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Research on improving the effectiveness of ideological and political course in higher vocational colleges from the era of self media

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Abstract. A kind of method study of improving the effectiveness of ideological and political course of vocational college in we-media era of classifier models based on weighted QPSO in order to improve the effectiveness of ideological and political course in vocational college. First, study on the evaluation index of effectiveness of ideological and political course in vocational college in media era, develop and optimize 21 secondary evaluation indexes of effectiveness of ideological and political course of vocational college in we-media era; next, put forward a kind of new classifier for the problems of traditional classifier model to improve the performance of PSO based on weighted quantum algorithm and design the classifier model on the basis of this; and last, effectiveness of proposed method has been verified by simulation experiment.

Key words. We-Media, Vocational college, Ideological and political course, Weighted quantum, Particle swarm.

1. Introduction

As China's higher education is faced with the task of cultivating a large number of innovative talents and making greater contribution to national independent innovation at present, more attention has been paid to quality cultivation in higher vocational education instead of quantity cultivation. Curriculum teaching process of higher vocational college students is an important link of controlling the quality cultivation of higher vocational college students[1], therefore, the evaluation on teaching quality of higher vocational college students also becomes one of the important subjects of improving the quality cultivation[2, 3]. However, it is a complicated system

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engineering to evaluate the teaching quality of higher vocational college students. The course teaching level cannot be completely and objectively reflected arising from many factors involved in course evaluation, subjectivity of questionnaire survey usually used for evaluation due to the determination of index and weight as well as invalid information or noise data of the survey objects' feedback[4].

As a kind of traditional classification model, Support Vector Machine (SVM) is generally used for small sample because of the classification principle based on statistical theory, featuring with disadvantages of slow training speed in the case of large sample, which will not consider the possible dependency between data during the training process and cannot accurately classify the large sample data due to complex calculation of Quadratic Programming (QP). Particle Swarm Optimization (PSO) is a kind of iterative optimization tool proposed by Kennedy J et al in 1995 [5], featuring with simple calculation, fast rate of convergence and less parameter adjustment, without calculating gradient. The Literature [6] proposes a kind of classifier design based on learning automata, including PS-classifier, of which the classification accuracy is affected by some problems of easily falling into local optimal solution, slow rate of convergence and parameter setting when calculating the complex problems. Therefore, some scholars have improved the PSO algorithm. Quantum PSO (QPSO) based on quantum theory in Literature [7] is a kind of new algorithm with high-efficiency global search capability and is conducted in the case of assuming that contribution rates of all particles to the whole group are equal, which does not meet idea of survival of the fittest in the process of general evolution[8, 9].

The Paper achieves the improvement of performance of PSO based on weighted quantum algorithm in view of the problem, and obtains the classifier based on weighted quantum particle swarm by designing the classifier model based on this. The Paper accurately and objectively evaluates the teaching quality of ideological and political course of the School via classifier of weighted quantum particle swarm and finds out the problems so as to provide the direction for future teaching reform.

2. Evaluation index of effectiveness of ideological and political course of vocational college in we-media era

As the evaluation index system of teaching quality directly reflects the objectivity, rationality and fairness of evaluation results in we-media era, the establishment of scientific, systematic and effective teaching evaluation standards and index system is the key of teaching evaluation. The evaluation index system shall be established in accordance with its own characteristic of ideological and political course of the School on the basis of evaluation index system of teaching quality of institution of higher education. The main objective of ideological and political course is to cultivate the innovation awareness and innovation ability of thinking of the students, and it is a very practical course at the same time[10]. Higher requirements have been put on the use of multimedia and actual operation ability of teachers, etc. The evaluation index shall be designed in accordance with the subject of evaluation, including experts and students, which shall be timely, direct and intuitive other than general and vague[11].

