Analysis of the application effect of BLS in national education for students from Hong Kong and Macao

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Abstract— BLS(Broad Learning System) has been proved to be an effective learning system in various tests, and there are not many related studies on the verification of width-based learning in national education in China. This paper discusses the application of BLS in national condition education, and evaluates the effect of BLS on the improvement of students' national condition literacy through the data analysis of an experiment (Fig 1). This study makes use of the characteristics of horizontal expansion and incremental learning of width learning, and further verifies and predicts the accuracy and feasibility of the survey data through the output coefficient corresponding to data mapping. It provides some basis and reference for relevant researchers and educators to further develop the reasonable application of artificial intelligence in the field of national education. The results show that BLS can help students to have a more comprehensive and in-depth understanding of socialism with Chinese characteristics and national development strategy, and improve students' national literacy level.

Keywords— BLS, national conditions education, artificial intelligence, learning analysis

1. INTRODUCTION

National education is an important means to guide and shape the ideals and beliefs of young people. Only by studying the strategies and ways to effectively implement national education can we continuously improve the humanistic quality and patriotic feelings of college students. As a basic education course, national conditions education plays an important role in cultivating students' patriotism, national consciousness and global vision. The patriotism of students from Hong Kong and Macao is of profound significance to the realization of the long-term prosperity and stability of Hong Kong and Macao, the realization of the reunification of the motherland and the great rejuvenation of the Chinese nation. We should incorporate governance in Hong Kong and Macao into the overall goal of modernizing the national governance system and governance capacity. In particular, young people in Hong Kong and Macao should enhance their cultural identity, ethnic identity and national identity, so as to shorten the psychological distance between them and the mainland. However, due to the extensive content, often updated content and closely related to other disciplines, the traditional national conditions education courses are difficult to meet the needs of students. Therefore, how to improve the effect of national conditions education through new

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educational technology and methods is one of the urgent problems to be solved.

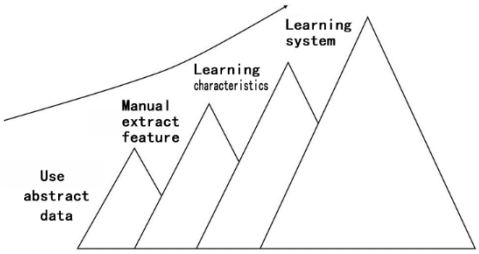

Fig 1 Broad Learning System testing procedure.

This study mainly through the questionnaire acquisition and analysis of the impact of Hong Kong and Macao youth national identity, and through the width of learning validation and predict the accuracy of the results and feasibility, for the future development direction of national education thinking and Suggestions, in order to enhance the Hong Kong and Macao youth patriotism education. The main implementation path is shown as Fig 2.

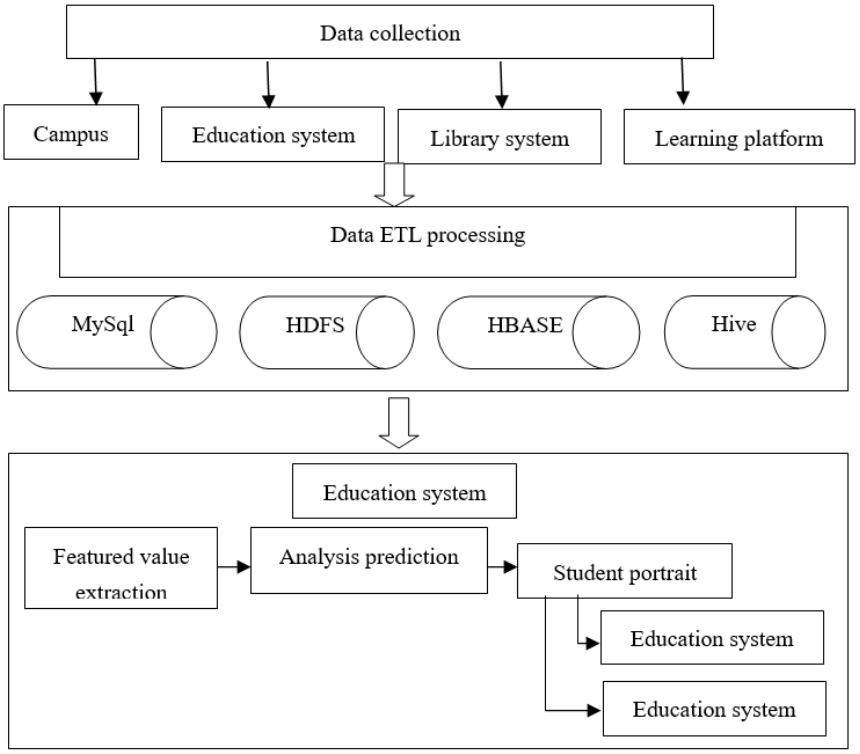

Fig 2 The main implementation path.

