E-Learning Data Mining

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Abstract. In order to effectively analyze a large number of original data, the concept of large data is proposed. Big data era has brought a new change for education. With the rapid development of education information especially digital campus network and the growing popularity of higher education, education in the field of the deployment of many of the software systems, software systems in these stores massive educational data. E-Learning produced a large number of educational data in a variety of forms. E-Learning has achieved a certain effect on the scale effect, but the support for the individual of the learners is still seriously inadequate. The new technology, represented by large data and social networks, provides a new possibility for personalized learning.

Keywords: Big data · E-Learning · Digital campus · Data mining

1 Overview

The general feature of today's IT technologies is the cloud-based infrastructure that supports big data processing and applications, shifting from "compute-centric" to "data-centric." For the current big data processing is the cloud compute itself, both of which are the combination of large-scale data aggregation and customized distribution. Large-scale data aggregation and customized distribution for information sharing, information collaboration and learning to create a completely new environment. In the past 10 years, with the rapid development of education information, especially the massive practice of digitized campus and network higher education, a large number of software systems have been deployed in the field of education, and massive educational data are stored in these software systems.

2 E-Learning's Development

Learning was formally proposed dating back to 2000 and has been for more than a decade now, but has made great strides in areas such as enterprise training, basic education, higher education and lifelong education. However, E-Learning has been placed great hope.

Through the overall investigation of the development of E-Learning in different periods, E-Learning is divided into the following three stages from the aspects of technology maturity, teaching idea and method, resources construction [1–5].

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1. The smart terminal has entered the period of popularity and started to be widely used in the field of education. With the proliferation of educational applications based on the store model, e-textbooks and their distribution channels have entered a period of rapid growth worldwide. Learners begin to really have the opportunity to conduct learning activities electronically and to provide a foundation for the acquisition of big data. The ubiquitous learning model has emerged.
2. The learning platform began to appear centralized, and a unified learning platform began to emerge globally. Based on the cloud platform unified data center, a unified resource center began to form.
3. The arrival of big data era. The popularity of learning terminals and a well-established unified data storage center provide the possibility for large-scale data storage for learners. Learner learning trajectory and its related features can be well documented. Learning analytics becomes an important support tool. The advent of the big data era has provided the possibility for learning analytic refinement. For the first time, E-Learning has the potential to find a convergence between a large education coverage and a personalized learning experience.

The development of E-Learning has witnessed the holistic transformation of education from the paradigm of education to the paradigm of learning. To some extent, it can be said that e-Learning promotes the transformation of education paradigm. Educational reform itself also requires technical Full support. In summary, the development of E-Learning shows the following trends (see Table 1):

Table 1. E-Learning stage of development and its characteristics

	Teaching mode	Main construction content	Theoretical basis	Application areas	Terminal	Characteristic	Iconic event
Preparation period Before 2000	There is no fixed teaching mode, mostly electronic traditional education	Multimedia courseware, prototype and so on	Mainly on traditional model of behavioristic teaching	The embryonic stage of Various types of educational application	PC-based	The supplement of traditional teaching system	Network popularity, vitality than to achieve a higher level
Exploring period 2000–2009	A variety of mode exploration, such as mixed learning, inquiry learning and so on	Sakai, Moodle, Integrated Learning Systems, Open Courses and Boutique Courses, Various Teaching Resources, Standardized Business Training Courses	Mainly on constructivism	Enterprise E-Learning, basic education model exploration, lifelong learning began to take shape	PC, smart phone, PDA began to appear	A variety of innovative application exploration and effect of the application are also based on simple transfer of resources	MIT's OCW program, Sakai, Moodle applications
Relative maturity period After 2010	A mixed learning mode as the core of flipping the classroom	MOOCs, Video Open Courses, Unified Data Center and Learning Archives, Generative Educational Resources	Mainly on constructivism and situation awareness	Higher education and basiceducation beganto be in-depth application, lifelong learning appearing and the enterprise field into the integration period	The popularity of PC and smart terminal	E-Learning began to integrate into the traditional education process and innovative teaching model	Khan Academy, MOOCs, ebook and ebook package

- From economies of scale to quality requirements;
- From pushing simple resources to innovating learning mode;
- From the Educational Metaphor of Knowledge Transfer to the Educational Metaphor of Knowledge Construction in Situations;
- From independent application to systematic application;
- From technology-centered to learning-centered;
- From staged learning to lifelong learning;
- From pre-established resources to productive resources.

