Remittances Review
January 2023
Volume: 8, No: 1, pp. 183-199
ISSN: 2059-6588 (Print) | ISSN 2059-6596 (Online)

Received: 11 November 2022 Accepted: 02 February, 2023
DOI: https://doi.org/10.33182/rr.v8i1.13

Exploration on the Reform and Practice of Civic Science Course Examination in Higher Education Institutions Based on Linear Regression Algorithm

Huan Jiang[1]*
Yanhua Hu[1]

Abstract

Exploring the examination reform of Civics in higher education institutions is to fully reflect the nurturing function of Civics. This paper introduces the linear regression algorithm, elicits the one-dimensional linear regression analysis model, and uses least squares to estimate the estimated value of the model. Then, based on the one-dimensional linear regression algorithm, the multiple linear regression algorithm is introduced. The algorithmic process of random forest is also introduced, illustrating that random forest is a classification result derived from majority voting using decision trees and bagged sampling methods. Based on the linear regression algorithm and the random forest model, a LR-RF model was constructed to analyze the examination reform and practice of the Civics course in higher education institutions, and the model was used to index the Civics course examination data of school X in two aspects, i.e., the content of the Civics course examination and the examination method. In terms of exam content, the average percentages of strongly agree, agree, disagree, and unsure are 29.53%, 26.37%, 29.28%, and 14.82%, respectively. In terms of the examination pattern, the average percentages of strongly agree, agree, disagree, and uncertain were 24.48%, 34.76%, 22.14%, and 18.62%, respectively. Based on the LR-RF model, we can effectively analyze the direction that the examination of Civics and Political Science courses in higher education institutions should be reformed, focusing on the examination content and examination mode, and focusing on reflecting the nurturing function of Civics and Political Science courses.

Keywords: *linear regression, random forest, decision tree, Civics exam*

Introduction

At the beginning of the last century, China resumed the examination system, and many scholars have studied the examination system of college entrance examinations, while almost no one has talked about the examination system of courses, so that the examination system of courses in China is relatively backward (Guan, 2019). One of the most typical is the examination system of Civics and Political Science courses in higher education institutions, which is designed to complete the task, not to measure students' learning ability and knowledge mastery, and students are considered

[1] School of Marxism, Shenzhen Polytechnic, Shenzhen, 518055, China.
Corresponding author: Huan Jiang (pirloxu@163.com)

to have completed the learning task of the subject as long as they achieve a passing score in the examination(Duanxian, 2021; Rui, 2022).

As a result, more and more students have started cheating in the exams of Civics subjects in higher education institutions. With the passage of time, the phenomenon of cheating regarding the examinations of Civics and Political Science courses has become more and more serious (Zhang, 2015). Many institutions in higher education colleges and universities even violate the relevant regulations about examinations in higher education colleges and universities and collude up and down to facilitate students' cheating (Zhong, 2021). This phenomenon of collective cheating is extremely detrimental to the development of Civics education in higher education institutions, and the education of students' Civics knowledge is seriously neglected, and as the situation becomes more and more serious, all walks of life are beginning to pay attention to the cheating situation in the examination system of higher education institutions (Tang, 2019).

The study on the examination of Civics and Political Science class is to be able to better play the function of educating people in Civics and Political Science education. The literature (Xiaoxia., 2020) believes that due to the similarity with Civics and Political Science class in the use of teaching materials and teaching methods in general higher education, it leads to the disconnection between cultivation goals and teaching goals. The literature (Gan Xiaona) believes that changing the teaching concept, improving the comprehensive quality of teachers of ideological and political theory courses and reforming the examination and assessment methods can effectively promote the teaching reform of Civics and Political Science courses. Literature (Xiaochun, 2017) believes that students in higher vocational colleges and universities lack theoretical basic knowledge, have low self-awareness and initiative in learning, and have weak learning ability, and have certain difficulties in the process of mastering knowledge. And most of the students in higher vocational colleges and universities have an obvious purpose for learning Civics and believe that professional courses are more helpful to them, and Civics and Political Science courses have more theoretical knowledge and less hands-on ability. Literature (Hongchuan.) argues that the influence of the general social environment causes the lack of enthusiasm of higher vocational students to learn ideological and political theory class, and the bondage of traditional education concept leads to a single teaching method.

In addition, the literature (Liu Chunxia) argues that students' attitudes toward Civic Science classes are not due to their own real willingness and enjoyment of learning, but rather due to external pressures, such as the influence of credits, teachers' grades, and parental oppression. The literature (Xiuying.) suggests that students' ideological and political education in higher education institutions should be taught in a targeted way, and interactive and activity-based teaching methods should be used in the classroom according to students' age and psychological characteristics, so as to make students' thinking move, stimulate students' learning enthusiasm and improve the classroom effect. Literature (Xu Hongjuan) believes that it is necessary to follow the law of ideological and political education, closely combine the characteristics, difficulties and key issues in the development of

higher vocational education, and take practical and effective measures to highlight the value identity of ideological and political education contents. According to literature (Hongchuan.), insisting on the education concept of "education for people and moral education first" is conducive to the establishment of correct outlook on life, values and worldview of students in higher vocational colleges.

