Research on deep learning modeling under the background of computer data

Juncheng Chen*

Northwest Minzu University, Lanzhou, Gansu, 730106

*Corresponding author: chenjuncheng113@163.com

Keywords: Computer data; DL; make a model

Abstract: In the era of computer data, the scale of data owned by a country and its ability to use data will become an important part of a country's comprehensive national strength, and the possession and control of data will become a new focus of competition between countries and enterprises. DL (Deep Learning) is a branch of machine learning and part of AI (Artificial Intelligence). DL achieves the purpose of acquiring new knowledge or skills by simulating human learning activities. Based on DL theory, with the goal orientation of diagnosing DL results, intervening DL process and predicting final performance, this paper explores the commonness and difference of existing learning analysis models by comparative research method, and constructs DL analysis model, in order to provide new ideas for exploring learning behavior and DL.

1. Introduction

The development of the Internet has changed the way of thinking and solving problems from different angles, and promoted mankind to a learning society. This background requires learners to improve their own quality and thinking mode, and at the same time, to have a deeper understanding of learners' learning behavior and to know the characteristics and laws of learning [1]. The amount of data involved in social networks, mobile devices, Internet of Things and cloud computing is increasing exponentially [2]. For people, how to effectively use computer data and obtain valuable information from it is a severe challenge, and machine learning, especially DL (Deep Learning), and increasing computing power will become a key to open the treasure house of computer data.

Traditional machine learning needs to preprocess the data, and then extract and select the features of the processed data in order to achieve the purpose of learning and realize the functions of reasoning and prediction. However, the accuracy of this method depends on the quality of feature extraction and feature selection, and human learning is often automatic. In order to make the machine realize automatic learning, the neural network simulating human brain for hierarchical analysis learning extends the concept of deep learning.

It is a representative implementation method of AI (Artificial Intelligence). DL is a neural network with many hidden layers overlapped, which makes the hidden layers have a certain structure, so as to learn more effectively [3-4]. The prediction accuracy and classification accuracy of data have reached unprecedented heights. The characterization function of DL does not require engineers to manually extract the hidden features in data, but automatically dig deep into data and extract the hidden high-dimensional features in data. Therefore, it is necessary to build a DL model based on computer data technology, which will help to grasp learners' learning status in real time, realize the visualization and accurate prediction of learning data, and help teachers and learners realize automatic feedback, thus playing a very important role in improving learners' learning effect.

2. Introduction to DL

DL follows the hierarchical structure of neural network, but it is different from neural network. The neural network uses BP iterative algorithm to train the whole network, randomly sets the initial value to calculate the output of the current network, and uses the difference between the output and the real sample to change the parameters of the previous layers until convergence.

DL contains multiple hidden layers, and the simple adoption of traditional BP algorithm will lead to high time complexity of the model, and the training of layers will also be over-fitted. Therefore, DL adopts top-down supervised training method and bottom-up unsupervised learning.

Generally speaking, CNN (Convolutional Neural Network) consists of two layers, the first layer is convolution layer, and various features of input images are convolved by multiple convolution filter banks, so as to generate feature maps. Assuming that only one feature is extracted by a convolution kernel, to get multiple features of an image, multiple convolution kernels are needed to extract different features, and each layer corresponds to multiple feature maps.

The second layer is pooling layer, which implements aggregation operation by averaging the features of a certain area of the image. It avoids the complex process of feature extraction and data reconstruction in traditional algorithms, and learns from training data. It can directly process gray images and can be directly used to process image-based classification.

3. DL algorithm model

3.1 CNN structure

The typical structure of CNN is shown in fig. 1, in which Input is the input layer, and after convolution operation, a convolution layer Layer1 is obtained, and after pooling operation, a pooling layer Layer2 is obtained, and after convolution and pooling operation, a convolution layer Layer3 and a pooling layer Layer4 are obtained, which are finally classified and output by the fully connected layer.

