International Journal of Advanced Smart Convergence Vol.8 No.4 40-46 (2019)
http://dx.doi.org/10.7236/IJASC.2019.8.4.40

IJASC 19-4-6

Best Practices on Educational Service Platform with AI Approach

Je Seong Hong[*1], Bo Kyung Park[*2], Jeil Kwak[**], R. Young Chul Kim[*3], Hyun Seung Son[***]

[3*]*Professor, SE Lab, Dept. of Software and Communications Engineering, Hongik University,*
[1,2]*graduate students, Korea*
[**]*Jeil Edus, president, Korea*
[***]*Senior Researcher, Reliability Technology Institute, Moasoft, Korea*
[*]{[1]hong, [2]park, [3]bob}@selab.hongik.ac.kr, [**]jeiledus@naver.com, [***]hson@moasoftware.co.kr

Abstract

The current education is becoming more extensive with the application of various teaching methods. This is a problem that is so distributed that it is difficult for users to find the data and it takes a long time to find the information they need. Currently, various educational services, materials, and instruments are developed and scattered. Therefore, it is important to raise students' awareness of aptitude and career path with customized education tailored to students. Conventional education platforms have very difficult to choose the right materials for students because of the spread of educational programs and institution materials.

To solve this, we propose a customized recommendation approach to recommend customized educational service materials and institution for students to teachers, which helps teachers conveniently choose materials suitable for their respective environments. On this new platform, the CNN algorithm provides recommended content for classes and students. For real service on the educational service platform, we implement this system for Jeil edus business . Through this mechanism, we expect to improve the quality of education by helping to select the right service.

Keywords: *CNN Algorithm, Education, Recommendation, User Focused.*

1. Introduction

This study is the development of an education recommendation system for Jeil Edus as a small and medium business administration project in 2019. As diverse and creative learning methods are applied in recent years, more and more customized curricula are applying to students in relation to their education. The purpose of the program is to enhance students' insight into their career path through various hands-on activities and career exploration and practical programs. Educational contents are vast and separated in many places, making it difficult for traditional education companies to provide customized educational contents. It is difficult to find content that suits the users themselves. Therefore, it is necessary to find various educational contents and teaching aid on one platform and to recommend suitable contents for students in charge of teachers'

Manuscript Received: September. 16, 2019 / Revised: September. 20, 2019 / Accepted: September. 29, 2019
Corresponding Author: bob@selab.hongik.ac.kr
Tel: +82-44-860-2477, Fax: +82-44-865-0460
Professor, SE Lab, Dept. of Software and Communications Engineering, Hongik University, Korea

membership to reduce the time required to find the desired materials.

This paper utilizes CNN (Convolution Neural Network) [1] among artificial neural network technologies in order to help educators select programs and teaching aid suitable for students on the education marketplace platform. Through CNN, we learn about teachers' personal profiles, their schools, class profiles, and profile information about programs or teaching aid data used by teachers through the CNN algorithm. The learned algorithm provides a list of recommendations for users.

The composition of this paper is as follows. Chapter 2 describes the education marketplace platform, Word Embedding and Text-CNN. Chapter 3 describes the recommendation application methods and examples of program and teaching aid of education marketplace platforms. Chapter 4 refers to conclusions.

2. Related Work

2.1 Education Marketplace Platform

The education market platform is aimed at the entire country in near future. It is an online mediation platform that connects educational institutions, enterprises and users by registering or requesting education programs and teaching aid. The education company and the institution, the seller, posts teaching aids and programs, and teachers who are the main customers of the purchase may request the desired programs considering the environment of the type of school in which they belong, the area, the desired education subject, the place of education, the number of classes, the length of education, the cost, etc. This platform allows users to find appropriate programs or teaching aids through searching keywords. Through learning with CNN, customized content is provided as a list of recommendations, making it convenient for teachers to select data.

2.2 Word Embedding

In this paper, we learn through CNN algorithm based on text data. Therefore, it is necessary to convert natural language so that it can be typed into a computer and used. Word Embedding is performed for this processing of natural language [2]. We also use One-Hot Encoding, one of the Word Embedding methods of converting words, which are text data, into vector values composed of numbers. The One-Hot Encoding method changes only the corresponding data of several data to "1" in order to change the word data to low-dimensional vector data, and the other data to "0". The figure below [1] is an example of the One-Hot Encoding method.