2. THE STUDY OF BLS

In the design of width learning (BLS), the feature of input data mapping is used as the feature node of the network(Fig 3). Secondly, the feature of the map is enhanced to a randomly generated weighted enhanced node.[1]

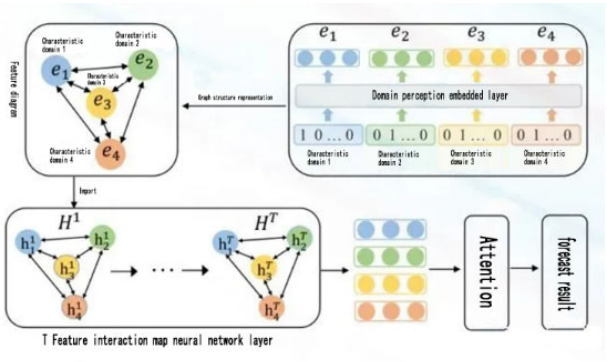

Fig 3 Feature Network for Data Mapping.

Finally, all the mapped features and enhancement nodes are directly connected to the output, and the corresponding output coefficients can be obtained by the express pseudo-inverse or gradient descent method (**Fig 4**). [2]

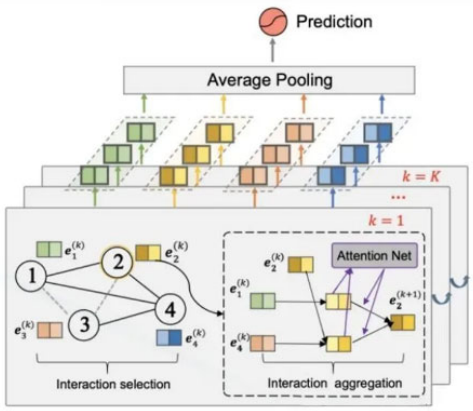

Fig 4 Mapped features and enhanced node output process.

The most important feature of BLS is its single hidden layer structure, which has two important advantages, one is horizontal expansion, and the other is incremental learning. Different from deep neural networks, BLS does not adopt the structure of deep neural networks, but is built on the basis of single hidden layer neural networks, and can use easy to understand mathematical derivation to do incremental learning (**Fig 5**). [3]

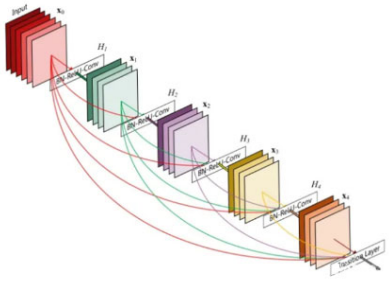

Fig 5 Construction of Single Hidden Layer Neural Network.

3. DATA SOURCES AND METHODS

3.1. Data sources

In the early stage, questionnaire collection is mainly used, and in the later stage, data collection, analysis and prediction are completed through the docking system. A total of 864 valid questionnaires were collected through the survey questionnaires were randomly distributed online. The object of the survey selected a university with a high proportion of foreign enrollment in Guangdong, and selected the preparatory, undergraduate, graduate and graduate questionnaires according to the educational administration system (see Table 1). The main target test objects select students from Hong Kong and Macao who study in the mainland, and classify them according to the educational level before coming to the mainland. Details can be seen in Table 2 and 3.

TABLE 1. DISTRIBUTION OF ACADEMIC QUALIFICATIONS

Education category	Number of people	Percentage
preparatory course	259	30%
undergraduate course	432	50%
postgraduate	69	8%
graduate	104	12%

TABLE 2. REGIONAL DISTRIBUTION

Area	Number of people	Percentage
Hong Kong	518	60%
Aomen	346	40%

TABLE 3. DISTRIBUTION OF EDUCATION LEVEL IN THE EARLY STAGE

Education level before studying in the mainland	Number of people	Percentage
primary school	43	9.09%
junior middle school	7	1.48%
senior middle school	355	75.05%
university	33	6.98%

other	35	7.4%

3.2 Research methods

The data acquisition of this study was mainly based on the questionnaire survey method and obtained in the form of written questions supplemented by random interview method (**Fig 6**), some teenagers from Hong Kong and Macao were selected to interview the interviewees by telephone and WeChat. The open questions were used to understand the ideas of the interviewees from multiple perspectives, so as to supplement and improve the content of the questionnaire and ensure the validity and reliability of the survey. In addition, in-depth interviews were conducted with front-line teachers and college counselors engaged in ideological education of Hong Kong and Macao students, Hong Kong and Macao youth developing in the Bay Area mainland, and Hong Kong and Macao youth who returned to Hong Kong and Macao after graduation from mainland universities, so as to deeply understand the ideological trends of the students, identity and national identity. Data verification, BLS method (Broad Learning System, BLS) was used for accuracy test. BLS refers to a random vector single-layer neural network learning system with random vector function link neural network (RVFLNN) as the carrier and through the increment of neural nodes.[4]

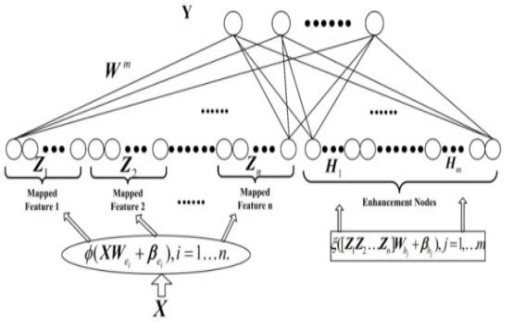

Fig 6 Random Vector Function Linked Neural Network.

