Mining Learning Behavioral Patterns of Students by Sequence Analysis in Cloud Classroom

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ABSTRACT

In a MOOC environment, each student’s interaction with the course content is a crucial clue for learning analytics, which offers an opportunity to record learner activity of unprecedented scale. In online learning, the educators and the administrators need to get informed with students’ learning states since the performance of unsupervised learning style is difficult to control. Learning analytics considered as a key process is to provide students and educators with evidence-based, analytical and contextual outcomes in a way of making sense of their learning engagements. In this conceptual framework, this manuscript per the authors intends to adopt sequential analysis method to exploit students’ learning behavior patterns in Cloud classroom (an online course platform based on MOOC). Moreover, this research also compares the behavioral patterns of four grade levels in a university, with the purpose of finding the most key behavioral patterns of each grade group.

KEYWORDS

Behavioral Pattern, Cloud Classroom, Learning Analytics, Massive Open Online Courses, Sequential Analysis

INTRODUCTION

With the rapid development of web technology, a variety of MOOC (massive open online course) platforms emerge in large numbers since 2012 (Pappano, 2012). An increasing number of people are engaging in these online course platforms, thus massive learning behavior data have been generated. It needs to note that the data is synchronously produced naturally when learners study in online course platforms. Therefore, it’s content-rich which offers great opportunities for researchers to study learners’ online learning behaviors via learning analytics.

Learning Analytics in MOOCs

Learning analytics has gained increased attention in recent years with the widely use of MOOC (Yousef, Chatti, Schroeder & Wosnitza, 2015). The Society for Learning Analytics Research (SoLAR) defines that “learning analytics is the measurement, collection, analysis and reporting of
data about learners and their contexts, for purposes of understanding and optimizing learning and the environments in which it occurs” (LAK2011, 2010).

Some researchers have done a series of studies about the learning analytics in MOOCs during the past two years. For example, Anderson et al. (2014) developed a conceptual framework for understanding how users engaged in MOOCs and examined the different behavioral patterns of high- and low-achieving students. They also investigated how forum participation was related to other modules of the course. They found that students with high grades watched more videos than those with lower grades. Moreover, students with different grades behaved differently in assignment and forum. Kizilcec et al. (2013) presented a classification method that identified a small number of longitudinal engagement trajectories in MOOCs. First, they made a rough description of each student’s individual engagement in a course. For each assessment period, all participants were labeled either “on track” (did the assessment on time), “behind” (turned in the assessment late), “auditing” (didn’t do the assessment but engaged by watching a video or doing a quiz), or “out” (didn’t participate in the course at all). Then they visualized labels sequence to show movement if students moved from one assignment period to next. In these papers, learners are classified based on their patterns of interaction with video lectures and assessments, which is also the primary feature of most MOOCs to date. Halawa et al. (2014) presented a dropout predictor that used student activity features to predict which students were at risk high of dropout. These students usually skipped videos and assignments, rarely logged in the platform for two consecutive weeks, and got a student’s average quiz score below 50 points. Wen et al. (2014) from Carnegie Mellon University proposed a novel method to characterize types of sessions in MOOCs by mining the habitual behaviors of students within individual sessions. They modeled learning sessions as a distribution of activities and activity sequences with a topical N-gram model. To summarize the related researches, the mining of learning behavior patterns is a significant procedure of the learning analytics in MOOCs. However, compared with some studies on behavioral patterns, there are few studies exploring students’ behavioral patterns by adopting the method of sequence analysis in MOOCs. In addition, Cloud Classroom is a small private online learning platform, which is designed for every grade level’s students at college. It can be considered as a powerful tool for researchers to mine students’ differences in learning behaviors. This paper, therefore, is to identify learning behavior sequence patterns of students for each grade level in a MOOC-style online course platform.

Cloud Classroom and Its Educational Strategies and Design

Cloud Classroom is an online course platform based on the concept of MOOC (McAuley, Stewart, Siemens & Cormier, 2010). It is designed and developed by a research and development team at the Central China Normal University (Nercel, 2015). It has five main modules for students to learn online, including “resource”, “announcement”, “homework”, “member” and “statistic”. Students can view videos, submit assignments, check announcements in the platform. And every action in Cloud Classroom is recorded and stored in backend database. Figure 1 is a screenshot of students’ interface of Cloud Classroom. Figure 2 is the structure of the resources module.

Function of Each Module

There are several main modules in Cloud Classroom, and each function is introduced as follows:

- **Resource**: This module contains most of the learning resources of a course in Cloud Classroom. Students enter the resource module immediately after they log in an online course. They can view the unit, courseware and activities in this module. The detailed introduction of the structure of resource module can be seen in Figure 2 and its illustration.

- **Announcement**: Student can check course announcements published by teachers in the announcement module.
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