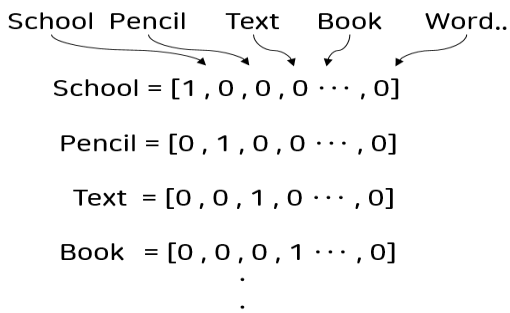

Figure 1. Example of One-Hot Encoding

Assume that there are four words in total: School, Pencil, Text and Book. Depending on the class of words that appear, School can be represented independently with vectors of [1,0,0,0], Pencil at [0,1,0,0], Text [0,0,1,0] and Book with vectors of [0,0,0,1].

2.3 Text-CNN

Among deep learning technologies, the CNN algorithm is mainly used for image data classification and boasts high performance. In addition, it also performs well for text data classification [3,4,5]. The figure below [2] shows the Text-CNN neural network structure. Filters that detect the characteristics of the data have a size of 3, 4 and 5, respectively.

The words needed to be learned are converted through One-Hot Encoding and embedded into two-dimensional data and entered into the Input Layer. It extracts the characteristics of the data through the Convolution Layer. Then, the Feature Map is created with extracted characteristics.

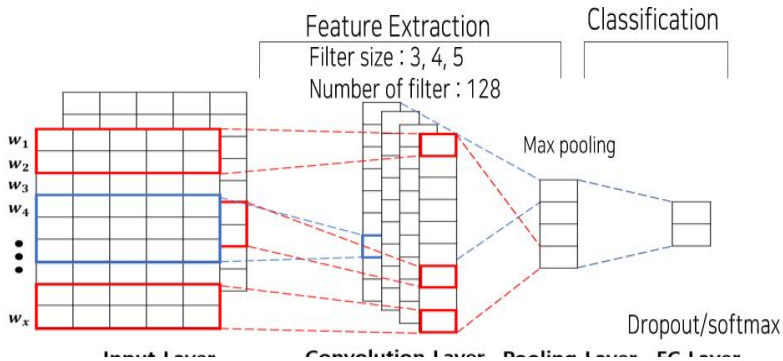

Figure 2. Structure of Text-CNN [1]

3. Our Customized Educational Service Recommendation Mechanism

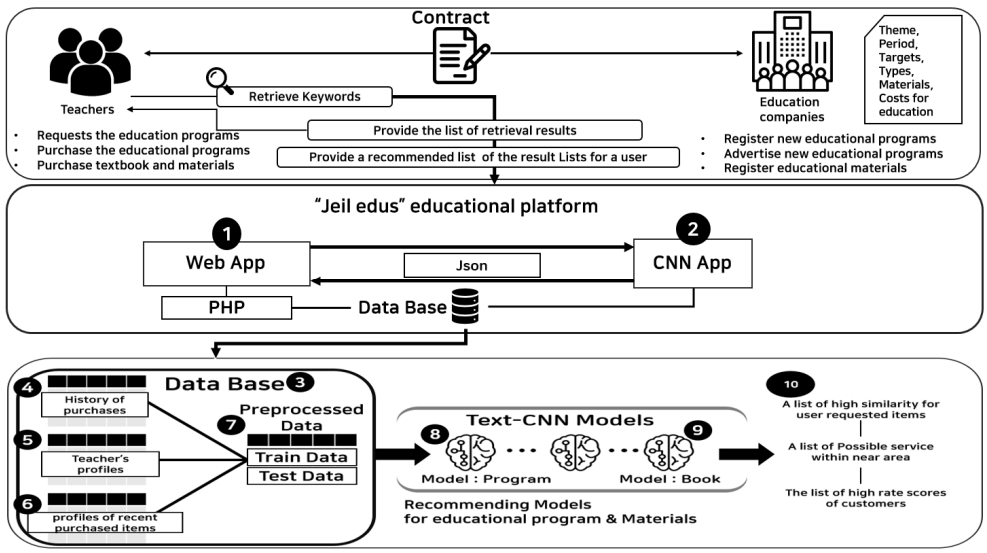

Figure 3. The Overall Structure of Education Service Platform

Figure [3] shows the overall structure of the education service platform. The servers of the education service platform consist of 1) Web App based on php that provides web services at the education service, 2) CNN App to provide a list of recommendations by measuring the similarity between CNN and 3) Database that stores information about teachers' use, programs and teaching aid. It saves teachers' 4) purchase history, 5) user profile and 6) item profile in the database via web page. Teachers' user profiles include the locality and the type of school in which they belong, gender, assigned task, class type, and region data of their interest. The