In order to explore the reform and practice direction of the examination of Civics in higher education institutions, this paper is studied through four parts. The first part introduces the linear regression algorithm. Starting from the linear regression algorithm, the one-dimensional linear regression analysis model is introduced, including its form and the method of estimating its estimation value using least squares. Then, based on the one-dimensional linear regression, a multivariate linear regression with multiple variables is constructed, and the way of solving its regression coefficients and the general process of this algorithm are described. The second part explains the random forest. It is explained that the random forest is based on decision trees, and the random selection property is introduced in the training process through the bag sampling technique, which in turn ensures the accuracy of the classification data. Based on the characteristics of linear regression and random forest, the LR-RF model for analyzing the examination reform and practice of Civics courses in higher education institutions is constructed, and the performance evaluation is also conducted for the model. The third part is an analysis of the examinations of college Civics courses, including the content and role of college Civics courses. The fourth part is a quantitative analysis of the Civics class examination data of school X using LR-RF, which mines two indicators of Civics class examination content and examination mode, and conducts mining analysis for the two indicators, so as to explore the reform and practice direction of Civics class examination in higher education institutions.

Linear Regression-Random Forest Model

Linear regression algorithm

Linear regression is divided into univariate linear regression and multiple linear regression, which establishes a functional relationship between the dependent and independent variables and is a supervised machine learning algorithm.

One-dimensional linear regression analysis model

The method of forecasting using a univariate linear regression model is the most basic and simple method, which is applicable to univariate forecasting models (He et al., 2022).

(1) The form of the one-dimensional linear regression model

Let x be the independent variable, y be the dependent variable, and there is some linear relationship between x and y, i.e:

$$y_1 = \beta_0 + \beta_1 x_1 + \phi_1 \quad (1)$$

where β_0, β_1 is the model parameter and ϕ_1 is the random error term, which represents the combined effect of various random factors on y.

(2) Least squares estimation of the parameters of the one-dimensional linear regression model

Suppose that a set of known statistics $(x_i, y_i), i = 1, 2, ..., n$ establishes a linear statistical model of x and y as:

$$\hat{y}_i = \hat{\beta}_0 + \hat{\beta}_1 x_i \quad (2)$$

where $\hat{y}_i$ is again an estimate of y_i and $\hat{\beta}_0, \hat{\beta}_1$ is an estimate of the model parameter β_0, β_1, respectively. The first order partial derivative is found for $\hat{\beta}_0, \hat{\beta}_1$ and its estimate is minimized when its partial derivative is 0.

Multiple linear regression

The multiple linear regression algorithm adds more independent variables to the one-dimensional linear regression algorithm, allowing for more dimensions of computational prediction. Based on the computational simplicity and high modeling efficiency, it is therefore used extensively by a wide range of domestic and foreign experts and scholars, and is also a commonly used method for predictive model building in machine learning techniques (Liang et al., 2022).

Let the dependent variable be y and let the M independent variables be $x_1, x_2, ..., x_M$ respectively, and the N sets of values are obtained by experiment as $(x_{t1}, x_{t2}, ..., x_{tM}; y_t), t = 1, 2, ..., N$, then:

$$\begin{cases} y_1 = \beta_0 + \beta_1 x_{11} + \beta_2 x_{12} + \cdots + \beta_M x_{1M} + \varepsilon_1 \\ y_2 = \beta_0 + \beta_1 x_{21} + \beta_2 x_{22} + \cdots + \beta_M x_{2M} + \varepsilon_2 \\ \vdots \\ y_N = \beta_0 + \beta_1 x_{N1} + \beta_2 x_{N2} + \cdots + \beta_M x_{NM} + \varepsilon_N \end{cases} \quad (3)$$

where $\beta_0, \beta_1, \beta_2, \cdots, \beta_M$ is $M+1$ parameters to be estimated, $x_1, x_2, ..., x_M$ is M knowable variables, and $\varepsilon_1, \varepsilon_2, \cdots, \varepsilon_N$ is N random variables. If we make:

$$Y = \begin{pmatrix} y_1 \\ y_2 \\ \vdots \\ y_N \end{pmatrix} \quad X = \begin{pmatrix} 1 & x_{11} & x_{12} & \cdots & x_{1M} \\ 1 & x_{21} & x_{22} & \cdots & x_{2M} \\ & \vdots & \vdots & & \vdots \\ 1 & x_{N1} & x_{N2} & \cdots & x_{NM} \end{pmatrix} \quad \beta = \begin{pmatrix} \beta_0 \\ \beta_1 \\ \vdots \\ \beta_N \end{pmatrix} \quad \varepsilon = \begin{pmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \vdots \\ \varepsilon_N \end{pmatrix} \quad (4)$$

Then the mathematical model of multiple linear regression can be written in matrix form, i.e.:

$$Y = X\beta + \varepsilon \qquad (5)$$

Let $b_0, b_1, ..., b_M$ be the least squares estimate of parameter $\beta_0, \beta_1, \beta_2, \cdots, \beta_M$, respectively, the regression equation is:

$$\hat{y} = b_0 + b_1 + ... + b_M x_M \qquad (6)$$

It is known from the least squares method that the sum of squared residuals should be minimized, i.e.:

$$Q = \sum_{t=1}^{N} (y_t - \hat{y}_t)^2 = \sum_{t=1}^{N} (y_t - b_0 - b_1 x_{t1} - ... - b_M x_{tM}) = Minimum \qquad (7)$$