Expert evaluation, according to the actual situation of ideological and political

course of the School, focuses on the equipment of course software and hardware, teaching preparation and data improvement, ability to organize classroom order, mode of expression in teaching, and coincidence degree with the teaching goal and the course orientation, level of professional theoretical knowledge and practice, renewal and expansion of knowledge, assessment methods and results, etc.; and the student evaluation focuses on teachers' love for class, sense of responsibility to students, degree of attention to inspire students and cultivate innovative ability, improvement of students' learning knowledge and ability after teaching, teacher's contribution after school[12], as well as guidance and communication with students in class and after school, etc. As teacher is the subject of the organization teaching, the teaching method, attitude and knowledge capability of the teachers directly affect the quality of teaching. Therefore, the Paper classifies 3 primary indexes based on the index designed from different angles in accordance with process of teaching organized by teachers, and develops and optimizes the following 21 secondary indexes according to the principle that the establishment of index shall be timely, directive and intuitive and study of Zhang Yunling et al focusing on main objective to cultivate students' innovative consciousness and creative thinking ability.

Table 1. Index list

Primary index	No.	Secondary index
Course content	U1	Whether the course content meets the discipline requirement
	U2	Whether the relationship with study direction is close
	U3	Difficulty of course content
	U4	el
	U5	Information content of course content
	U6	Whether the used text conforms to course requirements
Teaching process	U7	Whether the teaching method is novel
	U8	Interactivity in the teaching process
	U9	Degree of encouragement to creative thinking
	U10	Attendance situation
	U11	Classroom climate
	U12	Classroom discipline
	U13	Difficulty of usual test
	U14	Difficulty of class-ending examination
	U15	Learning time occupied after school
	U16	Condition of reading materials after school
Teachers conditions	U17	Enthusiastic teaching and full preparation
	U18	Clear explanation, strong logicality
	U19	Rich teaching experience
	U20	Giving lectures seriously
	U21	Positive question answering

3. PSO

3.1. Basic theory

As a kind of new algorithm proposed from the perspective of quantum mechanics, the particle state of QPSO is described by wave function $\psi(x,t)$ [13] rather than the position and speed of the particle, of which the probability density function is $|\psi(x,t)|^2$, depending on energy intensity parameter of potential well of the particle.

The particle obtained by Monte Carlo stochastic simulation shall be moved in accordance with the following iterative formula, where β means constriction factor and u, k represents the random number changed within the scope of [0, 1].

$$L = \beta \cdot |mbest^* - x(t)| \,. \tag{1}$$

$$\begin{cases} x_i(t+1) = p + L \cdot \ln(1/u) & if \;\; k \geq 0.5 \\ x_i(t+1) = p - L \cdot \ln(1/u) & if \;\; k < 0.5 \end{cases} \tag{2}$$

The concept of average best position Mbest shall be introduced in the QPSO as the center of gravity of all particles:

$$Mbest = \frac{1}{M}\sum_{i=1}^{M} p_i = \left(\frac{1}{M}\sum_{i=1}^{M} p_{i1}, \frac{1}{M}\sum_{i=1}^{M} p_{i2}, \cdots, \frac{1}{M}\sum_{i=1}^{M} p_{iD}\right). \tag{3}$$

Where, p_i refers to pbest of the i^{th} particle, which represents the best particle in a particle swarm, and in this case, to ensure that the particle swarm converges to the following coordinates via local attraction.

$$p = (c_1 p_{i,d} + c_2 p_{g,d})/(c_1 + c_2) \,. \tag{4}$$

3.2. Weight QPSO

The average best position Mbest in QPSO shall be calculated via formula (3), which means the average value of all particles at the individual best position, that is, the contribution of each particle to Mbest is the same because of range of search decided by average best position Mbest and particle creativity, which is a kind of main ideology. Although the individual best position is defined reasonably, there are some contradictions compared to law of natural and social evolution, of which the reason is that the mechanism of the whole society is determined by the main ideology, but it is not reasonable for each individual to be equal. In fact, the main idea of outstanding individual improvement is how to determine the optimal particle, that is, how to determine its importance to the calculation of Mbest value. The importance will be determined in accordance with adaptive value of the particle in other evolutionary algorithms [5], showing that the bigger the adaptive value is, the more important the particles are. Therefore, the particles shall be first arranged in descending order according to the adaptive value of the particle, and then the weight

coefficient a_i of each particle shall be determined, of which a_i is decreased linearly according to the order of the particle, showing that the closer the best solution is, the bigger the weight coefficient is, so that the calculation of the best average position Mbest shall be improved as follows:

$$Mbest = \frac{1}{M}\sum_{i=1}^{M} p_i = \left(\frac{1}{M}\sum_{i=1}^{M} a_{i1}p_{i1},\ \frac{1}{M}\sum_{i=1}^{M} a_{i2}p_{i2}, \cdots,\ \frac{1}{M}\sum_{i=1}^{M} a_{iD}p_{iD}\right). \quad (5)$$

Where, a_i means weight coefficient; a_{id} refers to the dimensional coefficients of each particle and M represents the number of swarm. The weight coefficient of each particle (1.5∼0.5) used in the Paper is decreased linearly.