product's profile includes search hash tags, education-enabled areas, education periods, types of lectures, types of activities and education subjects. These data are pre-processed. 7) Pre-processed data is learned by creating a Train/Test data set for Text-CNN algorithm learning. The CNN App is divided into two categories: 8) Recommendation education program model and 9) Recommended teaching aid model. These are the models learned from the purchasing history of all users. Since it is a model learned from users' profiles and product profiles, products that used by users in a similar environment and products that are similar to their choice are recommended. 10) The recommendation function recommends users within the list of search results when they search with keywords. In this case, Web App and CNN App send and receive data required for search keywords and recommended algorithms in Json's method when a search event occurs.

4. Our Customized Service Recommendation

4.1 The Function of Web Platform

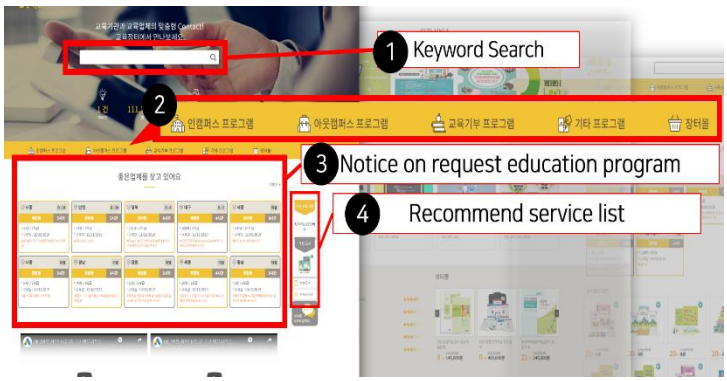

Figure 4. The Overall Structure of Education Platform 1

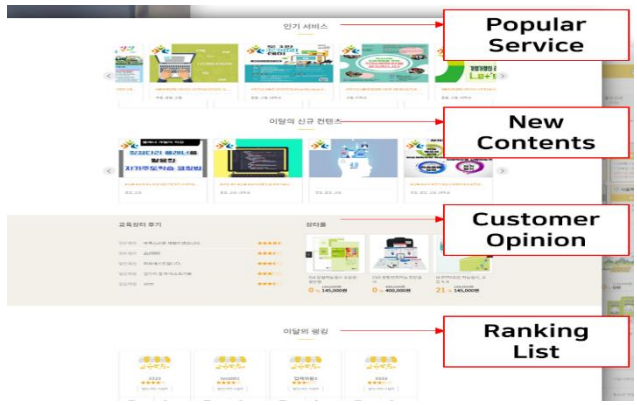

Figure 5. The Overall Structure of Education Platform 2

The following figure [4] shows the web service screen of the education service platform. From top to bottom, the following were implemented. (1) Users can find educational content related to keywords through keyword search function. (2) Users can see In-campus program which is an in-school program, Out-campus program which is a suburb program, Education contribution program by company which is a free program, other programs which is special lectures and consulting programs, and a marketplace mall which you can see teaching aid. (3) Users can write and publish information such as areas, education topics, class types, types of

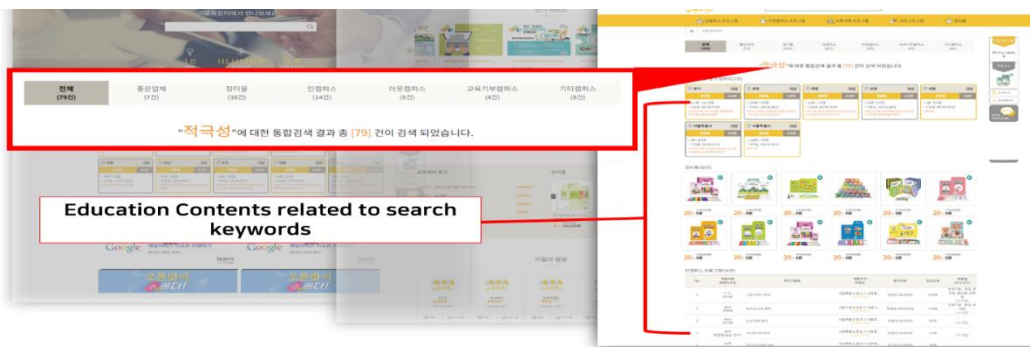

Figure 6. The Overall Structure of Education Platform 3

activities, and budgets that they want by posting a notice column for education programs at school. (4) This section is a banner where a recommendation list of customized contents is presented. The above figure [5]

shows popular content, new content, marketplace reviews and company rankings. The above figure [6] provides a list of educational content and teaching aid associated with search keywords. By adding "Activeness" to the keyword of the search, the related contents and teaching aid are printed.