3 The Building of E-Learning Data Mining Mode

E-Learning data mining mode is built to complete a specific mining tasks. From the previous analysis of mining tasks, there are many elements of E-Learning. We can mine elements such as students, teachers, learning contents and learning activities one by one, but lack a logical main line to organize these scattered mining topics. In the following, the author uses the grid frame method in grammar to mark the semantic grid with "E-Learning" as the central predicate. Common semantic grid includes the agent case, the tool case, the object case, making case, the locative case, the guest case and so on. The result is shown in Fig. 1.

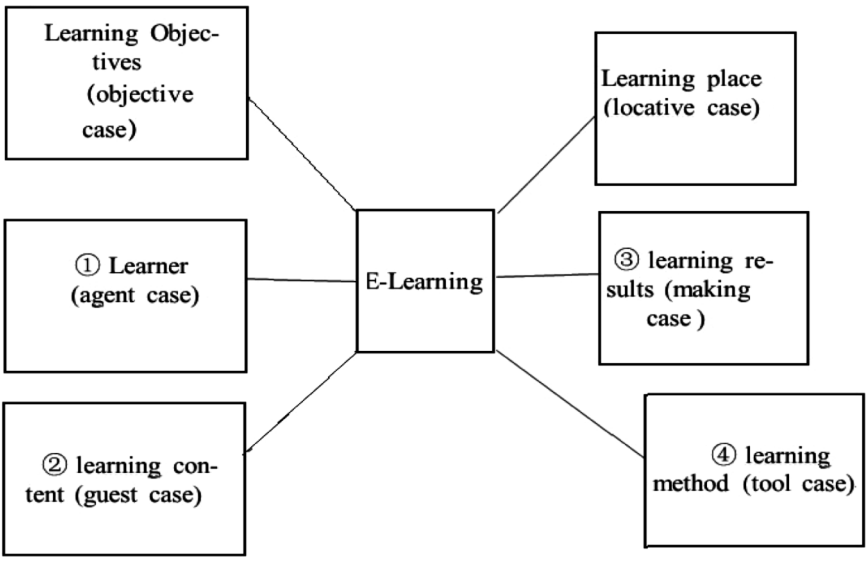

Fig. 1. E-Learning grid framework

As shown in Fig. 1, the author uses digital numbers to mark the four semantic grids that need to be focused on. The corresponding content of the four semantic grids has data records in the teaching platform or educational administration system and can form a clear logical main line. That the main line of "Who learns, what to learn, how to learn and learning effect" is the main line, using the data mining method to excavate and analyze the four semantic lattices, will make the central predicate "E-Learning" more clear, resulting in a more complete understanding of the current state of E-Learning.

Around this logical main line, three mining task scenarios can be generated, namely, learner feature mining for answering "who is learning", learning process mining for answering "what to learn and the results of mining for answering "learning effect", which builds three kinds of data mining patterns for others to complete similar mining tasks provide a reference.

3.1 E-Learning Data Mining Mode Components

E-Learning data mining mode consists of three elements: "data mining work", "tools and algorithms" and "data", "tools and algorithms" supports "data mining work" and produce the corresponding "data". The expansion of these three elements in time will respectively form the data mining workflow, tool and algorithm flow, and data flow. Data mining is in line with the general process of data mining, including data collection, data preprocessing, data mining, evaluation and application of model interpretation and other aspects. According to different mission situations, each part of "data mining work" has its own characteristics.

Tools and algorithms refer to the various tools and algorithms used in data mining workflows. The algorithms used in this paper cover the classical algorithms of data mining, including decision tree algorithm, timing algorithm, clustering analysis algorithm, sequential analysis and clustering analysis algorithm, association rules algorithm, linear regression algorithm and statistics and visualization methods. Data is the type of data that results from the use of tools and algorithms, including all kinds of knowledge gained from mining, such as visualizations, frequent itemsets, rules, sequence patterns, network diagrams, and so on.

3.2 Learner Characteristic Data Mining Mode

3.2.1 Training Algorithm

Backpropagation (BP) algorithm is the most popular type. This is a gradient descent search algorithm. It tries to update depending on the difference between the network output and the available data includes two passes: forward transmission (error calculation) and a backward pass (parameter tuning). In the forward pass, the effect applied to the input neuron's activity pattern propagates through the network layer by layer, producing the output of the network. The connection weights are assigned randomly at the beginning, so the input value is mapped to the output, but meaningless mode. The outputs are then compared to what is expected and the following error signal is generated (Fig. 2).