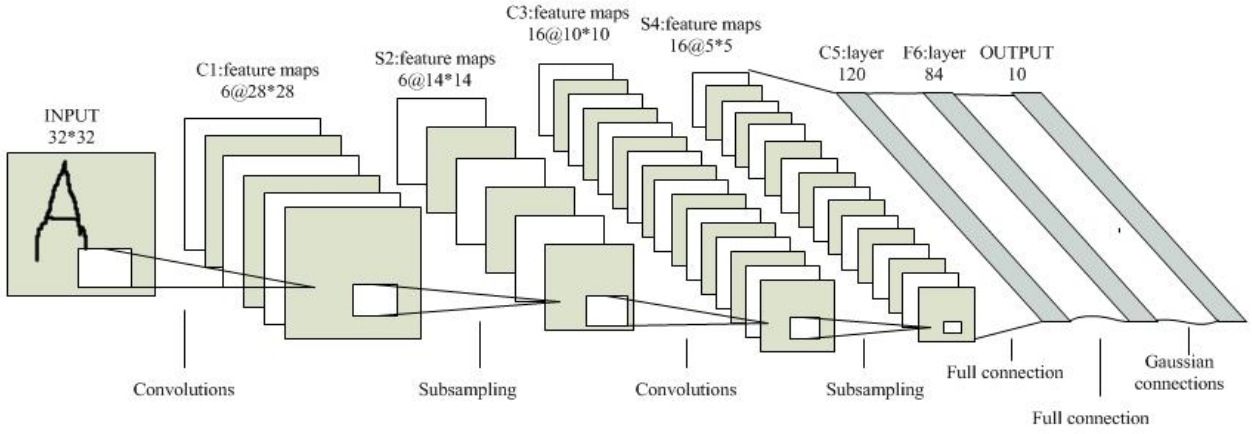

Figure 1. CNN structure diagram.

In the convolution stage, the input data is convolved by multiple convolution kernels, and then a convolution layer composed of multiple feature graphs is formed. Assuming that the input data is a two-dimensional array of $i_1 \times i_2$, the input feature map is convolved with $k_1 \times k_2$ convolution kernels, and then the output is a feature map composed of n two-dimensional arrays.

$$y_j = f\left(\sum_i w_{ij} * x_i + b_j\right) \tag{1}$$

In which: w_{ij} is the weight of each convolution kernel; y_j is the j th feature map of the output; x_i is the input i th feature map; b_j is a trainable offset; f is the excitation function; Commonly used ReLU excitation function expression is:

$$f(x) = \max(0, x) \tag{2}$$

Pooling stage can reduce the dimension of convolved feature map, effectively prevent over-fitting, and reduce training parameters, thus reducing model training time. The commonly used pooling method is maximum pooling, and its process principle is shown in Figure 2.

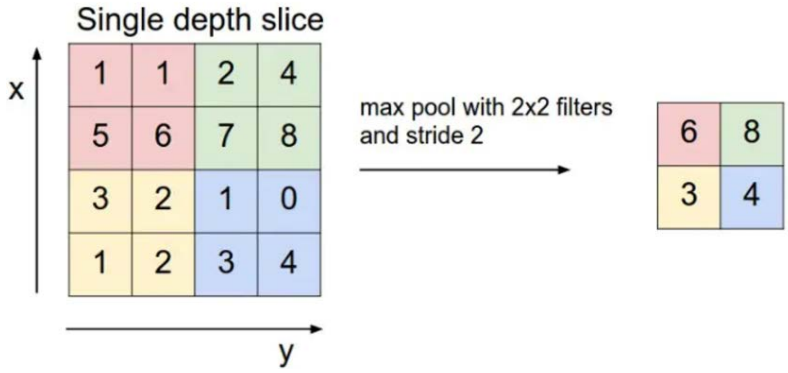

Figure 2. Schematic diagram of pooling stage.

In a 4×4 feature map, a 2×2 filter is used to traverse the feature map with a step size of 2, and the maximum value is taken in the area traversed by each filter to replace the area. After traversing, the new 2×2 feature map shown in the figure is obtained.

3.2 Large-scale DBN

The training of large-scale DBN (Deep Belief Networks) involves many independent restricted Boltzmann machines (RBM) and millions of parameters, and parallel operation is dominant in large-scale DBN, which leads to the traditional CPU being unable to effectively realize fine-grained parallel processing of the algorithm. And the inherent parallel structure of GPU is very suitable for large-scale parallel operation in two hierarchical structures, Block and Threads.