4.2 I/O (Input and Output) of Data from Education Content Recommendations

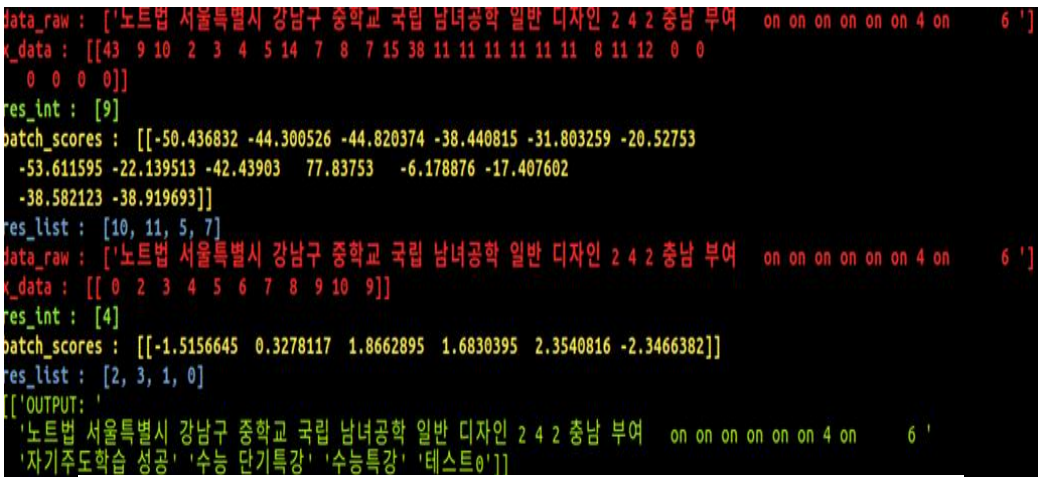

Figure 7. Data I/O process

The above figure [7] shows the data input and output when searching under the keyword "How to Note" with an account containing the information of a middle school teacher in Gangnam-gu, Seoul. Two CNN models operate to recommend educational programs and teaching aids. Data is digitized with One-Hot Encoding. Each model extracts a list of highly similar products according to the content recommendation mechanism mentioned in section 3.1 above. Description of the data output is given in the below table [1].

Table 1. Main parameters

Name	Description
data_raw	Text type data with user profile and product profile information
x_data	One-hot encoding method that converting text data into numeric data
res_int	The highest category number in the list of similarities calculated through the CNN model
batch_scores	Similarity score for all categories calculated through the CNN model
res_list	The top four of the list numbers calculated through the CNN model are highly similar
Result	Name of the total of 5 similar categories, including res_int and res_list
OUTPUT	Final recommendation list calculated through both user area and filtering and high-grade product filtering.

