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An Embedding Method of Dynamic Educational Content through Big Data Analytics

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Abstract.A large variety of digital content for smart mobile devices has entered the market. The demand for more diverse digital content has been accelerated through the implementation of an educational environment termed 'Smart Education' in Korea. Digital content can be displayed on smart devices using a content viewer application. However, existing contentonly supportstatic features, and do not support features that deliver analysis of big data. To address these shortcomings, here we propose a method for embedding dynamic educational content,which can be obtained frombig data analytics, into existing smart educational content.

Keywords: Smart Educational Content, Dynamic Content, Big Data Analytics, Educational Content Viewer

1 Introduction

There has been much growth in the use of smart mobile devices in recent years, and the range of digital content available on mobile devices has also grown at a considerable pace. The electronic book (e-book) industry and digital textbooks,has grown especially quickly.E-books and digital textbooks can be viewed on smart devices using a number of existing e-book viewersand content viewer applications. The most popular e-book viewers include Apple's 'iBooks 2' and Readium's'Readium'. However, even though these support various features of the electronic publication format 3 (EPUB3.0), neither these viewerssupport features to embed dynamic content based on big data analytics. To address these shortcomings, we have developed a dynamic educational content viewer that can implement big data analytics and supports multiple device platforms. This educational content viewer was implemented as a part of the cloud-based smart education system[1,2]. For big data analytics[3,4], we usedHadoopMapReduce, which is an open-source framework for processing big data. We then visualize the results of these analytics results on the content viewer using SVG(scalable vector graphics).

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The remainder of this paper is organized as follows. Section 2 reviews content viewers, and the cloud-based content-oriented smart education system, and then describesthe process of embeddingdynamic content based on big data analytics to smart content, and our experimental results, and section 3summarizes the paper.

2 Creating Dynamic Content based Big Data Analytics for a Cloud based Education System

Many academic institutions are leveraging cloud-based technologies to support advanced teaching and learning processes,as well as to exploit the potential economic benefits. Cloud-based smart education systems have been developed by integrating a number of features for enhanced e-learning content services. Most of them is one developed by Jeong, et.al [2]. Figure 1 shows the infrastructure of the six main features required to support cloud-based educational content services [8]. The content viewer is designed to run on multiple device platforms, and supports a wide range of content. Specially, the content describing current state at a specific time such as current sales volume of smart phones, can be included. Clearly, the content can be changed over time, is called dynamic content, and is needed to be analyzed to summarize scattered data. In this paper, we describe the enlargement ofthe set of supported features by augmenting functions that deliver big data analytics, as shown in Figure 1. The big data analytics are visualized by seamlessly aligning the results thereof with other 2D and 3D objects.

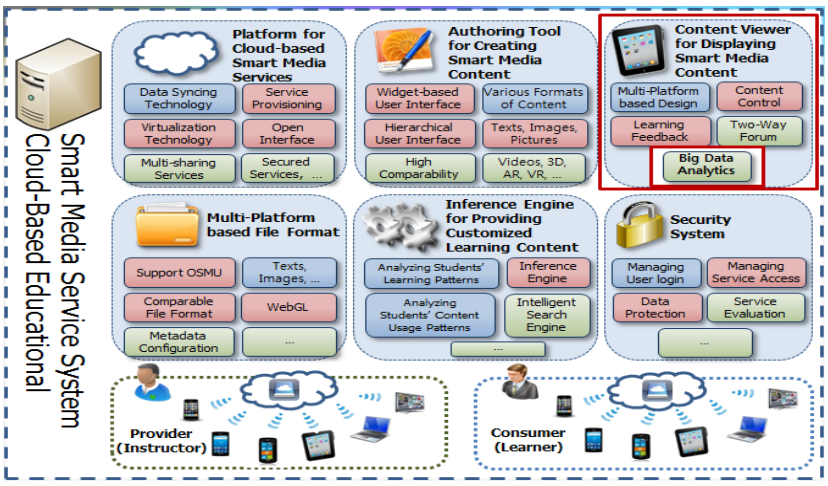

Fig. 1. Infrastructure of the cloud-based education system [8]

Based on the infrastructure as shown in Figure 1, we need to process big data analytics for embedding dynamic content into the educational content. In order to do it, first, we save the data to be analyzed to storage using the Hadoopdistributed file system (HDFS), and filter the data and perform a statistical summary operation using Ma-

pReduce (i.e., using the Map() and Reduce() methods). We thensave the statistical results to a database and visualize them on the user's screen using SVG.In the filtering process, the movies to be counted are imported to maps using the mapper, the outputs of which are partitioned per reducer using the values with the same key. We can then obtain the number of comments on each movie by counting the occurrences of each keyword in the reducers. As many output files are created as the number of reducers.

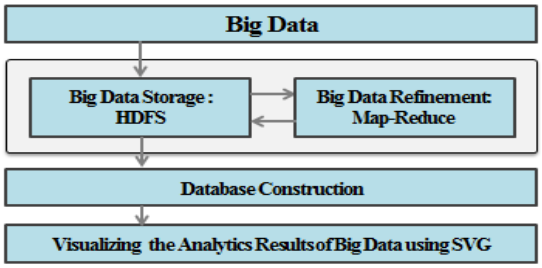

Fig.2 The process of big data analytics for embedding dynamic content

Figure 3(a) shows the result of big data analytics used on data hosted by the Ministry of Science, ICT and Future Panning (MSIP)[5], and National Information Society Agency (NIA) in 2013. Figure 3(b) shows the visualization of dynamic content containing the analysis result. We analyze the user preferences of movies, which contain over 10,000 comments. We selected 62 movies out of 870, which had more than 10,000 comments. We categorized the 62 movies into 7 genres, as shown in Figure 3(a) [5].

Genre	Percent(%)
Drama	25%
Comedy	17%
Melo	10%
Thriller	9%
Action	23%
SF	14%
Horror	2%
Total	100

(a)

(b)

Fig.3.(a) The results of big data analysis and (b) visualization of these data

3 Concluding Remarks

This paper proposed a scheme for embedding dynamic content into smart education content, where dynamic content will be created through big data analytics. The proposed scheme provides for teachers to more conveniently create dynamic content. The study is ongoing, and more frequent dynamic content based on advanced big data analytics will be investigated in future research through the expansion of a variety of content.

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