In order to make full use of the computing power of GPU, reference [5] regards a connection between two neurons as the minimum computing unit of H core and V core. This decision utilizes the algorithm of computing hidden layer unit in BP layer in reference [6], which is similar to it. Therefore, it can be considered that the connection between neurons has undergone a simple functional operation through its weight, that is, multiplied by "compression input". In this case, each Block represents a neuron, and the sum of the values calculated by each Thread is obtained by using the fast shared memory, and the neuron output value of the active sample is calculated.

The stage of knowledge transfer and application mainly includes transfer, knowledge transformation, transfer and application, knowledge transfer and application, etc. This stage mainly guides learners to transform acquired knowledge into skills through independent training and intensive practice, and by practicing and applying skills in complex, rich and changeable situations, learners can acquire accurate understanding and mastery of knowledge and skills.

Evaluation and reflection stage is the key stage in DL model under computer data technology, which mainly includes analysis and evaluation, creation, reflection, evaluation and creation and problem solving, etc. Its core is to cultivate learners' evaluation ability and creative thinking.

4. DL modeling under computer technology

DL is an advanced learning method in which learners actively and critically accept new knowledge on the basis of deep understanding, and solve complex problems and innovate through the established connection between old and new knowledge [7-8]. The general idea of DL analysis model is similar to the general model of learning analysis, except that it is based on DL result evaluation instead of general academic achievement [9].

DL model starts with simple features, and continuously extracts more complex features to the next layer by combining them layer by layer through neural network, and finally extracts high-dimensional abstract features. DL model trains DL model through input data and output data. The development of DL needs the support of computer data technology.

Therefore, according to the five elements of learning analysis model summarized and combined with the data characteristics of learning behavior computer data, this paper constructs a DL analysis model based on learning behavior computer data, as shown in Figure 3. The model includes data

collection, data processing, data analysis, result presentation and application, and essential conditions in the process.

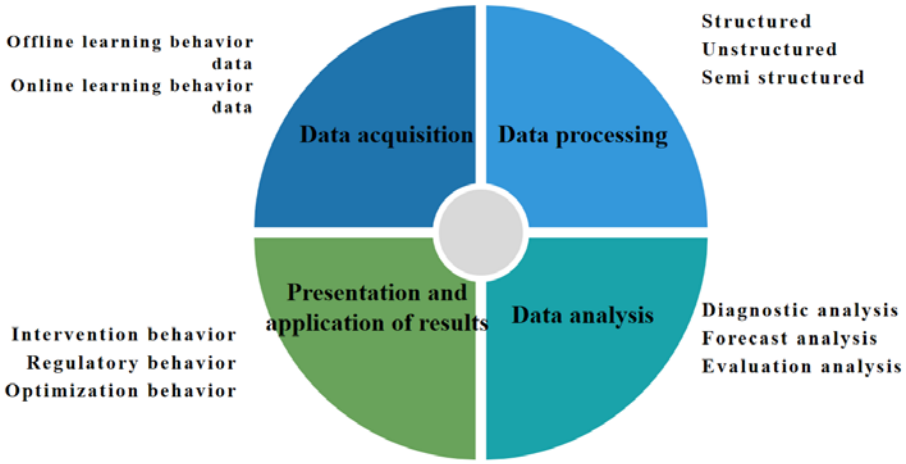

Figure 3. DL analysis model.

The first step is to collect a large amount of data about students' learning behavior, which includes all the interactive data about learning generated by students on the online platform, as well as all the data about learning generated by the IOT sensing technology in offline daily learning. The collected behavior data should be stored and cleaned according to different data types and characteristics.

Step 2: Data processing, that is, unified management of structured, semi-structured and unstructured data is realized through corresponding data storage and cleaning methods, and data formats are integrated according to requirements to eliminate irrelevant data.

Step 3: Data analysis stage, which is to analyze the processed data according to different analysis methods (diagnosis analysis, prediction analysis and evaluation analysis), so as to evaluate the results of students' DL.

