International Journal of Scientific and Technical Research in Engineering (IJSTRE)
www.ijstre.com Volume 7 Issue 6 ǁ Nov-Dec 2022.
ISSN: 2581-9941

Application Of Artificial Neural Network To Build Models Of Vocational Education Consulting

Hoa Tran Thi Thieu
Ha Tinh University, Viet Nam
tranthithieuhoa@gmail.com

ABSTRACT: *Vocational education activity plays an important role in the future career orientation of students. Vocational education activity helps to adjust the career choice tendency of students, on the other hand, it also helps regulate and rationally use labor potential in the future, brings into full play their capacity and forte, develop their ability to be creative in labor and create a balanced workforce in society.*

Decision on a career choice for the future after finishing each level of study is a very difficult job that requires students to grasp many issues and have the attention of their families and schools. A wrong choice will lead to great material and spiritual losses for students and families, affecting the labor balance of the country. In this article, we apply Artificial Neural to build a model of vocational career counseling for students.

KEYWORDS *- Artificial Neural Network, vocational education, educational consulting.*

I. INTRODUCTION

Vocational education has appeared for a long time and is understood in many different ways, but the general orientation is to build a system of measures taken inside and outside the school to help students have professional knowledge and have the ability to choose a career on the basis of combining the individual's aspirations and forte with the labor demand of the society. Vocational education affects students' perception in choosing a career for the future and thereby helps students understand the value of the profession and work that they choose. Vocational education activities play an positive role in the future career orientation of students.

Vocational education helps to adjust students' tendency when choosing a career, regulates and rationally uses the future labor potential of a country, brings into the full capacity and forte of work, develops creative ability in labor. Vocational education will discover, foster professional personality qualities for students, and help them understand their abilities, and the requirements of the profession, thereby choose the right career for themselves. This also helps adjust the social division of labor, create a balance in the allocation of the labor force and itself synchronize the occupational workforce, redistribute the labor force and specialize the young labor potential of each country.

In Vietnam, vocational education is conducted through four stages: the stage of vocational education, the stage of vocational counseling, the stage of job selection and the stage of job adaptation. In which, the general school system implements the first two stages, and the second two stages belong to vocational schools, professional secondary schools, colleges and universities.

The issue of career counseling for students is covered with many criteria, factors, and different approaches to be solved. In Vietnam, there have been a number of different research works on this issue such as vocational education for high school students [4], research on management of vocational education activities for students [5], etc. In this study, we only carried out the second stage out of the four stages indicated above through studying the problem of career counseling for students based on an application-oriented approach to information technology. We use intelligent computing techniques that are trained based on sample data about each student's information to build a model of career counseling, hence, help to make decisions for students as they enter the parameters of their evaluation information into the system.

Our research process is based on an approach based on 5 vocational education ways that the current Vietnamese vocational education system uses: Vocational education through teaching basic science subjects, organizing of main course vocational education activities and extracurricular activities, teaching and learning technology and career orientation activities. Factors affecting the choice of direction for the future are described through 17 specific criteria [6]. Each individual participating in counseling needs to provide the values of a set of criteria, through which the software system will calculate and determine the need for vocational education counseling for students according to two options: continuing to study or apprentice.

II. BUILDING MODEL OF CONSULTATION CONSULTATION

In order to carry out the counseling process, we research and build a vocational education counseling model as follows.

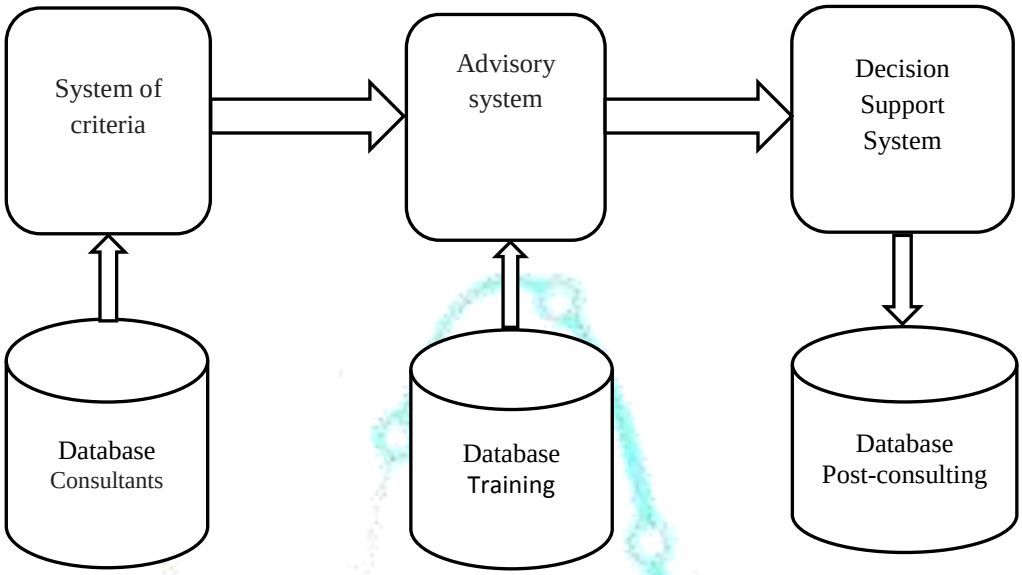

Figure 1. Mathematical model of general vocational education counseling

Components of the recommender model:

- Database of consultants: This is the component that needs to be consulted, the data sample used here is students at schools. In the experiment, with this part, we conducted a survey of students in schools through a questionnaire with the information described below.

- System of criteria: These criteria are built through the characteristic data of students, this part is described in the table [6].

- Training database: This is a sample data warehouse used as training data for the automatic recommender system.

- Recommender system: This is the main component of the model, which uses an artificial neural network algorithm to build a learning machine from the given sample data sets. The system receives input data that are weighted criteria and through which the system advises the output results. The system proceeds to retrieve the criteria when the consultant chooses, through which, it realizes the students'problems that the criterion presents. By understanding from the training data warehouse, the system will give out the decision that to advise the student whether to continue his education or choose an apprenticeship.

- Decision Support System: This section gives the results after consulting that contains information including 02 states, 1- Continue to study to higher levels, 2- Choose a vocational education. The results are determined based on the knowledge of the system by the artificial neural network algorithm through training with a given sample data set.

- Post-consultation database: This is the consulted data result including the consulting object and the corresponding consulting result. This data result can also be added to the training sample to make the system grow stronger and more complete.

III. ARTIFICIAL NORON NETWORK ENGINEERING LANGUAGE

1. Algorithm

- Input: Database needs consulting.
- Output: Result of vocational education counseling.
- Algorithmic steps:

Step 1: Log in to the system
Step 2: Select the criteria value
Step 3: Check the criteria
Step 4: Process and give results
Step 5: Evaluate errors
Step 6: Display the results.
The diagram of the algorithm implementation:

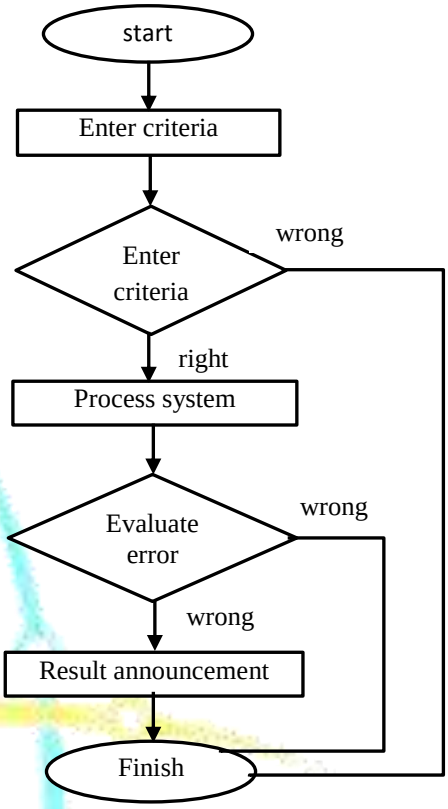

Figure 2. Algorithm diagram of vocational education counseling

2. System of criteria

The system of criteria are the factors affecting the choice of a student's future direction and are specifically described through 17 criteria in the table below [6]. Each individual participating in counseling needs to provide full values of the set of criteria, through which the software system will calculate and determine the need for vocational education counseling for students according to two options: continue. study to higher levels, choose an apprenticeship.

Table 1. Weight of criteria used in software

No	List of criteria	Weigh t	Weight Normalization
I.	Learning results at the end of the cours	0.5	0.5 (50%)
II.	Individual's wishes	0.1	0.1 (10%)
III.	Criteria of selection	0.4	0.4 (40%)
1	Family educational environment	0.3	0.085714286×40%
2	Parents'willings	0.3	0.085714286×40%
3	Parents' social position	0.3	0.085714286×40%
4	School educational environment	0.2	0.057142857×40%
5	Teachers	0.2	0.057142857×40%
6	Vocational education Day	0.1	0.028571429×40%
7	Career value orientation of individuals	0.3	0.085714286×40%
8	Individuals'capacity	0.3	0.085714286×40%
9	Friends	0.1	0.028571429×40%
10	Social values of the profession	0.2	0.057142857×40%
11	Occupational needs of society	0.3	0.085714286×40%
12	Development policies of the State	0.3	0.085714286×40%
13	Career opportunities	0.4	0.114285714×40%
14	Mass Communication	0.1	0.028571429×40%

15	Propaganda materials in the School	0.1	0.028571429×40%

Calculation method: Call the Weight column in the row with order i in table 1 as ti, i=1..15; The normalized value θi in the alphabetical order i is calculated as follows [1]:

$$\theta_i = \frac{t_i}{\sum_{j=1}^{15} t_j} \times 40\%$$

The weights are selected and determined based on experience from the research process. However, each regional condition has different variations, so the weights may have changes. The criterion value after being normalized will be the input value of the input layer of the artificial neural network used in the algorithm.