Solving equation (6) according to the extreme value theorem, then $\hat{y} = b_0 + b_1 +$ should be the solution of the following system of equations, namely:

$$\begin{cases} \dfrac{\partial Q}{\partial b_0} = -2\sum_{t=1}^{N} (y_t - b_0 - b_1 x_{t1} - ... - b_M x_{tM}) = 0 \\ \dfrac{\partial Q}{\partial b_j} = -2\sum_{t=1}^{N} (y_t - b_0 - b_1 x_{t1} - ... - b_M x_{tM}) = 0 \\ j = 1, 2, ..., M \end{cases} \qquad (8)$$

The above equation is called a regular system of equations, for which it is further reduced to:

$$\begin{cases} Nb_0 + \left(\sum_{t=1}^{N} x_{t1}\right) b_1 + \left(\sum_{t=1}^{N} x_{t2}\right) b_2 + \cdots + \left(\sum_{t=1}^{N} x_{tM}\right) b_M = \sum_{t=1}^{N} y_t \\ \left(\sum_{t=1}^{N} x_{t1}\right) b_0 + \left(\sum_{t=1}^{N} x_{t1}^2\right) b_1 + \left(\sum_{t=1}^{N} x_{t1} x_{t2}\right) b_2 + \cdots + \left(\sum_{t=1}^{N} x_{t1} x_{tM}\right) b_M = \sum_{t=1}^{N} x_{t1} y_t \\ \vdots \\ \left(\sum_{t=1}^{N} x_{tM}\right) b_0 + \left(\sum_{t=1}^{N} x_{tM} x_{t1}\right) b_1 + \left(\sum_{t=1}^{N} x_{tM} x_{t2}\right) b_2 + + \left(\sum_{t=1}^{N} x_{tM}^2\right) b_M = \sum_{t=1}^{N} x_{tM} y_t \end{cases} \qquad (9)$$

Let $A = X^T X, B = X^T Y$. Then equation (9) becomes:

$$(X^T X)b = X^T Y \quad or \quad Ab = B \qquad (10)$$

The matrix equation is solved to obtain the regression coefficients of the regression equation (6).

The general flow of the multiple logistic regression algorithm is shown in Figure 1.

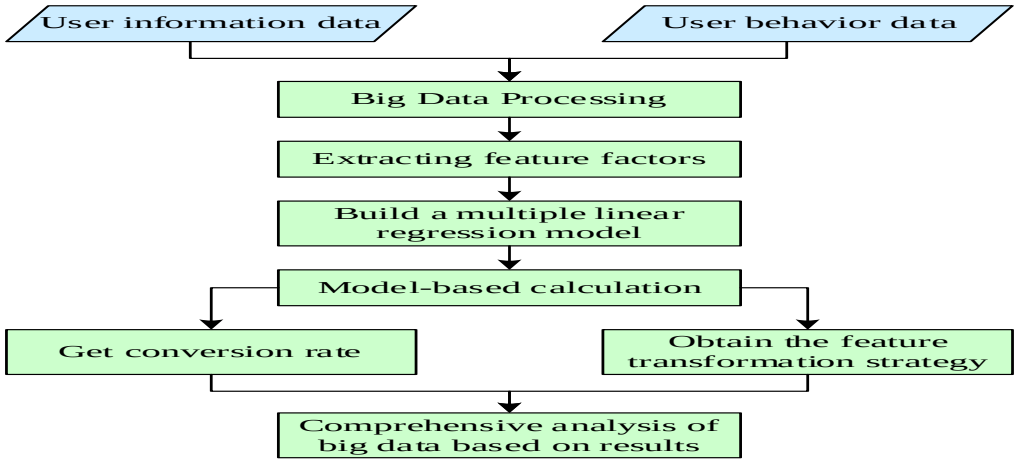

Figure 1: General process of multiple logistic regression algorithm

Random Forest

Random forests are based on decision trees and introduce random selection attributes in the training process through bagging sampling techniques. Random forests are simple, easy to implement, and computationally compact, and have demonstrated excellent performance in a large number of real-world tasks as a set of integrated algorithms, and are known as "a method representing the state of the art in integrated learning" (Antoniadis, Lambert-Lacroix, & Poggi, 2021).

As shown in Figure 2, the random forest uses the Bagging technique to construct a single decision tree by first randomly selecting a certain amount of samples from the original sample. At the node splitting of each decision tree, the splitting is also performed by randomly selecting the feature subspace. Finally, the prediction results of all single decision trees are counted and the final prediction results and prediction probabilities are derived using a voting process. To better understand the random forest and feature importance scores, this section first introduces the decision tree and Bagging integration techniques, and then describes the random forest execution process and the importance score calculation method.

