J. Electrical Systems 20-7s (2024): 3174-3189

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Innovation and Entrepreneurship Methods and Ability Enhancement of College Students in Higher Vocational Colleges and Universities in the New Era Based on Bayesian Statistics

Abstract: - As higher education thrives and evolves in the contemporary world, a new paradigm for the advancement of additional practical abilities is the combination of entrepreneurship and creative education. This manuscript proposes the use of Bayesian statistics to enhance the ability of college students in Higher Vocational Colleges and Universities (IEAECS-HVCU-NEBS-EPTANN) to innovate and entrepreneurship methods. The first source of the input data is the 2015 dataset from the Kauffman Entrepreneurship Education Inventory Four-Year Colleges (KEEI). Then, the collected data is fed into pre-processing utilizing Distributed Minimum Error Entropy Kalman Filter (DMEEKF). The DMEEKF is used to Cleaning up the data, Integrating the data, data generalization and data transformation. Then the preprocessed data undergoes Signed Cumulative Distribution Transform (SCDT) for feature extraction. SCDT extract statistical features such us entropy, energy, variance, mean and standard deviation. Extracted features are fed to features selection. Here, it selects 16 features by utilizing Fox-inspired Optimization Algorithm (FOA). The Efficient Predefined Time Adaptive Neural Network (EPTANN) is then given the chosen characteristics in order to forecast and categorise as either a course or no course for higher professional colleges' instruction on innovation and firm ownership. Generally speaking, EPTANN does not represent optimisation techniques that may be adjusted to find the best parameters for predicting company ownership and innovation education courses in higher professional institutions. Hence, the Fractional Pelican African Vulture Optimization(FPAVO)is used to optimize EPTANN which accurately classifies the courses in higher professional universities that educate about innovation and company ownership. The proposed IEAECS-HVCU-NEBS-EPTANN approach is implemented in Python. Using performance criteria including accuracy, precision, recall, F1-score, MSE, and ROC, the proposed method's effectiveness was evaluated. The proposed IEAECS-HVCU-NEBS-EPTANN approach contains 29.9%, 28.5% and 26.8% higher accuracy, 27.46%, 25.68% and 18.79% higher F1-Score and15.79%, 18.51% and 24.61% lower MSE compared with existing methods, such as Research on the practice of innovation and entrepreneurship education in universities under the environment of big data (IEEU-EBD-FCM), research on the construction problems of innovation and entrepreneurship education programmes in higher vocational colleges and universities against the backdrop of the digital technology era (IEEP-HVCU-SVM), and research on the function of structural equation model analysis in higher education agglomeration and innovation and entrepreneurship (CSE-HEAIE-SEM).

Keywords: Distributed Minimum Error Entropy Kalman Filter, Entrepreneurship, Efficient Predefined Time Adaptive Neural Network, Fractional Pelican African Vulture Optimization, Fox-inspired Optimization Algorithm, and Higher Vocational Colleges.

I. INTRODUCTION

People may now live more tangibly in a digital world because to the rise of the Internet 2.0 era. Additionally, the iterative development of digital technology has had a major influence on humankind, driving it in the direction of big dataism, digital urbanity, digitization, and algorithmic socialization the three pillars of the community [1-3]. The two groups that together make up today's digital society are digital people who were born into the digital era and people who are transitioning from traditional society to the digital era [4]. Interacting with one another, these actors provide assistance to individuals who have to undergo the difficult shift from being conventional to being digital. Even while the shift to a digital age is unavoidable given the push to innovate in the era of artificial intelligence, which has completely machine-powered social interactions, there is resistance to it [5-7]. Because digital technology is disruptive and has altered the way traditional commercial operations are conducted, institutional limitations or a lack of them usually interfere with the entrepreneurial process driven by digital technology, making the process of digitalization in this field particularly challenging and slow [8–13]. To stay up with technology, colleges and institutions need to provide courses on entrepreneurship and innovation. Creating a large pool of competent people in applied innovation and entrepreneurship is one of the most crucial responsibilities for academic institutions given the status of society today [14–16]. Universities and colleges

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must modernize their ideas, determine how they want to be positioned in the education sector, continually improve professional environments and course material, enhance the preparation of creative instructors, and successfully reinforce statistical principles [17-19]. Higher education institutions are encouraged to expand comprehensively and holistically by developing their entrepreneurship and the digital technology era provides a setting for innovation courses [20].