Step 4: Presentation and application of results. According to different audiences, the results of data analysis are presented in different visual ways. Teachers and administrators can intervene and guide students' learning behaviors according to the analysis results, so as to promote students to achieve DL results. Students can also adjust and optimize their learning behaviors directly according to the analysis results, so as to achieve DL results.

The model is a circular optimization model, and the results of data analysis will be collected as new data while being applied to optimize students' DL process. After processing and analysis, the DL process will be further optimized to form a virtuous circle, which is in line with the meaning of DL and can greatly promote students' DL. In the whole process of the model, computer, manpower, theory and environment will jointly become the factors affecting the results of DL analysis.

5. Development prospect of DL under the background of computer

The popularity of mobile Internet and various intelligent devices makes human society enter the era of computer data. The delicate relationship between data and DL As AI experts have said, AI is a rocket, DL is the engine of the rocket, and computer data is the fuel of the rocket. These two parts must be done well at the same time before they can be successfully launched into space.

The weight sharing of CNN makes its structure more similar to that of biological neural network. The hierarchical structure reduces the complexity of the model and reduces the number of weights. Its advantages are that the input of multi-dimensional images can be directly used as the input of the network, which is in good agreement with the topological structure of the network, and feature extraction and pattern classification are carried out at the same time, thus avoiding the complicated process of feature extraction and data reconstruction in traditional algorithms and learning from training data. It can directly process gray images and can be directly used for processing image-based classification.

For the current DL neural network, the ability to process computer data is a priority. When it exceeds a certain critical point, entering more information will not bring better performance, and may be counterproductive. Therefore, it is necessary to develop and constantly adjust the network system of DL to meet the requirements of computer data. Conversely, an appropriate increase in the amount of data will sometimes in turn improve the performance of DL.

However, we can still foresee the development trend of DL theory in some aspects, that is, under the background of computer data, DL architecture will rapidly become larger and more complex, and these architectures will also become an integral part of future innovative architecture.

6. Summary

Under the background of computer age, DL, as an important branch of machine learning, has attracted more and more scholars and research institutions' attention. Computer data needs DL, and the development of DL needs the support of computer data technology. Massive data in the computer age has solved the problems of over-fitting and poor generalization ability of early neural networks due to insufficient training samples. In the future academic field, DL will become the key research content in its field. Data needs DL, which is realized by the technology provided by computer data. The era of computer brings learning advantages to neural network. The integration of its technology and DL is beneficial for instructors to fully grasp the actual state of learners and realize automatic feedback, which has a far-reaching impact on improving learners' learning effect.

References

[1] yang jiwu. my opinion on the teaching reform of computer basic courses in higher vocational colleges under the background of big data [J]. 2021(2019-30):5-6.

[2] Zhang Jiarui. Research on the application of computer education blended teaching under the background of big data [J]. New Generation: Theory Edition, 2019, 000(010): P.22-22.

[3] Dong Yanlei, Yu Fei. Research on Teaching Reform of University Computer Foundation under the Background of Big Data [J]. Industry and Technology Forum, 2019, 018(004):173-174.

[4] Sang Zihua. Research on Teaching Reform of Computer Basic Courses in Higher Vocational Colleges under the Background of Big Data [J]. Peasant Staff, 2019(17):1.

[5] Xie Fangjun. Research on innovative teaching of computer application basic courses in secondary vocational schools under the background of big data [J]. Education Information Forum, 2021(2020-5):83-84.

[6] Yang Chunping. Research on the Application of Computer Software Technology under the Background of Big Data [J]. 2021(2020-14):24-25.

[7] Zhang Pei-Lu. Research on the recommendation algorithm of computer professional curriculum system under the background of big data [J]. Science and Technology Innovation, 2020(12):171-172.

[8] Li Yuanyuan. Research on Mobile Learning of Computer Application Technology in Secondary Vocational Schools under the Background of Big Data [J]. Middle School Curriculum Counseling (Teaching Research), 2019, 013(036):126.

[9] Wei Rong. Research on computer information processing technology under the background of big data [J]. Information and Computer, 2020, 032(002):207-208.