3. Technique of Neural Network

Machine learning technique based on artificial neural network is one of the techniques with many outstanding advantages and is widely used in different problems [2, 3]. Therefore, we choose the artificial neural network machine learning technique to use for the training system through the vocational classification process from the training database, where each entity is the sample data of a learner. Students are represented by 17 criteria, after receiving and evaluating, the system will give counseling results that are given 2 states: continuing to study to higher levels or choosing an apprenticeship.

The structure of the neural network is designed as follows:

- Number of layers: 03 layers in which 01 input layer, 01 hidden layer (Hidden), 01 output layer.
- Input: 17 buttons, each button corresponds to criteria, the criteria are normalized to the actual value of [0, 10].
- Output: 02 buttons correspond to 02 output results, the output value will be in [0, 1], the total value of the 2 output buttons is always 1.0, which output value gets the larger value, the system will advise according to that result. In this problem, the output buttons output 1 corresponds to the value "continue learning to higher levels", the output button 2 corresponds to the value "choose an apprenticeship".
- Hidden: 09 buttons, the larger the number of hidden layers and the number of buttons in each hidden layer gets, the higher the complexity is. However, when the complexity of the neural network is large, the training data and the input and output values are not complicated, the system easily leads to difficulty in classification or overfitting. In this study, we build a neural network using 01 hidden layer, in the process of testing with many structures we have determined with the implementation of 09 hidden buttons for the given training time for guessing, getting and giving the best effect.

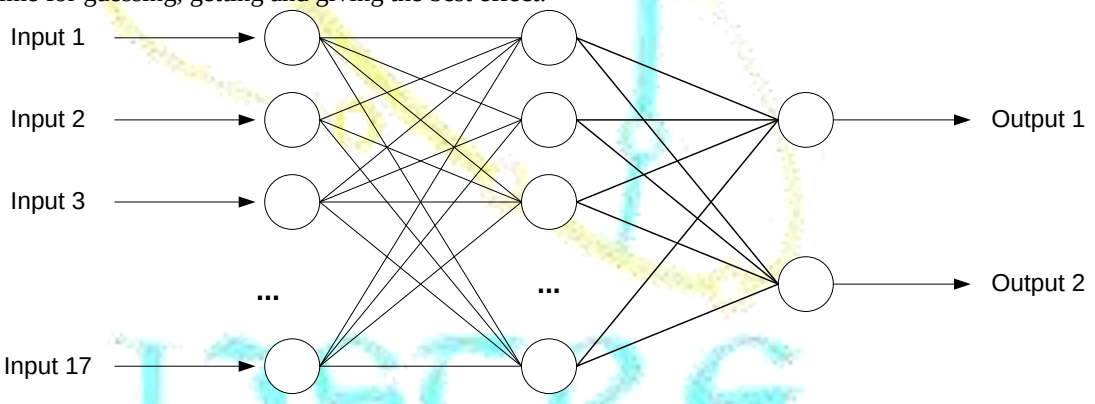

Figure 3: Neural network structure

The following layer buttons value x is calculated by the formula: $x_i^l = \sum_j w_{ij}^{l-1} \times x_j^{l-1}$

In which, l is 1st layer, xi is the button value i, wij is the weight buttons j passed to button i of the next layer. Then, l=2 is the hidden layer, l=3 is the output layer.

IV. VERIFICATION EXPERIMENT

1. Training data

Training data includes 2680 samples, each sample includes 17 criteria, surveyed via google form. The survey subjects were high school students.

2. Test data

Test data is extracted from the sample data warehouse according to the ratio: Practice 90%, test 10%. The research process uses a sample data warehouse consisting of 2680 samples collected from the actual data of the training institution, the data reflecting the values according to the collection area. The research uses 2412 samples for training and 268 samples for testing.

3. Result

Training results of the problem: In the process, we performed the experiment 5 times, in which using the stopping condition (in the last row of the table) shows that the algorithm stops when the condition reaches the maximum number of iterations. (max epoch) or less than the maximum error (max error).