Developing innovative and entrepreneurship education curricula is a challenge faced by higher education vocational colleges and universities today due to a lack of a strong entrepreneurial culture within the institution, a weak entrepreneurial cultural legacy, a faculty shortage, and budgetary limitations. The limited scope of the data analysis and conclusions is one of the drawbacks. The research recognizes the author's limited ability to analyze data, which might have resulted in a lack of comprehensive understanding of postsecondary education training on innovation and entrepreneurship. This shortcoming may impede a thorough understanding of how educational programs affect students' entrepreneurial motivations and talents. There might be restrictions when using a multivariate linear regression model for analysis and a Support Vector Machine (SVM) model for classification. SVM models may have trouble analyzing complex or nonlinear relationships in the data, despite their effectiveness in some situations. The intricacy and richness of the data may not be entirely captured by the FCM algorithm. It might oversimplify the patterns found in the context of entrepreneurship education, creating clusters that don't fairly reflect the range of student experiences and results.

In the context of the digital age, this study looks at how two methods have shaped the development of innovation and entrepreneurship courses in higher vocational schools. Using the sequence of student behaviours in feature modelling is one approach to address the current method of gathering statistical characteristics by hand from previously recorded student behaviour data. This strategy could cause a lag problem in terms of forecasting the courses that higher professional universities provide on innovation and company ownership education. Based on careful assessment of students' behavioural goals and attentiveness, students' short-term behavioural features are carefully trained using the EPTANN sequence learning approach. The IEAECS-HVCU-NEBS-EPTANN used in the research, is optimized overall by optimizing the multiple regression coefficients and screening the independent variable values for optimization. The curriculum's relevance to students' creativity and entrepreneurship as well as its consequences is studied, and a regression model is subsequently constructed with the goal of teaching innovation and entrepreneurship at higher vocational institutions and universities. The aim of this research is to investigate how innovation and entrepreneurship courses are currently being created in higher vocational institutions.

Below is a summary of this research work's principal contributions.

- Based on Bayesian statistics, this study (IEAECS-HVCU-NEBS-EPTANN) proposes ways to improve college students' skills at universities and higher vocational schools in the modern era via entrepreneurship and innovation.
- The initial source of the input data is the dataset for Kauffman Entrepreneurship Education Inventory Four Year Colleges 2015 is kept up to date by KEEI.
- The proposed IEAECS-HVCU-NEBS-EPTANN method integrates multiple advanced techniques, including Distributed Minimum Error Entropy Kalman Filter (DMEEKF) for preprocessing. The SCDT is utilised for feature extraction from the preprocessed data.
- Then the extracted features undergo feature selection using Fox-inspired Optimization Algorithm (FOA). FOA selected 16 features are given to Efficient Predefined Time Adaptive Neural Network (EPTANN) for forecasting business ownership and innovation education programmes at advanced professional colleges.
- Unlike traditional EPTANN approaches, which lack optimization methods for computing optimal parameters, the proposed method incorporates Fractional Order Water Flow Optimizer (FOWFO). FOWFO optimizes the weight parameters of EPTANN.
- The effectiveness of the proposed model is examined using existing techniques like IEEP-HVCU-SVM, IEEU-EBD-FCM and CSE-HEAIE-SEMmodels respectively.

The remaining manuscripts are arranged as: The literature review is reviewed in Part 2, the technique is explained in Part 3, the results are verified in Part 4, and the article is concluded in Part 5.

II. LITERATURE SURVEY

Several works have presented previously in literatures were depending on the higher professional universities' predictions regarding their courses on innovation and business ownership education using deep learning. Few of them were mentioned here,

Xu [21] have presented aIn light of the digital technology era, research is being conducted on the difficulties in creating courses on innovation and entrepreneurship education in higher education institutions and universities. This study aims to investigate how higher vocational schools are currently developing courses on innovation and entrepreneurship. The attentional sequence in short-term conduct was specifically employed to extract the behavioural features of students, and the SVM model was then utilized to forecast how higher professional colleges would classify their courses on firm ownership and innovation. In higher vocational institutions, these courses were built using data mining, which combined historical knowledge from the digital era. There might be restrictions when using a multivariate linear regression model for analysis and a Support Vector Machine (SVM) model for classification. SVM models may have trouble analyzing complex or nonlinear relationships in the data, despite their effectiveness in some situations. This method attains high MSE and low accuracy.

Wang [22] have presented a studies on the usage of big data in higher education to educate entrepreneurship and innovation. The idea and method of instruction known as "entrepreneurship education" emerged from socioeconomic development. Universal entrepreneurship education not only helps college students obtain employment, but it also has the long-term advantage of assisting in the industrial structure's modernization and revolution. How to develop the innovation and entrepreneurship education model in higher education within the context of big data analysis was one of the major difficulties at the time in order to achieve the objective of creating contemporary higher education. The present study employed the Apriori algorithm's association rules and the FCM algorithm's clustering analysis to comprehensively mine college and university entrepreneurial data. This method attains high accuracy and low recall.