4. Classifier design based on weighted QPSO

4.1. Encoding rules and fitness functions

The teaching data of ideological and political course shall be encoded by improved Michigan encoding scheme [5], of which each particle corresponds to the encoding rule, and the rule set corresponds to the whole particle swarm. Each particle is composed of different dimensions. Each feature attribute in the dataset corresponds to the different dimension values of the particle. The categorical attribute of dataset corresponds to a dimension value of particles, but does not participate in the exchange of information between particles, which belongs to the constant attribute of particles. Therefore, one to one correspondence between classification rules and particle shall be established. Each dimension of the particle expresses different meanings via this encoding rule, which can easily update the particle position of PSO, and can satisfy the independence requirement of information exchange between different dimensions of particles at the same time.

Assuming that each political theory courses teaching in the dataset D of the political theory courses teaching includes r characteristics such as $x_1, x_2, \cdots, x_r$, and the binaryzation processing shall be made for the attribute of r dimension as the dimension of MFCC coefficient of each political theory courses teaching in the Paper. If there is n political theory course teaching in the experiment, it shows that classification attribute is n, namely clsss1, class2, ... , classn. In such a way, the i^{th} particle is an r-dimension vector $x_i = (x_{i1}, x_{i2}, \cdots, x_{i,r-1}, x_{ir})$, $i = 1, 2, \cdots, n$ forming the search space of r-dimension rule. The optimal classification shall be conducted in this r-dimension target search space.

Fitness function is defined as follows:

$$fit(p_i) = T - Miss(p_i)\,, \quad (6)$$

Where, T refers to the general training sample dataset and $Miss(p_i)$ means the point that is mistakenly trained by p_i. The optimal classification shall be realized by maximizing fitness function and minimizing the number of the error training points.

4.2. Hyperplane of decision-making

The general type of the hyperplane is defined as:

$$d(X) = w_1x_1 + w_2x_2 + \cdots + w_nx_n + w_{n+1}\,. \tag{7}$$

Where, $X = (x_1, x_2, \cdots, x_n, 1)$ and $W = (w_1, w_2, \cdots, w_{n+1})$ refer to expanding feature and weight vector respectively, and n represents the number of dimension of characteristic space that will be divided into different areas by many hyperplanes (where $\log_2^M$ means the minimum value and M refers to the number of category) in general. The classification of 3 hyperplanes in two-dimensional space is shown in Fig.1.

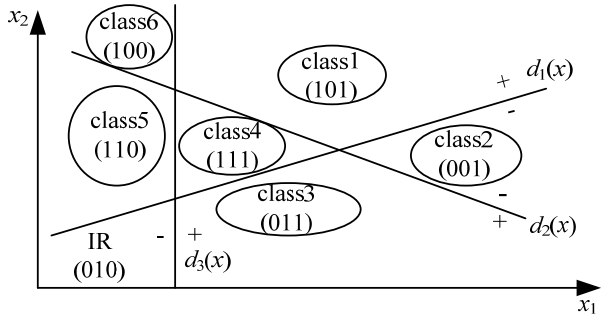


Fig. 1. Classification of 3 Hyperplanes in Two-Dimensional space

The classification of 3 characteristic attribute and category attribute is shown in Fig. 1, showing that each category belongs to the encoding of a region which is obtained by 3 hyperplanes (compared to two-dimensional characteristic space), where, IR refers to undermined area. $W_j(j = 1, 2, \cdots, H)$ is found in the solution space via the classifier proposed in the Paper, where H refers to required 5 hyperplanes.