3.3. Experimental design

To assess the impact of breadth learning on students' national literacy, we randomly divided the quiz students into two groups: experimental group and control group. Both groups received the same national education course, but the experimental group will use the BLS algorithm.

3.4. Data collection and analysis

Data collection and Analysis We used the questionnaire approach and the national literacy test to collect the data, and we used the SPSS software for data analysis. Specifically, we will use descriptive statistics, t-test and ANOVA to evaluate the learning effect of the experimental and control groups and draw conclusions. ELM (Extreme Learning Machine) is a machine learning algorithm based on neural networks, which is based on randomly initializing hidden layer weights and bias to quickly train an efficient classification or regression model.

Compared with the traditional neural networks, ELM has the advantages of fast training speed and strong generalization ability. Linear regression model is a common regression analysis to predict a continuous type output variable by fitting linear relationships between variables in the dataset. To compare the prediction error between ELM and linear regression models, it is evaluated using indicators such as root mean square error (RMSE). RMSE measures the average error between the predicted value and the true model value by the formula:

$$RMSE = sqrt(1/n * \Sigma(yi - \hat{y}i)^2$$

Where n is the number of samples, yi is the true value of the i th sample, and ŷi is the predicted value of the i th sample. When comparing the prediction errors of the ELM and linear regression models, the RMSE values of the two models can be compared to determine which model predicted better. In general, the smaller of the RMSE value is the better prediction effect of the model. [5]

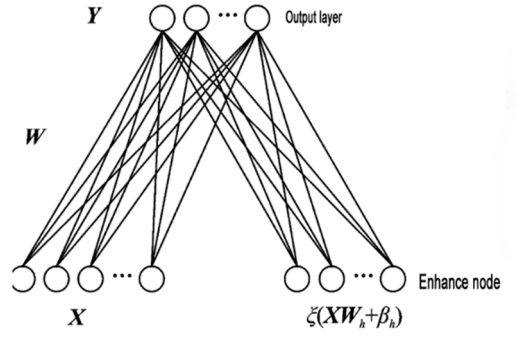

Fig 7 Neurons processed in the network.

4.RESULTS ANALYSIS

The BLS method is improved by improving the linear model to construct a neural network with multilayer structure, nonlinear function and symmetric connection. The neurons in this network are processed layer by layer, and the characteristics of each layer are the output results of the previous layer, and finally output a nonlinear model with multiple hidden layer units that can exceed thousands (**Fig 7**). Unlike traditional shallow learning models, BLS aims to mine different features to obtain better prediction performance.[6] The prediction performance of the educational data set is compared by using the extreme learning machine (ELM) and the traditional linear regression model. Specifically, evaluated using five crossover datasets, where each has two random subsets, and the prediction errors of the two models are shown in the table 4.

TABLE 4. ELM AND LINEAR REGRESSION MODEL PREDICTION ERRORS

Model	Data set 1	Data set 2	Data set 3	Data set 4	Data set 5
ELM	2.6	4.4	4.2	2.1	3.9
linear regression	8.1	8.9	9.3	8.5	7.7

5.CONCLUSION

National condition education is an extremely complex system engineering, and it is also a very difficult task to make scientific evaluation and accurate prediction and intervention of students' learning behavior and status. However, "data mining analysis and reform education" has become an irresistible development trend in the new era. The rapid development of artificial intelligence application education will bring many new ideas and realization means to the informationization and intelligence of national conditions education. With the rise and application of big data-related technologies, the emergence of wide learning in the field of machine learning has brought a new way and possibility for us to collect and analyze educational big data with the help of emerging technologies, and use big data technology to apply to national education data mining and learning analysis. The development of new technology of BLS undoubtedly plays a positive role in data mining and analysis in the field of national education, but BLS has few specific applications in learning analysis and education data mining. Most of the studies of applying BLS to national education are still in the experimental and exploration stage, and they will need a long process of integration and research in the future. This paper introduces the BLS method and its application in the analysis of national state education. The results of empirical analysis show that this method can excavate various characteristics and can get better results in prediction. Although the model of BLS is large, this method still has wide applications. Therefore, in the future research, how to explore better model optimization methods and reduce the model size of the problem, will be worth in-depth research direction.

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