Table 2. Test results

Content	Time 1	Time 2	Time 3	Time 4	Time 5
Training (90%)	2680	2680	2680	2680	2680
Test (10%)	268	268	268	268	268
Max epoch	200,000	400,000	600,000	800,000	1,000,000
Max error	1.00E-02	1.00E-03	1.00E-04	1.00E-06	1.00E-09
Evaluated error	0.0009	0.0008	0.0006	0.00058	0.00046
Time of training	340s	560s	560s	780s	3,900s
Stopping condition of training	max epoch	max epoch	max error	max epoch	max epoch

As the table of data shows:

For the 1st training, the number of iterations is 200,000 is not enough to guarantee the desired error (max error), so the stopping condition is max epoch.

For the 2nd training, the number of iterations is also 400,000, not enough to guarantee the desired error (max error), so the stopping condition is max epoch.

In the two cases 1 and 2 show, the algorithm can fall into the local optimal point without finding the desired error, so the algorithm is stopped by reaching the maximum value of the number of iterations in the training process.

For the 3rd time, when the maximum number of iterations increases, the desired error is achieved early, the test error is reduced, and the quality of the advice is improved better.

For the 4th time, when the maximum number of iterations is higher, the desired error is achieved earlier, the test error is reduced more deeply, the quality of the advice is better.

In the two cases 3 and 4 show that when the number of iterations is larger, the search algorithm gets more convergent value, that is, the error value is more advanced and beyond the local optimal point.

Through the above 4 tests, it shows that, in the process of learning, for each set of data, it is necessary to test with the parameters of the maximum number of iterations (max epoch) or the maximum error (max error). The derived meaning requires a rich set of sample data, experimenting with diverse parameters to derive the most suitable parameters.

For time 5, the condition stops when the maximum number of iterations is reached, which indicates that the optimal evaluation error function is blocked. The error test value does not improve much, in many similar cases, when the training error is too small and the number of iterations is too large, it can easily lead to overfit problem, this phenomenon makes the result diagnosis, classification disorder.

The test results show that through 5 times of implementation with 2680 data samples, in which 90% used for training and 10% used for testing, the results were obtained with different evaluation values. Also, the results shows that the algorithm accurately reflects the rules of the classification method, the obtained value is highly satisfactory.

V. CONCLUSION

Vocational education plays a very important role and affects the classification of labor quality in each country. Vocational counseling is one of the modern career-oriented education methods that is effectively exploited by many countries around the world.

Currently, vocational education activities in schools are carried out by 5 popular ways through lessons in vocational education activities. However, the effectiveness brought about in vocational education activities through these ways is not high, and especially, students have not been able to classify after the school. In the research process, we have proposed a career counseling system by applying artificial neural networks and considering it as the 6th approach in current vocational education activities. The data classification which is done basing on Artificial neural network techniques and performed on the sample data set before the survey shows satisfactory and acceptable results.

Through 5 times of implementing experimental results with a dataset of 2680 samples, in which the rate of using training is 90% and 10% is used for testing, and with different number of iterations in the experiment, the effectiveness has been confirmed and statistically significant to different evaluation values. This, once again, confirms that the application of artificial neural network algorithms in the classification process is effective and feasible.

This research result is also a basis for us to prove that using the way of counseling to implement in vocational education activities through artificial intelligence will bring high efficiency. However, because the consulting results are still affected by many different factors, it is important to improve the sample data and the number of test samples on different sets of weights to help the algorithm be intelligent and make consultation more effective.

REFERENCES

Examples follow:

Journal Papers:

Note that the journal title, volume number and issue number are set in italics.

Books:

Chapters in Books:

Note that the place of publication, publisher, and year of publication are enclosed in brackets. Editor of book is listed before book title.

Theses:

[1] Dan W. Patterson (1996). Artifical Neural Networks, Theory and Application. Singapore ; New York : Prentice Hall.

[2] Simon Haykin (1993), Neural Networks and Learning Machines . Mc Master University, Canada. This third edition

[3] X. Wan, "Co-training for cross-lingual sentiment classification," presented at the Proceedings of the Joint Conference of the 47th Annual Meeting of the ACL and the 4th International Joint Conference on Natural Language Processing of the AFNLP: Volume 1 - Volume 1, Suntec, Singapore, 2009.

[4] Hoa, Trương Thi (2016), Vocational education for high school students in Hanoi area through vocational consultation, PhD thesis.Vietnam Institute of Educational Sciences

[5] Tra, Le Thi Thu (2016), Managing vocational education activities for high school students in Hanoi, Thesis of Master of Science in Education. Vietnam Institute of Educational Sciences.

[6] Ministry of Education and Training (2013), Organizing career counseling and enrollment counseling for a large group of high school students, Hanoi National University Publishing House.