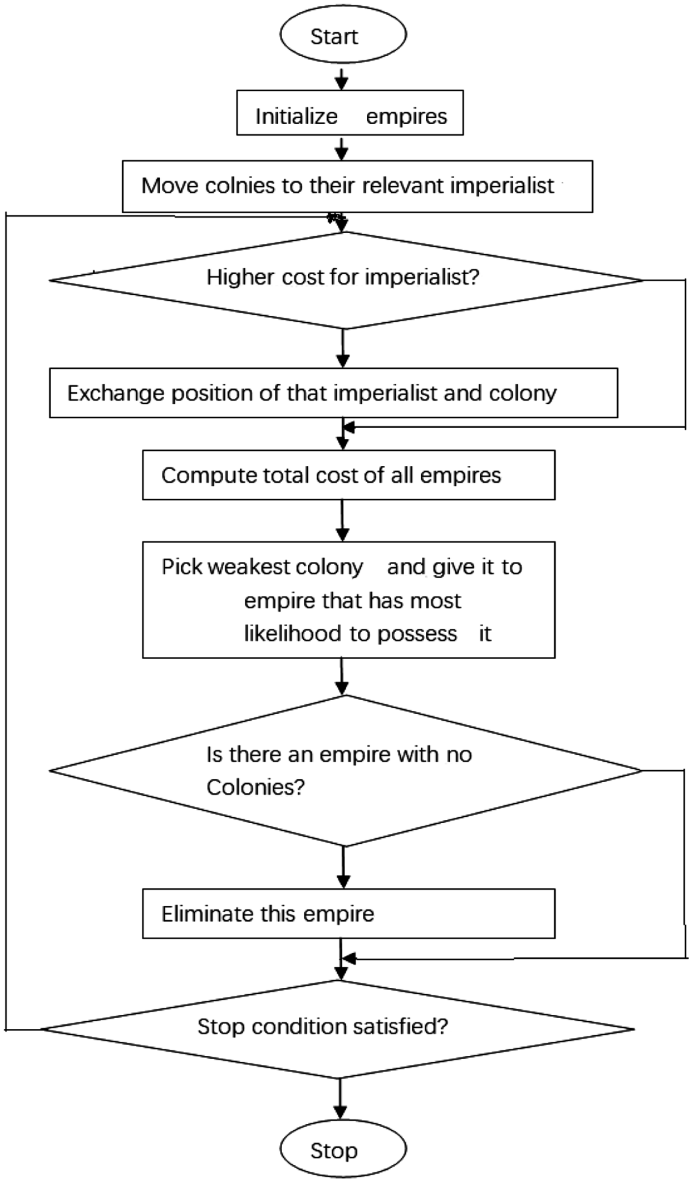

Fig. 2. ICA algorithm flow chart

4 Researchers Co-network Analysis

4.1 Researchers

According to the authors of the collected literature, there are a few researchers who can conduct in-depth research on education data mining field during 2008–2016. There are mainly 4 scholars who published more than 6 research papers.

4.2 Research Team

187 author indexes in the bibliographic information of 187 bibliographies were extracted, and the researchers conducted a quantitative analysis through the artificial intelligence network structure to calculate the overall network density of 0.0367. The connectivity between the network nodes (this refers to the researchers) is not high, is a sparse network, indicating that the degree of cooperation between researchers is relatively low, most of them are one or two researchers co-authored (Table 2).

Table 2. Quantitative statistics

Researchers	Chen 1	Ma 2	Niu 3	Chen 4	Wang 5	Li 6
Number of articles	8	5	9	8	4	8

5 Conclusion

Personalized Learning Appeal has A new way to achieve in Big Data Era - Big data analysis based on large-scale knowledge dissemination offers the possibility for learners and learners to analyze their content. A fusion of learning based on learner needs is taking shape. The difference between blended learning and traditional blended teaching is:

(1) The core concept: mixed teaching is mix of teaching methods at the core of the teaching behavior, The fusion learning mode is based on data analysis and is a holistic design method and technical analysis framework.
(2) Application areas: The traditional hybrid learning model is mainly to solve the problem of the choice of space-time education, and did not improve the core of learning itself, so its application areas are concentrated in relatively simple enterprise areas. Convergent learning is a learning model that focuses on learning internal mechanisms and is well used throughout the learning area, such as basic education, higher education, and lifelong learning.
(3) Fusion learning emphasizes learner's development and practical problem solving. The learning power of learners requires that learners have sufficient choices, including the choice of learning content, learning styles and learning process autonomy; learning process is a continuum of small-grained learning activities; E-learning is a continuous teaching system, which should be fully integrated into the overall education system, not just the supplement of the traditional teaching mode. Learning may take place at any time and place. Schools, social places,

workplaces and families will play different roles. E-learning completes the support and perfection of individual lifelong learning; the learning technology framework should be an open and scalable social learning support system; any individual is the designer and the consumer of the learning system, and the productive resources become the mainstream.

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