Zhang and Meng [23] have presented the role that structural equation model analysis plays in entrepreneurship, innovation, and higher education agglomeration. The society was in dire need of individuals with an inventive spirit and entrepreneurial attributes as the pace of national modernization quickens. Colleges and universities must so actively foster their students' innovative spirit and entrepreneurial nature. The perspectives of college and university students, the external environment, and university students themselves should be taken into consideration while building the innovation and entrepreneurship education quality evaluation index system. In this article, a structural equation model (SEM) containing 23 observable variables and seven hidden variables was constructed. This method attains high F1-scoreand low precision.

Liu [24] have presented a constructing an algorithm-based data fusion talent training system for higher education institutions to instruct in innovation and entrepreneurship. Using data fusion techniques to establish the goals and specifications of the talent training mechanism, colleges and other institutions actively tackle the issue of "mass entrepreneurship and innovation" in an attempt to generate the greatest number of highly qualified applied talent. In light of the flaws and issues with the present college and university talent training programme, this study develops a data fusion method based on information fusion theory and proof theory. The goal of the research was to ascertain whether or not colleges and universities might implement a talent training plan for entrepreneurship and innovation education. Low accuracy and a high MSE are achieved by this approach.

Gao et al. [25] have presented Big Data analysis reveals the dilemma and breakthrough in higher vocational college graduates' innovation and entrepreneurship. The study uses the decision tree approach to develop a model for massive data processing. Next, the approach is applied to assess higher vocational graduates' entrepreneurship abilities, and the disparities in entrepreneurial aptitude between students of different genders are examined. Finally, it examines the factors that influence graduates' potential for entrepreneurship and does a correlation analysis for each level's relevant factors. Finally, the problem and creative approach for fostering graduates' entrepreneurial skills were explored, and the entrepreneurial scenario for graduates of higher vocational schools was optimised and simulated. This method attains high ROC and low accuracy.

Hu, [26] have presented A Study on the Establishment of Teacher Teams for Innovation and Entrepreneurship Education in Higher Education Universities and Vocational Colleges to Strengthen "Double Creation" Since higher vocational schools and universities encourage "dual-creation" education, staffing their faculties is a difficulty. The present study examines strategies for promoting innovation and entrepreneurial education in the context of "dual-creation." The evaluation model utilised in the research was built using a back propagation neural network. In order to offer targeted building solutions, it examines the teaching technique, the circumstances of the instructors, and the effects of entrepreneurship and innovation courses on the students. This method attains high MSE and low ROC.

Guo and Yang [27] have presented the best possible distribution of resources for entrepreneurship and innovation education at higher education institutions, employing computer multimedia intelligent networks. Although Internet usage was common among college students, this article focuses on how to more effectively distribute educational materials in the field of IE. The educational requirements for students in the IE topics, together with the issues and solutions that these subjects' existing students were facing, were made clear by an examination of the contemporary environment. The intelligent computer multimedia network and Internet Explorer's educational offerings became the subjects of subsequent scholarly investigations. The second section created an algorithm model for the use of computer multimedia intelligent networks and put forth several algorithms to create the algorithmic framework for these networks. Low accuracy and a high f1-score are achieved by this strategy.

III. PROPOSED METHODOLOGY

In order to use innovation and entrepreneurship approaches (IEAECS-HVCU-NEBS-EPTANN) to enhance the abilities of college students in Higher Vocational Colleges and Universities in the New Era, this section proposes employing Bayesian statistics. Six phases make up the approach: pre-processing, data acquisition, feature extraction, feature selection, classification, and optimisation. The dataset for four-year colleges in the Kauffman Entrepreneurship Education Inventory was gathered in 2015 by the KEEI is the first phase in the process and is essential to guaranteeing the availability of accurate and pertinent data for analysis. Following Data acquisition, the data’s undergo pre-processing using a Distributed Minimum Error Entropy Kalman Filter (DMEEKF) for data cleaning, integrating the data, data generalization and data transformation. Then the preprocessed data is given to Signed Cumulative Distribution Transform (SCDT) for extracting features. Then the extracted features undergo feature selection stage, the Fox-inspired Optimization Algorithm (FOA)is employed to select features. The selected 16 features are then input into an Efficient Predefined Time Adaptive Neural Network (EPTANN)for the purpose of prediction. The EPTANN, known for its robustness and ability to handle complex data, is tasked with the critical role of prediction. By leveraging its deep learning capabilities, the EPTANN predicts and categorises as either a course or no course the courses that higher professional colleges provide on innovation and company ownership education. To further enhance the performance of the EPTANN and optimize its parameters for improved accuracy and efficiency, the Fractional Pelican African Vulture Optimization (FPAVO) technique is employed. Block Diagram of the proposed IEAECS-HVCU-NEBS-EPTANN is displays in figure 1