4.3. Classifier structure based on weighted QPSO

Based on above definition, the classifier can be formed on the basis of classification rule mining with QPSO. Classification rule mining focuses on the acquisition of particle representing an optimal rule, and more focuses on the combination of the optimal coordination rule. Because of the particularity of classification rule mining, QPSO shall be improved in view of this problem with reasonable search method based on quantum behavior. And then the data shall be classified by rule set with Credit Assignment Algorithm (CAA). The precision defined in literature [6] shall be used for weight of classification rule, and the classified category of contradictory data shall be determined based on this to achieve classifier design based on QPSO.

The main steps of classifier design in the Paper are as follows:

Step 1: Initialize the swarm, set swarm scale as M and particle dimension as D, and then initialize $\beta = 1.2$, $a_i = 1.5$.

Step 2: Calculate the fitness value of each particle in accordance with the

formula (8), and arrange it in descending order to determine the weight coefficient a_i of each particle.

Step 3: Calculate the L value in accordance with formula (1) so as to calculate the best average position *Mbest* according to formula (5).

Step 4: Judge the upgrade position of the particle in accordance with the formula (2).

Step 5: CAA makes rule sets classify data in accordance with precision.

Step 6: Judge whether the loop condition is met, if satisfied, end optimization and output the results; otherwise, back to Step 2.

Each particle in classifier of the Paper is selected from the solution space in random in the following form:

$$\boldsymbol{P} = [W_1, W_2, \cdots, W_i, \cdots, H'] .$$

Where, $W_i = (w_{i1}, w_{i2}, \cdots, w_{in}, w_{in+1})$ means the weight vector of the i^{th} hyperplane and H represents the number of predefined hyperplanes. The fitness function is as follows:

$$p - dist = \|p_g - p_i\| = \sum_{k=1}^{H} w_{kd} - w_{ki} . \tag{8}$$

Where, both p_i and p_g refer to matrix, $p_i = [W_{1i}, W_{2i}, \cdots, W_{Hi}]'$, $p_g = [W_{1g}, W_{2g}, \cdots, W_{ig}, \cdots, W_{Hg}]'$; $|\bullet|$ means the normalization of $(W_{kd} - W_{ki})$ vector, and termination condition is the best fitness or default maximum iterations; and the maximum iteration shall be selected in this experiment and weight vector $\boldsymbol{w}$ is selected as linear decrease.

5. Experimental analysis

5.1. Data acquisition

In this Paper, the questionnaire is developed in accordance with the indexes at the bottom layer listed in the Table 1, appeared in the form of multiple-choice questions which shall be set in accordance with the degree of index itself. For example, the choice question whether the teacher tells key points clearly in class shall be set for key index, provided with options respectively for A. All the points are explained carefully; B. Individual emphasis has been emphasized; C. No key points basically, and wait for student questioning; D. No focus at all and the students' questions cannot explain clearly. Basically, each index is set with 2 multiple-choice questions. When the results of the statistics are given, the choice of A is 4 points, the B option corresponds to 3 points, and the C option corresponds to 1 point, and the D option corresponds to 0 in order to be able to quantify the final results of the questionnaire. The corresponding options shall be added in the case of multiple-choice questions on each index for the purpose of reducing the subjective randomness arising from free grading. The questionnaire was filled out by the expert teachers and students in the School, including 10 questionnaires from the final experts, and questionnaires filled

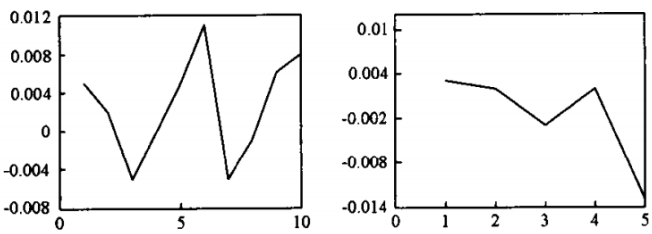
out by expert teachers shall be served as training sample after the quantification. It is because expert teachers are rich in experience, with relatively mature and objective thought, and understand the objective and conditions of the ideological and political course in depth so that the evaluation of expert teachers can reflect the final result when training the network by adopting sample data from expert teachers. 171 questionnaires filled out by the students are collected and the screening results show that there are 43 invalid questionnaires, which cannot be used as sample data because all options are A and answer is slipshod. With regard to the rest 128 questionnaires, 5 typical questionnaires shall be selected from the results of the questionnaires as the test sample and the other 123 questionnaires shall be used as evaluation sample. In addition, the normalization processing shall be implemented on the data after the quantification of obtained questionnaire results in order to quicken the rate of convergence of the network.