4.3 The result list of Educational Content Recommendation

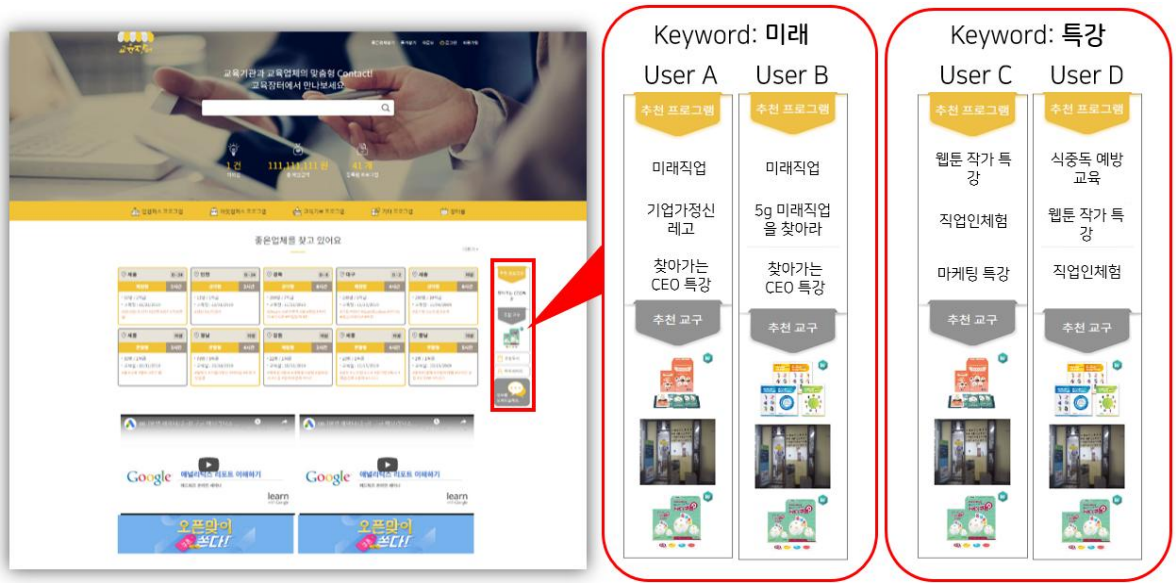

Figure 8. The List Results of Education Service Recommendation

The figure [8] above shows when users with different profiles (school information, assigned task, class type and recently used content) search with the same search keyword. As a result, it provides a different list of recommendations for individuals. When users A and B search for "future", the recommendation list results in "future job: entrepreneurship and CEO Special Lectures on Visit " for user A and "future job: find 5g future job and CEO Special Lectures on Visit" for user B. In addition, when users C and D search for "special lectures", user C is recommended for "Webtoon Writer Special Lectures, Job Experience, Marketing Special Lectures" and user D is recommended for "Food Poison Prevention Training, Webtoon Writer Special Lectures, Job Experience".

5. Conclusions

The current education is becoming more extensive with the application of various teaching methods. This is a problem that is so distributed that it is difficult for users to find the data and it takes a long time to find the information they need. This paper proposed educational programs and teaching aid recommendations using CNN algorithms in the education service platform to help teachers conveniently choose materials suitable for their respective environments. The improved education service platform can enhance the convenience of users by intermediating diverse materials and recommending customized lists of data on the education marketplace platform, which makes it difficult for them to navigate and select data as they are diverse and distributed. We are considering of using better word-similarity identification algorithm that “word2vector” machine learning.

In the future, we will also apply students' personality and aptitude test data into the recommendation algorithm.

Acknowledgement

This work was supported by the Technology development Program (S2685061) funded by the Ministry of SMEs and Startups (MSS, Korea) and this research was supported by Basic Research Program through the National Research Foundation of Korea(NRF) funded by the Ministry of Education(NRF-

2017R1D1A3B03035421).

References

[1] M. Oquab, L. Bottou, I. Laptev and J. Sivic. “Learning and transferring mid-level image representations using convolutional neural networks", 2014 IEEE Conference on Computer Vision and Pattern Recognition(CVPR), pp.1717-1724, 2014
DOI: https://doi.org/10.1109/CVPR.2014.222

[2] Yeongsu Kim, Seungwoo Lee (2018). “Combinations of Text Preprocessing and Word Embedding Suitable for Neural Network Models for Document Classification”, Journal of KIISE, Vol. 45, No. 7, pp. 690-700, 2018. 7
DOI: https://doi.org/10.5626/JOK.2018.45.7.690

[3] Yoon Kim, “Convolutional Neural Networks for Sentence Classification”, Journal of EMNLP, 25 Aug 2014
DOI: https: //doi.org/10.3115/v1/D14-1181

[4] P. Arena, L. Fortuna, L. Occhipinti, "A CNN algorithm for real time analysis of DNA microarrays", IEEE Transactions on Circuits and Systems I: Fundamental Theory and Application, Vol. 49, No. 3, pp.335-340, Mar 2002
DOI: https: //doi.org/10.1109/81.989167

[5] P.L. Venetianer, F. Werblin, T. Roska, L.O. ChuaAnalogic,"CNN algorithms for some image compression and restoration tasks", IEEE Transactions on Circuits and Systems I: Fundamental Theory and Applications. Vol. 42, No. 5, pp.278-284, May 1995
DOI: https: //doi.org/10.1109/81.386161