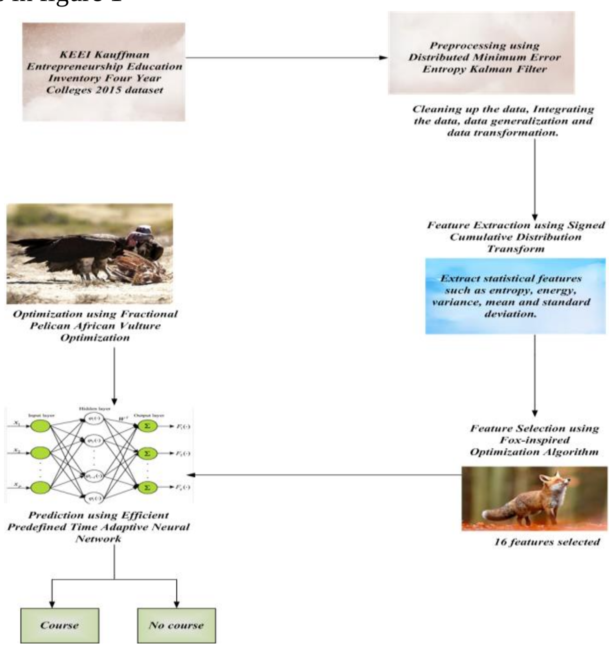

Figure 1: Block Diagram of the proposed IEAECS-HVCU-NEBS-EPTANN

A. Data Acquisition

The original source of the input data was the dataset for four-year colleges from the Kauffman Entrepreneurship Education Inventory (2015), which is maintained by KEEI [28]. The information in this dataset, which includes co-curricular activities and associated infrastructure, is a summary of how entrepreneurship education is offered and structured in American four-year colleges and universities as of 2015. Included are public, private, profit-making, not-for-profit, and specialised four-year universities. The dataset sheds light on the availability of entrepreneurship education in business departments as well as other college campus units. A broad definition of entrepreneurship includes managing small businesses and associated career-focused possibilities. Table 1 shows the features of the Kauffman Entrepreneurship Education Inventory Four-Year Colleges 2015 dataset

Table 1: Features of the Kauffman Entrepreneurship Education Inventory Four-Year Colleges 2015 dataset

Sl.No	Features	Sl.No	Features
1	Second Class	14	lecture
2	Elective course	15	Required course
3	team consciousness	16	not content
4	less concerned	17	not rich enough
5	The course is boring	18	not familiar
6	no sound system	19	Not enough internship
7	policy support	20	Improve capacity
8	Open a new course	21	Combine professional
9	Lack of practice base	22	Lack of suitable material
10	Purse oneself	23	Life experience
11	Job solving	24	lack of awareness
12	teachers	25	Gender difference
13	comprehensive quality	26	financial support

B. Pre-Processing Using Distributed Minimum Error Entropy Kalman Filter (DMEEKF)

In this section, Pre-processing using DMEEKF [29] is utilized. DMEEKF is used to Cleaning up the data, Integrating the data, data generalization and data transformation. Using DMEEKF in the context of teaching innovation and entrepreneurship gives students an effective tool for managing challenging tasks like data fusion and estimate, encouraging teamwork, and improving their problem-solving skills. Students obtain hands-on experience with sophisticated estimate methodologies and distributed computing principles by incorporating DMEEKF into projects pertaining to innovation and entrepreneurship. Their skills are improved, and this practical learning equips students for difficulties in similar sectors. Data is cleaned in equation (1),

$$R_i^c = diag[R_{1,i}, R_{2,i}, ... R_{N,i}] \tag{1}$$

Where R_i^c represent the fused covariance of measurements, $R_{1,i}$ represents the identity matrix, $R_{2,i}$ represents the fixed point recursion, $R_{N,i}$ represents the residual error. Data generalization is determined in equation (2),

$$x_i = F_{i-1}x_{i-1} + q_i \ , y_i^c = H_i^c x_i + r_i^c \tag{2}$$

Where x_i represents the real state, F_{i-1} can be represents the time instant, x_{i-1} represents the map layer, r_i^c represents the fused measurement. H_i^c represents the fused measurement matrix. The data integration is determined in equation (3),

