSC (IEEE Learning Technology Standard Committee), and ADL (Advanced Distributed Learning Initiative). The well-known standard SCORM (sharable Content Object Reference Model) was proposed by ADL in 1997.

SCORM divides the course into many objects, called **learning object**, and using the XML metadata to describe those objects. The metadata consists of four elements, learning objective, pre-assessment, learning content, and post-assessment. Teachers and students can use the information to adjust the schedules and choose the courses in web-based learning systems.

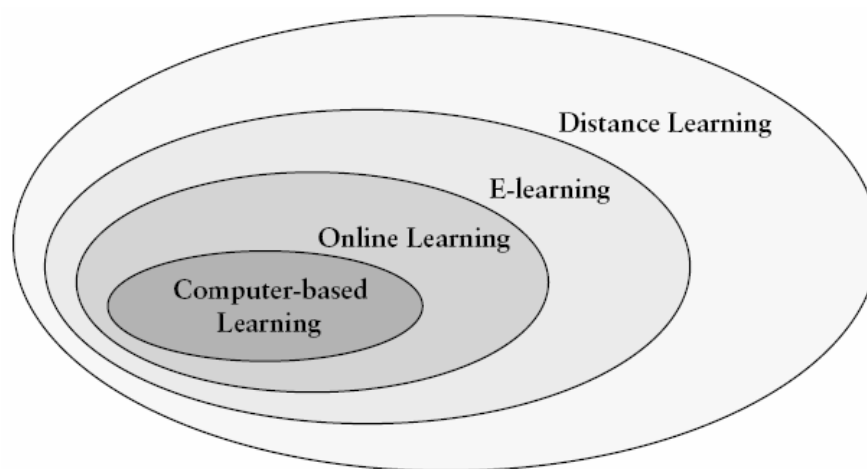


Figure 5.1: The areas of Distance Learning [17].

Recently, web-based learning system has been a popular distance learning technique, because we can surf the Internet easily, and edit HTML Documents effortlessly. Besides, the development of CAI authoring tools makes it more easily to design and plan an online course. Web based learning system inherits the characteristics of distance learning that provide a self-organization learning environment and learners can choose the learning methods and materials freely [18]. Through the Internet, teachers can utilize some resources such as hypertext, multimedia and so on, to encourage the learning motivation of students.

Web-based learning also brings us the disadvantage of distance learning such as lacking face-to-face conversation. Teachers are difficult to find the learning disorder and

hard to manage the atmosphere of class [19]. In order to overcome this problem and help teachers to understand the learning circumstances of students, we can analysis the learning behavior of students to discover their implicit behavior [20][21].

Student ID	Courses
S <sub>1</sub>	{A, B, F, G}
S <sub>2</sub>	{A, B, G}
S <sub>3</sub>	{A, C, H}

Figure 5.2: Learning behavior of 3 students, S<sub>1</sub>, S<sub>2</sub> and S<sub>3</sub>.

Table 5.1: List of learning objects.

Symbol	Object Name
A	Computer
B	Operating System
C	Database
D	Data Structure
E	Interface
F	Overview of OS
G	Process Management
H	DBMS
I	Application of DB
J	Tree
K	Introduction of Interface
L	Processes
M	Threads
N	Binary Tree

To analyze the learning behavior, we can transfer the learning object that students have learned into a transaction database. Figure 5.2 is a transaction database represents the learning behavior of 3 students. The learning objects are listed in Table 5.1, separately. For example, the learning objects for student S<sub>1</sub> are Computer, Operating System, Overview

of OS, and Process Management. Note that we do not consider the order of the courses yet in this thesis.

**Example 5.1** Considering the dataset of Figure 5.2, with the minimum support set to 2, the frequent supersets are {A, B, F, G}, {A, B, C, G, H}, and {A, B, C, F, G, H}, presented in Table 5.2.

Table 5.2: Frequent supersets of the dataset in Figure 5.2.

Symbol	Object Name
{A, B, F, G}	{Computer, Operating System, Overview of OS, Process Management}
{A,B, C, G, H}	{Computer, Operating System, Database, Process Management, DBMS}
{A, B, C, F, G, H}	{Computer, Operating System, Database, Overview of OS, Process Management, DBMS}

Considering a student  $S_4$  reads the object {A: Computer}, the subset of  $S_1$ ,  $S_2$  and  $S_3$ , and he does not get better grades, while all of them do. It is likely to recommend  $S_4$  to read the courses B, F, and G, that is computer, Operating System, Overview of OS, and Process Management, which consist of the minimum frequent superset {A, B, F, G}, to get better grades. Because the minimum frequent superset of those students is a norm of all students that have better grades.

In this case, we find the frequent supersets of students' learning behavior to recommend the new learning objects. Besides, there are still many applications that adopt the frequent supersets in E-learning system. The first is to predict the learning outcome of one student by comparing the learning pattern of a student and the frequent superset of all students that have better grades. The second is to class students into several groups for

collaborative learning activities [22] by making each group has as larger frequent superset as possible. The third is to help teachers to understand the circumstances of students. When students do not read the recommended learning objects, teachers have to remind them of the necessary courses. The last is to investigate the abilities of frequent superset stated previously and establish a personalized learning environment.