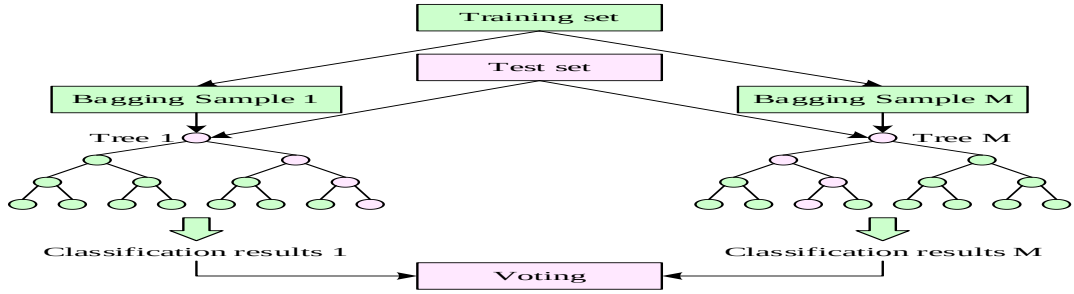

Figure 2: A simple structural framework for random forest algorithms

Decision Trees

Decision tree is a widely used tree prediction model, which starts from the root node of the tree, selects the optimal splitting attribute at each node and performs node splitting, and then builds a tree node by node until a decision tree satisfying the stopping condition is constructed. The decision tree has good interpretability, and its root node represents a test of a feature, the path from the root node to the leaf node represents a rule, and the leaf node represents a category test result. The decision tree makes predictions on samples in terms of nodes and rule bases. For example, when predicting a set X of samples with an unknown category, the decision tree starts from the root node and determines the only path to the leaf nodes, at which point the category in which most of the samples in the leaf nodes are located is the predicted value of the decision tree. By following the path from the root node to the leaf node in the decision tree, the prediction process of that sample can be obtained.

Both ID3 and C4.5 use the Shannon entropy as the tree splitting criterion, which is computationally burdensome and affects the computational efficiency of the algorithm. 1984, Breiman et al. designed the bifurcated decision tree generation algorithm named CART, which achieves greater improvement in computational real time. In the CART algorithm, the Gini coefficient is used as the tree splitting criterion: when the nodes are split, the Gini coefficient of the two subsets of each attribute is calculated first. Then, the attribute with the smallest Gini coefficient is selected, i.e., the attribute with the largest decrease in Gini coefficient before and after the split. Finally, this attribute is used to split the node into two sub-nodes, the left and the right. And so on, until the stopping condition for tree building is reached.

Decision trees are single prediction models with poor generalization ability and are very sensitive to data, making it difficult to significantly improve prediction performance through optimization methods. Therefore, integrated learning algorithms that integrate multiple decision trees have emerged.

Bagging Sampling Bagging

Breimanl first proposed the Bagging technique in 1996. It is a sampling technique with put-back

based on Bootstrap sampling. Bootstrap sampling is a sampling technique with put-back in which the probability of each sample not being drawn during Bootstrap sampling is:

$$P = (1-(1/N))^N \quad (11)$$

When the value of N is large enough, then:

$$\lim_{N\to\infty}(1-\frac{1}{N})^N = e^{-1} \approx 0.36787 \quad (12)$$

The above equation shows that 36.79% of the original samples will not be selected by Bootstrap sampling. These samples that are not selected by Bootstrap sampling will constitute the out-of-bag data set.

In a random forest, the M sample set generated by Bagging is not a simple copy of the original dataset, but a sample reconstruction achieved by resampling. Therefore, there is a difference between these M sample sets, and this difference makes the decision trees generated in the forest somewhat random. Breiman experimentally demonstrates that the Bagging process can reduce the correlation between models while maintaining the capability of individual prediction models, and can improve the accuracy of the random forest algorithm. At the same time, the Bagging algorithm focuses on reducing the variance and thus overfitting, which can suppress the tendency of overfitting in complex models.

Random Forest

Random forest is an integrated forecasting model consisting of a set of decision tree forecasting models, i.e.:

$$R = \{h(x,\theta_k), k = 1,2,...,K\} \quad (13)$$

where $\{\theta_k\}$ is a random vector that follows an independent identical distribution, indicating the number of decision trees in the random forest.

For a given independent variable of X, each decision tree model decides the optimal classification structure by voting. A random forest is a prediction model with many decision trees integrated together. If a decision tree is compared to an expert in a classification task, a random forest is many experts working together to classify a certain task. The algorithm flow of random forest is shown in Figure 3.

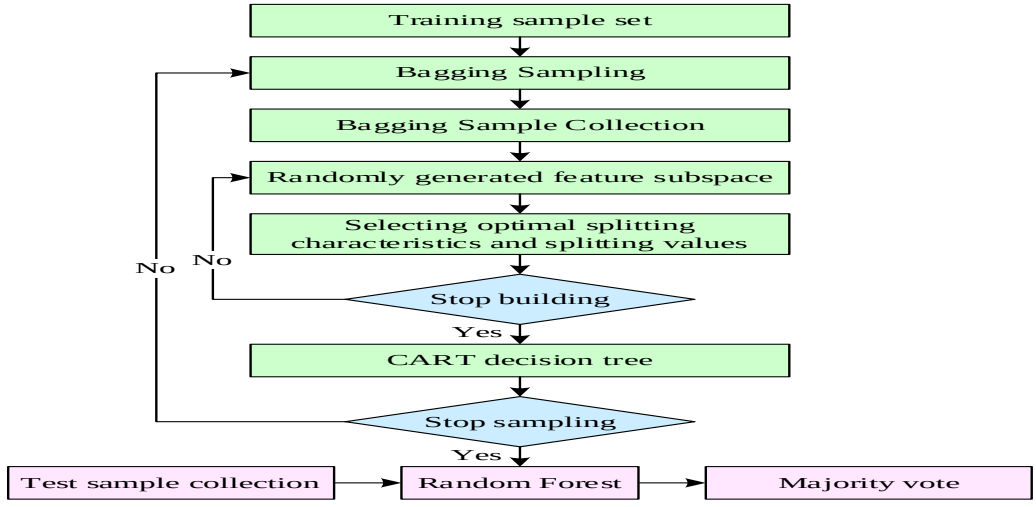

Figure 3: Algorithmic flow of random forests

Assume that given the original training data set $\chi = (X, Y)$, the number of samples is N, i.e., $(x_1, y_1), \ldots, (x_n, y_n), \ldots, (x_N, y_N)$, and each sample contains D features. The main steps of the random forest algorithm include:

First, M training sample is extracted. The Bagging technique is used to draw N samples in the data set (X, Y) in a put-back manner to form a new sample set $(X^{(m)}, Y^{(m)})$, i.e., $(x_1^{(m)}, y_1^{(m)}), \ldots, (x_n^{(m)}, y_n^{(m)}), \ldots, (x_N^{(m)}, y_N^{(m)})$. The samples that are not drawn form the out-of-bag set.

Second, train M CART tree. The CART tree is constructed on each extracted set of training samples $(X^{(m)}, Y^{(m)})$. First, D_m features are randomly sampled from the original D features ($D_m < D$). Then, in the feature subspace composed of D_m features, splitting features are selected according to the maximum impurity descent method. Finally, the next-level sub-node is obtained by splitting. The above process is repeated until the stopping condition for decision tree construction is satisfied (i.e., the number of samples in the leaf nodes is less than a threshold).

Third, majority voting determines the classification results. Predictions are made using each CART tree in the forest independently for the out-of-bag ensemble sample. Then, a vote is taken based on the results of each tree, and the final predicted category is output using majority voting. The "vote share" of each category in the voting results can also be counted, and the category with the most votes is used as the prediction category, and the corresponding "vote share" is used as the prediction probability.

LR-RF model

The LR-RF model is built from a categorical regression tree as the base model and a linear regression algorithm as the base algorithm, and a combined integrated algorithm. It provides both quantitative and qualitative analysis capability, and has good prediction effect on both complex nonlinear data, and is insensitive to noise and multivariate covariance. In addition, LR-RF randomly selects sample subsets and feature subsets, and all the underlying models are independent and different from each other, so it is not easy to overfit, and has better generalization performance and robustness. It has been widely reported for speech recognition, image processing, automatic control, financial computing, classification prediction analysis and other industries.

Priority is given to collecting random self-help sample sets from the original training set through multiple sampling techniques. The key steps in CART model construction are feature selection and regression tree generation. Feature selection selects a feature from all features and then divides the original sample space using the feature values. The sample space is continued to be divided using another feature until the depth of the tree and the number of leaf nodes are satisfied. Finally, the final output of the LR-RF model is obtained by calculating all CART prediction model outputs and taking their average value.

LR-RF Model Performance Evaluation

Performance evaluation indicators

The performance metric of a classification prediction model is mainly the model differentiation metric. A good classification prediction model can distinguish the label categories correctly, i.e., good discrimination. The samples are correctly distinguished by setting a certain threshold value, above which they are judged to be positive (or negative), and below which they are judged to be negative (or positive). For classification prediction models, accuracy, sensitivity, completeness and F1 metric are generally used for performance evaluation, which can be calculated based on the confusion matrix, which is shown in Table 1.

Table 1 Confusion Matrix

	Positive	**Negative**
Positive	TP	FN
Negative	FP	TN

Performance evaluation analysis

In this section, the performance of the LR-RF model proposed in this paper is evaluated using the dataset in the UCI database. The data in the UCI database are validated using the ten-fold cross-validation method, and the dataset is experimented in the ratio of 1:9, and the average value of ten experiments is taken as the evaluation criterion, and the results of the ten-fold cross-validation are shown in Figure 4. The accuracy and precision of the model in this paper are maintained between 85% and 95%, and the recall rate is maintained between 15% and 20%. The average accuracy of

the ten data tests is 91.16%, the average precision is 87.73%, the average recall is 17.46%, and the average of the ten F1 measures is 0.939. This shows that the LR-RF model proposed in this paper based on linear regression algorithm and random forest algorithm has good stability, and all the indexes meet the expected performance requirements of the model, which can achieve the purpose of data This shows that the LR-RF model proposed in this paper based on linear regression algorithm and random forest algorithm has good stability, and all indexes meet the expected performance requirements, and can achieve the purpose of regression for data classification.

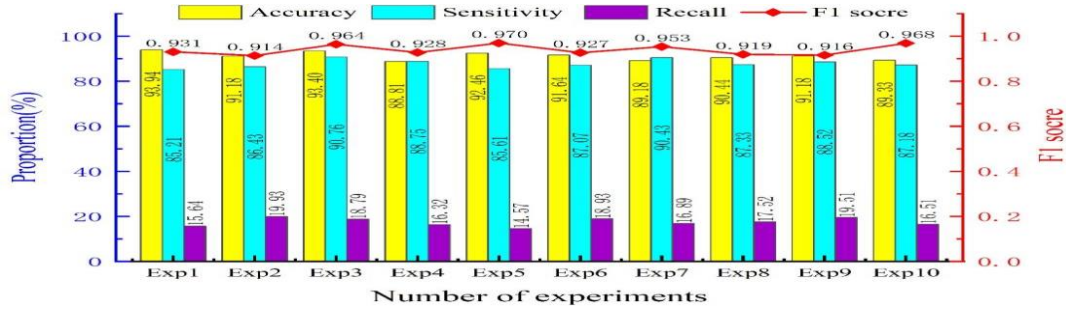

Figure 4: Ten-fold cross-validation results for the LR-RF model

Analysis of Examination Reform and Practice Exploration of Civics and Political Science Courses in Higher Education Institutions

Civics courses in higher education institutions play a vital role in enhancing students' political sensitivity, helping them to establish a correct outlook on life, worldview and values, to strengthen their ideals and beliefs, and to cultivate responsible and responsible talents for the country.

