Analysis of application of CNN value orientation to College students

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Abstract. In view of the problem of value orientation analysis of college students in the new era, most of the value orientation analysis in China is conducted from the qualitative aspect, and there are few researches based on reasonable quantitative mathematical models. This paper USES the questionnaire survey and the Convolutional Neural Networks (CNN) to firstly preset classification of F values orientation, with Sigmoid function as the activation function, the questionnaire results as input, the respondents with preset classification compatibility as well as the output be simplified as the final result, F value by calculation and comparison of CNN compared with traditional mechanical analysis, found that CNN’s F value is 12.53% higher than the traditional analysis method, having certain superiority, providing quantitative reference for the analysis of value orientation.

1. Introduction
Value is an explicit or implicit measure of inner activity, a general and fundamental view of what is “worthy”, and it affects people’s choice of behavior mode, means and end. [4] It provides reasons for people’s behavior and activities. Value orientation is an important part of values. When values are internalized into individual behavior standards, they are manifested as individual value orientation. Value orientation can be perceived by the outside world through an individual’s behavior, which reflects the human brain’s understanding of the outside world.

Jiangsu university of science and technology college of humanities and social science Li Xijie think that college students’ ideological and political education mechanism and our country economic base and superstructure of dramatic changes in every field directly affect college students’ value orientation, and the development of the society on the one hand makes the values of college students is more diversified, has certain negative influence on the other hand. [1] Shaoxing liberal arts college studies ministry Du Kunlin through sampling questionnaire survey to understand college students in colleges and universities such as university student’s self-assessment as well as to the value orientation of “happy life” come to the conclusion: (1) in both countries, social relationship and personal interests, individualism tendency continuously emerging, the pursuit of material enjoy were up to 79.3%. (2) While adhering to the mainstream socialist values, moral values are becoming increasingly diversified and utilitarian.13.8 percent said they paid more attention to money and 9.48 percent to power. In adhering to the traditional morality, it keeps innovating and being pragmatic. [2] Shenzhen power supply bureau co. LTD., the electric power research institute Yu Peng, Tian Jie using convolution neural network analysis of emotional characteristics of multidimensional Weibo expression, constructing multi-dimensional matrix eigenvalues is obtained, and then through the regularization and...
activation function to get the results of the analysis, finally obtained by F value found that convolution of sentimental training than emotional trained neural network CNN high accuracy 10.6%, than the mechanical analysis of high precision 13.2%. [3]

However, the current analysis of college students’ value orientation is qualitative research, and there is no quantitative link between external factors and college students’ value orientation. The existing analysis of value orientation is all mechanical analysis based on questionnaires. Based on the CNN model, this paper attempts to build a model of the influence of college students’ value orientation. The questionnaire results are taken as the trained neural network input to obtain the value orientation analysis results. Meanwhile, the output is more quantified for the difference in accuracy between mechanical analysis and questionnaire analysis. Further analysis of its psychological principles to promote the development of ideological and moral education for college students to provide practical reference.

2. Principles and algorithms
Convolutional Neural Networks (CNN) consists of an input layer, a convolutional layer, a pooling layer, a full connection layer and an output layer. Compared with BP neural network, it is improved, that is, the nodes of two adjacent layers are connected in part, which significantly reduces the number of parameter weights and improves the speed of model construction. The calculation process is the data input to the input layer, after the hidden layer of the calculation to get the output layer. Then the error between the output value and the target value is calculated again, the desired threshold is reached, and the operation is finished. If not, the error will be input from the output layer to the input layer, and the error will be distributed to the neuron nodes of each layer. In the process of error back propagation, the weight between the neuron nodes of each layer will be constantly modified until the operation process is completed. In this paper, CNN algorithm is used to build a model to classify the value orientation (see Figure 1).

First, input known samples, and the results of questionnaire collection and value analysis are respectively represented by X and Y. Then the weights and thresholds of the neural network are modified until the target error or the maximum number of iterations is achieved. The training process is as follows:

The neural network value orientation analysis model was initialized. According to the input samples, X and Y determined the number of nodes. The questionnaire results were expressed as \( X_1 \sim X_5 \), and the output nodes were expressed as \( Y_1 \sim Y_4 \). The convolution layer function is:

![Figure 1. Forward propagation and back propagation in CNN Algorithm.](image-url)
Where $X_{i:i+h+1}$ represents the questionnaire results from the $i$th respondent to $i+h+1$ respondent, $w$ represents the weight of the connection layer, $b$ represents the threshold, and $h$ represents the number of nodes. $f$ is the activation function of the convolutional layer. The activation function adopts the Sigmoid function, and the expression is:

$$f(x) = \frac{1}{1 - e^{-x}}$$

The neural network predictive output function $T_k$ can be expressed as:

$$T_i = \sum_{j=1}^{k} H_j w_{jk} - b_k, k = 1, 2, ..., m$$

Then, the error $e_k$ is calculated, and according to the predicted input and expected output, the expression is:

$$e_k = O_k - T_k, k = 1, 2, ..., m$$

Finally, the feasibility of the CNN for value orientation analysis is tested. Two control groups were set according to the known algorithm. [5] The first group did not use the trained CNN, that is, mechanized analysis was adopted. The second group adopted the CNN obtained after training for analysis, and measured the actual classification effect through $F$ value and accuracy rate. $P_{acc}$ represents the accuracy rate, $P_{prec}$ represents the accuracy rate, and $P_{recall}$ represents the recall rate. The above values and $F$ values can be calculated by the following formula:

$$P_{acc} = \frac{T_p + T_N}{T_p + F_p + T_N + F_N}$$

$$P_{prec} = \frac{T_p}{T_p + F_p}$$

$$P_{recall} = \frac{T_p}{T_p + F_N}$$

$$F = \frac{2P_{prec} * P_{recall}}{P_{prec} + P_{recall}}$$

3. Experimental design
The respondents were asked five questions: “How hard-working they are”, “How brave they are”, “How willing they are to explore the unknown”, “How selfless they are” and “How driven they are by fame and fortune” (Respectively Q1–Q5) and the respondents rated themselves from 0 to 1 with a gradient of 0.1. A high score means that student is in the highest degree of conformity with themselves, and each score is different. At the same time, according to the existing social survey data and the consultation with the psychoanalyst, the value orientation is roughly divided into four categories, namely “Individual”, “The collective to promote”, “The pursuit of stability” and “Adventure”. [2] The analysis process is shown in Figure 2:
First of all, the obtained data were normalized and non-directed questionnaires were distributed. 143 questionnaires were obtained, and the number of 140 valid questionnaires were recalled, with a recall rate of 97.9% and an effective rate of 97.86%. The neural network input is normalized. Due to too much data obtained, only 10 respondents’ questionnaire results are shown here, as shown in Table 1.

Table 1. Normalized sample data.

| Respondents | Q1 | Q2 | Q3 | Q4 | Q5 |
|-------------|----|----|----|----|----|
| R1          | 0.9| 0.8| 0.6| 0.2| 0.5|
| R2          | 0.9| 0.4| 0.8| 0.2| 0.3|
| R3          | 0.5| 0.1| 0.3| 0.6| 0.4|
| R4          | 0.6| 0.9| 0.3| 0.1| 0.7|
| R5          | 0.3| 0.7| 0.4| 0.5| 0.8|
| R6          | 0.5| 0.7| 0.9| 0.3| 0.4|
| R7          | 0.6| 0.5| 0.8| 0.1| 0.2|
| R8          | 0.4| 0.5| 0.4| 0.9| 0.7|
| R9          | 0.5| 0.4| 0.7| 0.8| 0.1|
| R10         | 0.9| 0.7| 0.3| 0.6| 0.5|

4. Results and discussion
The obtained questionnaire results are used as inputs to the trained CNN. In the network testing stage, the output of the neural network appears too many decimal places. For this reason, the output is simplified to some extent. For the final output value $Y_1$ to $Y_4$, only 1, 0.5 and 0 are used to convert the predicted output value, in which $t$ stands for the predicted output value and $Y$ stands for the converted output value. The division rules are as follows:

$$Y = f(t) = \begin{cases} 
1, & t \geq 0.7 \\
0.5, & 0.2 \leq t < 0.7 \\
0, & t < 0.2 
\end{cases}$$

(9)

Finally, the obtained questionnaire results are input into the trained neural network as input and output as matching values for each value orientation classification. The output results are shown in Figure 3.
According to Figure 3, most of the respondents were classified as hard-working and selfless in value orientation. The reason may be that college students are in the learning stage and have a strong will to forge ahead, hoping to promote their own and social development.

All the above tests were completed by 10 fold cross calculation. The recall rate and F value of the questionnaire results were compared between the traditional mechanical analysis and the trained CNN, and the calculated results are shown in Table 2.

Table 2. Data analysis results.

| Model | Accuracy | Accurate rate | The recall rate | The F value |
|-------|----------|---------------|-----------------|-------------|
| 1     | 0.7025   | 0.6887        | 0.7384          | 0.7182      |
| 2     | 0.8516   | 0.8554        | 0.8354          | 0.8435      |

Model 1 is traditional mechanical analysis, that is, the CNN without emotional analysis is used to analyze the questionnaire results. Model 2 is a questionnaire analysis using an emotionally trained CNN, and it was found that compared with the traditional analysis, the accuracy of the CNN increased by 0.1253 and the recall rate increased by 0.097, indicating that the adoption of the CNN was more helpful for questionnaire analysis. This indicates that compared with the traditional mechanical analysis, the CNN has a higher recall rate and a higher accuracy of 12.53%, which has higher reliability and certain advantages. This greatly simplifies the analysis process and improves accuracy.

Among them, value orientation types with a matching degree of 1 (The Main Type) and value orientation types with a matching degree of 0.5 (The Minor Type) account for as shown in Figure 4.
According to the output results, the pursuit of “The collective to promote” accounts for the largest proportion of the main types of “Individual”, about 10% more than the number of respondents who mainly pursue “personal interests”, indicating that the value orientation of college students in the new era is more inclined to collective promotion and more identify with collectivism. “Individual” and “Adventure” accounted for the largest 30% of the secondary types of value orientation. It shows that the value orientation with development and struggle as the core is the most recognized among college students. The reason may be that struggle and development are the mainstream value orientation in today’s society, and the spirit of struggle is widely recognized among college students.

5. Conclusions
This paper sets up a questionnaire, takes the questionnaire results as the input vector of neurons, trains the CNN to analyze the questionnaire results with sigmoid function as the activation function, and simplifies the output junction to obtain the degree of conformity between each respondent and the classification of values orientation, which is feasible. The results show that the prediction effect of CNN is better than that by traditional value orientation analysis method. By comparing the analysis of F value, it can be seen that the analysis accuracy of CNN is 12.53% higher than that of traditional mechanical analysis, and the recall rate reaches 83.54%, which shows certain advantages. Replacing the questionnaire results with numerical values, outputting the matching value of value orientation can make the analysis more quantitative, providing an application reference for the quantitative analysis of value orientation. For example, if more detailed value orientation classification and questionnaire design are adopted, the CNN can be used to quickly classify the respondents. It has certain significance to the social investigation and statistics of psychology, which is helpful to the research of social psychology statistics and the classification of value orientation.

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