5.2. Result analysis

Input the top 10 groups of training sample data in the Table 2 in accordance with the above-mentioned steps, and list the results in the Table 2. The error curve in Fig. 2 (a) shows that the network output value is basically consistent with the expected output value (expert evaluation value); and the error curve in Fig. 2 (b) shows that the error between the test sample and the training sample is very close, and the results of network evaluation are consistent with the results of expert evaluation, with less error and high precision, therefore, the established evaluation model is reasonable, which can reflect the teaching quality of ideological and political course in the School more accurately.

Table 2. Comparison table of results and evaluation results from expert

No. of test sample	1	2	3	4	5
Network evaluation value	0.837	0.798	0.673	0.558	0.323
Network evaluation results	Excellent	Good	Moderate	Qualified	Unqualified
Expert evaluation value	0.84	0.78	0.67	0.56	0.31
Expert evaluation results	Excellent	Good	Moderate	Qualified	Unqualified



(a) Error Curve of Training Sample (b) Error Curve of Test Sample

Fig. 2. Error curve diagram

5.3. Evaluation of teaching quality

The results of 123 questionnaires filled out by the students shall be input into the established model as evaluation sample to evaluate the teaching quality, of which the final evaluation results are shown in Table 4.

As we can see from Table 4, 123 questionnaires collected reflect that the School has a better teaching quality of the ideological and political course in general and student evaluation is generally better, of which the evaluation above good accounts for 78% of total sample number, accounting for the vast majority, but with a low excellent rates. Choice questions with lower average value in the questionnaire score statistics reflect that the problems in 4 aspects shall be strengthened:

1) Strengthen the educational idea of student-oriented. Students are basically in a passive position, teachers pay more attention to the inculcation of knowledge, and some students also think that they can learn the ideological and political course by themselves via the software instead of attending a lecture under the current teaching mode. However, it is because of half-heartedness of a few students that the teaching quality is affected. Therefore, on one hand, the school shall strengthen the management for students from management system and on the other hand, more attention shall be paid to how to attract the students to enhance interest in class.

2) Emphasize the key points further. The teaching of ideological and political course in the School focuses on the cultivation of two-dimensional critical thinking skills and it is difficult for students to clearly understand the key points if teacher do not repeatedly emphasize the key points in the process of teaching as there are many knowledge points and many critical thinking skills.

3) Enhance the communication with students. Communication includes the communication in class and after class. We can find the problems in the process of student's learning, and adjust the teaching methods, progress of teaching and the key points of teaching in time via communication. The approaches to obtain the knowledge for students shall be broadened by making full use of network technology and multimedia technology to enhance the time of autonomous learning of students. The emotion between teachers and students will be further strengthened through communication so as to create a harmonious teaching and learning climate.

6. Conclusion

Although there are more findings, it is difficult to evaluate the effect of some course as the evaluation factors for course of higher vocational college students is relatively complex and the weight measure of each item is a nonlinear problem. Based on concrete analysis on study item and results, the Paper proposes a kind of new classifier in allusion to the deficiencies of SVM and PS–classifier classifier and applies it to achieve the teaching identification of ideological and political course. The experimental results show that the classifier in the Paper overcomes the shortcoming that SVM is not suitable for large sample classification and PS-classifier is easy to fall into local optimum and improves the training speed in high dimensional space, with better convergence accuracy. Based on this, a course evaluation model of classifier

based on weighted QPSO is proposed. Through the analysis and study of the history course survey data via BP network, the model can evaluate and analyze the course of higher vocational college students. The experiment verifies that the evaluation effect of such model reaches expected requirements. In addition, there are still some problems in the practical application of the course evaluation model, mainly because the normalization of the evaluation result statistics cannot deal with the qualitative index, and some problems such as "What are the abilities improved mainly by the course?" cannot be included in the system, which needs to be improved further in future study.

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