Research on Civics in Higher Education Institutions

Analysis of Civic Science Courses in Higher Education Institutions

"Ideological and political theory course is an important position to consolidate the guiding position of Marxism in the ideological field of colleges and universities, adhere to the direction of socialism, is the main channel to comprehensively implement the Party's education policy, cultivate qualified builders and reliable successors for the cause of socialism with Chinese characteristics, implement the fundamental task of establishing moral education, and is the core course to educate the core socialist values and help It is the core course to educate students on the core socialist values and help them establish a correct world view, outlook on life and values". Its distinctive political nature makes it the first course in higher vocational institutions. Its core objective is to arm college students' minds and answer their confusion, resist the negative influence of multiple value cultures and various social trends, and educate and guide them to establish correct world view, outlook on life and values.

The Role of Civic Science Courses in Higher Education Institutions

As a compulsory public course, the Civic Science course in higher education institutions is the main

course of ideological and political education for higher education college students, and has an important role and significance in cultivating socialist successors and builders. It can be understood as a classroom form in which Marxist theory and the relevant theoretical achievements of Marxist Sinicization are directly presented to college students in the form of classroom teaching. The teaching process of Civic Science Course for college students in higher vocational colleges and universities is a social practice activity that takes into account the ideological characteristics and actual situation of students in higher vocational colleges and universities, and starts teaching and education for them in an organized, purposeful and planned way to make them form correct socialist moral.

Evaluation index system of Civics course examination in higher vocational institutions based on LR-RF model

Based on the foundation related to Civics in higher education institutions introduced in the previous section, this section establishes evaluation indexes for the examination reform and practice of Civics in higher education institutions with the LR-RF model, using the data analysis in the later section.

Evaluation indexes of Civic Science course examination content in higher vocational institutions

If the examinations of Civics and Political Science courses in higher education institutions want to be reformed and developed in practice, the contents of the examinations must be analyzed in depth. In this section, the LR-RF model is used to mine the content of the current examinations of Civics and Political Science in higher education institutions. The content of Civics and Political Science examinations in higher education institutions is mainly analyzed by seven sub-indicators in three aspects, as shown in Table 2.

Table 2: Content indicators for Civics exams

Variable	Mining items	Coding
Skills and knowledge	Understand the basic skills and fundamentals of Civics	SAI1
	Understand the philosophy of Civics	SAI2
	Learn to apply the ideas of a Civics class	SAI3
Analysis and Solution	Analyzing problems through Civics learning	SAI4
	Use Civics ideas to solve problems	SAI5
	Be able to analyses the content of thinking class ideas	SAI6
Innovation and enquiry	Creative awareness of Civics ideas	SAI7
	Explore the values behind Civics	SAI8
	Exploring the changes Civics makes	SAI9

Evaluation indexes of examination mode of Civics and Political Science courses in higher education institutions

In addition to the innovation of the examination content, the examination mode also affects the

students' favorability to the Civics class. In this section, we conducted a survey on the examination pattern of Civics class in school X. After summarizing the data, we used LR-RF model to classify and organize the examination pattern of Civics class in colleges and universities from two aspects with seven mining items, as shown in Table 3.

Table 3: Civics Exam Pattern Indicators

Variable	Mining items	Coding
Traditional examination mode	Half-open book Civics exams	TIE1
	Closed book Civics examinations	TIE2
	Open-book Civics examinations	TIE3
Innovative examination models	Conducting case studies of ideas in Civics classes	TIE4
	Conducting class discussions in Civics	TIE5
	Adopt Civics class essay writing	TIE6
	Using Civics class ideas to operate practice	TIE7

Analysis of Examination Evaluation Indexes of Civics Courses in Higher Vocational Institutions Based on LR-RF Model

According to the previously selected evaluation indexes of Civics class examinations in higher education institutions, the data of Civics class examinations in a university were used as the research object for analysis. The evaluation indexes for the examinations of Civics courses in higher education institutions are evaluated and analyzed in four dimensions: strongly agree, agree, disagree, and don't know. In this section, the LR-RF model is used as the basis to analyze the data of the Civics class examinations conducted in school X, so as to help the Civics class examinations in higher education institutions achieve reform and development.

Analysis of the content indicators of Civics examinations in higher vocational institutions

According to the subindex content and analysis objects determined in the previous section, the LR-RF model was used to analyze the Civics exam data of school X. In this way, the reform direction of Civics exam content was explored, and the results of Civics exam content index analysis in higher vocational institutions are shown in Figure 5. Looking at the indicators of the exam content, the average percentage of those who strongly agree is 29.53%, the average percentage of those who agree is 26.37%, the average percentage of those who disagree is 29.28%, the average percentage of those who are not sure is 14.82%, and the overall percentage of those who agree is 55.91%, indicating that most students still think that the exam content will have an impact on the reform of the Civics exam. Among them, the highest percentage of 45.12% strongly agree that the purpose of the Civics exam is to learn to use the ideas of Civics to establish a correct outlook on life, worldview and values, and the second highest percentage of 44.31% believe that the Civics exam will make the ideas conveyed in Civics to be innovative and will help students to make innovative changes. The highest percentage of those who agreed was 38.85%, believing that Civics exams are about using the ideas conveyed in Civics to solve problems and should be strengthened. The highest percentage of those who disagreed was 48.86%, believing that Civics

exams do not help students tap into the value behind Civics and that whether or not Civics is conducted does not change the content of existing Civics exams. There is also a part of uncertainty, with the highest percentage of 24.57%, this part of students are not sure whether passing Civics exams will help them to solve their problems.

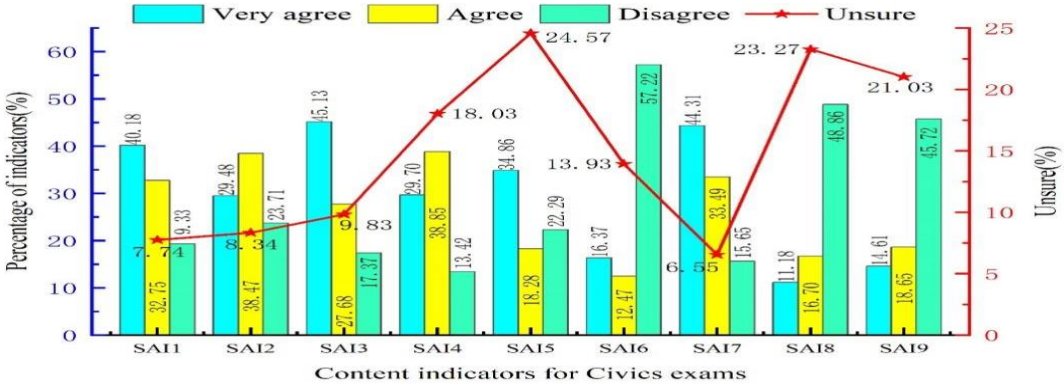

Figure 5: Analysis of content indicators for Civics examinations

Thus, based on the LR-RF model, certain problems in the content of Civics examinations can be effectively analyzed and need to be addressed in the reform process in order to help Civics *examinations get back on track and improve students' political literacy.*

Analysis of the examination pattern indicators of Civics and Political Science courses in higher education institutions

According to the content of subindexes and analysis objects determined in the previous section, the data of Civics examination of school X were analyzed by using LR-RF model, so as to explore the reform direction of Civics examination mode, and the results of Civics examination mode index analysis in higher vocational institutions are shown in Figure 6.

Looking at the indicators of the examination pattern, the average percentage of those who strongly agree is 24.48%, the average percentage of those who agree is 34.76%, the average percentage of those who disagree is 22.14%, the average percentage of those who are not sure is 18.62%, and the overall percentage of those who agree is 59.24%, indicating that most students still think that the examination pattern will have an impact on the reform of the Civics examination.

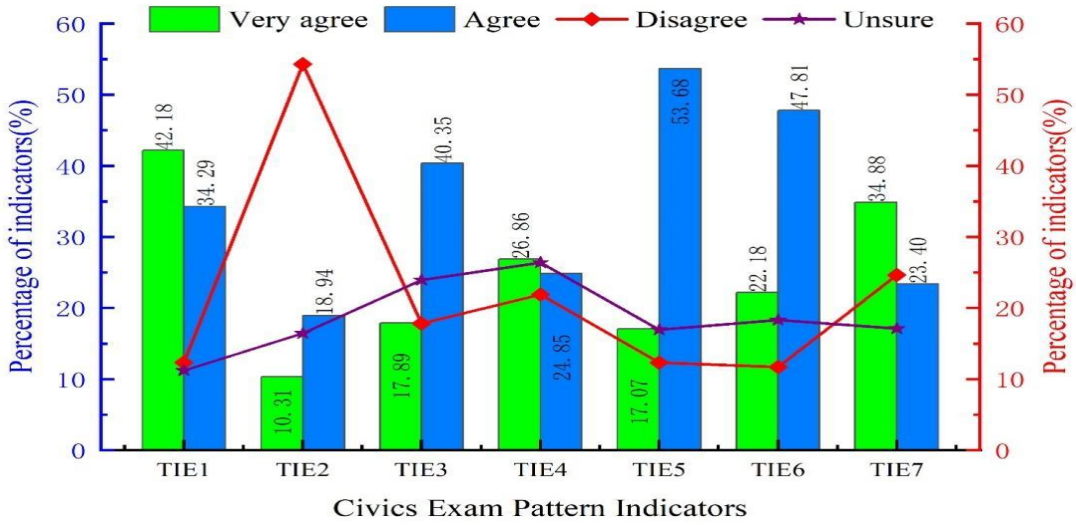

Figure 6: Analysis of examination pattern indicators for Civics courses

Among them, the highest percentage of those who strongly agreed was 42.18%, who thought that the Civics exam could be in the form of semi-open book, which could better attract students' interest in Civics, and the second highest percentage was 34.88%, who thought that the Civics exam could be assessed in the form of operation practice. The second highest percentage of 53.68% agreed that the Civics exam should be conducted in the form of classroom discussion, which can increase the knowledge of Civics ideas among students and deepen their impression. The highest percentage of those who disagreed was 54.31%, believing that Civics is an open-ended subjective answer, and using a closed-book format for the exam intelligently makes students memorize in order to cope with the exam, which fails to meet the requirements of Civics education. There is also a part of uncertainty, the highest percentage is 26.39%, this part of students are not sure if the case study of ideas in the Civics exam will help them to form a correct view of Civics education, there are doubts about such an examination method.

Conclusion

An important part of education in higher education institutions includes the examination of Civics and Political Science courses in higher education institutions, which has an irreplaceable role in the education and training of talents in higher education institutions. In this paper, starting from linear regression algorithm and random forest algorithm, we construct LR-RF model to analyze the reform and practice of Civics course examination in higher education institutions, and conduct index mining of examination content and examination pattern with Civics course examination data of X colleges and universities.

(1) From the index data of exam content, the average percentages of strongly agree, agree, disagree, and unsure are 29.53%, 26.37%, 29.28%, and 14.82% respectively, indicating that most students

still think that the exam content will have an impact on the reform of the Civics exam.

(2) From the index data of examination mode, the average percentages of strongly agree, agree, disagree and unsure are 24.48%, 34.76%, 22.14% and 18.62% respectively, which indicates that most students still think the examination mode will have an impact on the reform of the examination of Civics and Political Science.

Based on the LR-RF model, we can effectively analyze the direction that the current examination of Civics in higher education institutions should be reformed, so that the examination of Civics in higher education institutions can become an effective measure to help establish the correct three views of students.

Funding

1.This research was supported by Colleges and Universities in Guangdong Province character and innovation projects (2022WTSCX264).

2. This research was supported by educational science planned project of Guangdong Province of China (2021JKDY061).

3. This research was supported by 2021 major project of Guangdong higher vocational college teaching steering committee (SM202101).

4. This research was supported by Shenzhen Polytechnic 2021 ideology and politics education planning project (10018021310018Z).

5. This research was supported by the 14th Five-Year Plan 2022 project of Shenzhen Education Science Planning(2022JKCGPY20).

References

Antoniadis, A., Lambert-Lacroix, S., & Poggi, J.-M. (2021). Random forests for global sensitivity analysis: A selective review. *Reliability Engineering & System Safety, 206*, 107312.

Duanxian, W. (2021). The internal examination of ideology and politics education in colleges and universities under the perspective of social subject research method. *Journal of Educational Theory and Management, 5*(2), 96-98.

Gan Xiaona, H. W. Investigation on the teaching status of Ideological and Political Theory Course in Higher Vocational colleges *Education and Careers, 2016*(05), 91-93.

Guan, Z. (2019). A Few Thoughts on the Reform of Ideological and Political Course Examination in Colleges and Universities. *Frontiers in Educational Research, 2*(1).

He, Z., Liu, P., Zhao, X., He, X., Liu, J., & Mu, Y. (2022). Responses of surface O3 and PM2. 5 trends to changes of anthropogenic emissions in summer over Beijing during 2014–2019: A study based on multiple linear regression and WRF-Chem. *Science of The Total Environment, 807*, 150792.

Hongchuan., F. Research on Problems and Countermeasures of Ideological and Political Education of Students in Higher Vocational Colleges *Education and Careers, 2014*(3), 48-49.

Hongchuan., F. Teaching Reform of Ideological and Political Theory Course in Higher Vocational Colleges *Education Review, 2014*(08), 117-119.

Liang, D., Frederick, D. A., Lledo, E. E., Rosenfield, N., Berardi, V., Linstead, E., & Maoz, U. (2022). Examining the utility of nonlinear machine learning approaches versus linear regression for predicting body image outcomes: The US Body Project I. *Body Image, 41*, 32-45.

Liu Chunxia, Z. W. Research on the Teaching Status and Countermeasures of Ideological and Political Theory Course in Higher Vocational Colleges *China Vocational and Technical Education, 2015*(35), 89-92.

Rui, J. (2022). Using Android Platform for Conducting Ideological and Political Education in Colleges and Universities. *Mobile Information Systems, 2022*.

Tang, G. (2019). Research on the Effectiveness of Ideological and Political Education in Higher Vocational Education under the Background of Ideological and Political Education.

Xiaochun, Y. (2017). Thinking on the Teaching Reform of Ideological and Political Theory Course Adapting to the Characteristics of Higher Vocational Students *Vocational and Technical Education, 38*(20), 70-72.

Xiaoxia., C. (2020). Teaching Reform and Practice of Ideological and Political Theory Course in Higher Vocational Colleges in the New Era -- Comments on the Present Situation and Way Out of Ideological and Political Theory Course Reform in Higher Vocational Colleges *Education and Careers*(17), 119.

Xiuying., L. Analysis on the Ways of Ideological and Political Education in Higher Vocational Colleges *Vocational and Technical Education, 2018*(23), 63-65.

Xu Hongjuan, Z. Y. Content Optimization and Quality Improvement of Ideological and Political Education for Higher Vocational Students in Micro-media Era *Education and Careers, 2020*(7), 80-84.

Zhang, L. (2015). Analysis on new approaches of ideological and political education in colleges under new media environment. *Creative Education, 6*(22), 2427.

Zhong, J. (2021). Exploring and researching ideological and political education of college students' psychological quality for the development of artificial intelligence. *Mobile Information Systems, 2021*, 1-12.