$$\varepsilon_i^c = x_i - \hat{x}_i^c \tag{3}$$

Where ε_i^c denotes the estimation error, x_i can be represents the real state. $\hat{x}_i^c$ represents the optimal fused estimation. The data transformation is determined in equation (4),

$$\hat{x}_i^c = \arg\max\ J_L(x_i) \tag{4}$$

Where $\hat{x}_i^c$ represents the optimal fused estimation. L represents the Minimum Error Entropy criterion window length. x_i represents the real state. Finally the DMEEKF is used to clean up the data, Integrating the data, data generalization and data transformation. Then the pre-processed data are given to Signed Cumulative Distribution Transform (SCDT) for Feature Extraction.

C. Feature Extraction Using Signed Cumulative Distribution Transform(SCDT)

In this section SCDT [30] is discussed. Statistical characteristics including entropy, energy, variance, mean, and standard deviation are extracted using SCDT. SCDT makes it easier to spot patterns in student performance, entrepreneurial pursuits, and innovative projects. This facilitates focused interventions and enhancements by assisting administrators and instructors in determining areas of strength and weakness in universities, vocational schools, and higher education. Benchmarking and comparing against prior performance or external criteria are made possible by SCDT. This can be useful in comparing the success of the programmes in entrepreneurship and innovation at different universities and in the long run.
The extracted features are given below,

1) Entropy

In thermodynamics, it is employed to quantify system disturbances. An excellent method for determining the degree of unstable disturbance and the quantity of information contained in the event is to measure entropy.

$$Entropy = -sum(P * \log(P)) \tag{5}$$

Where P represent the probability vector.

2) Energy

It is applied to an operation inside a probability framework to characterise an information measurement. When combined with the Markov Random domain, this is referred to as the greatest a priori evaluation. Depending on the circumstances, energy can be used to minimize or maximize in a positive or negative way.

$$F = \sum_j \sum_i q(j,i)^2 \tag{6}$$

Where $q(j,i)$ represent the intensity value of the data at the point (i, j).

3) Variance

After the mean value is subtracted, the variance is defined as the mean square and is computed using equation (7).

$$\theta^2 = \frac{1}{q} \sum_{i=1}^{q} \left(Y_j - M\right)^2 \tag{7}$$

Where θ represent the variance. q represent the no. of samples. Y_j represent the input.

4) Mean

Calculate the average value in the data,

$$Mean = \sum_{i=1}^{r} \sum_{j=1}^{t} \frac{q(i, j)}{rt} \tag{8}$$

Here $q(i, j)$ signify the intensity value of the data at the point (i, j).

5) Standard Deviation

Determines the average distance between the mean and the data value; a low standard deviation number suggests that the data deviate from the mean less, while a bigger value implies a high contrast.

$$\sigma = \sqrt{\sum_{i=1}^{r} \sum_{j=1}^{t} \frac{(q(i,j)-m)^2}{rt}} \quad (9)$$

Where σ represent the intensity value of the data at the point. Finally Signed Cumulative Distribution Transform (SCDT) extracted the statistical features such as entropy, energy, variance, mean and standard deviation. Following the completion of feature extraction, the Fox-inspired Optimisation Algorithm (FOA) is fed the extracted features in order to choose features.

D. Feature Selection Using Fox-inspired Optimization Algorithm

In this section, feature selection using Fox-inspired Optimization Algorithm (FOA)[31] is discussed. FOA can handle complicated, nonlinear optimization problems and is very flexible to various problem fields. Because of its flexibility, it may be used to handle the wide range of issues that arise in innovation and entrepreneurship projects, giving students a flexible set of tools for problem-solving.FOA strikes a balance between exploitation and exploration tactics, which is essential for entrepreneurship and innovation. It promotes a dynamic and iterative approach to innovation by enabling students to investigate novel concepts and opportunities while simultaneously making use of already-existing information and assets.

Step 1: Initialization

A randomly formed swarm is the first step in the FOAiteration process.

$$X = \begin{bmatrix} X_{11} & X_{12} & X_{13} & \cdots & X_{1n} \\ X_{21} & X_{22} & X_{23} & \cdots & X_{2n} \\ \vdots & \vdots & \vdots & \cdots & \vdots \\ X_{m1} & X_{m2} & X_{m3} & \cdots & X_{mn} \end{bmatrix} \quad (10)$$

Where X is represented by matrix.

Step 2: Random Generation

Through FOA, the input fitness function acquired randomization upon initialization.

***Step 3*:** Fitness Function

Based on the present best location, the initialised parameters are determined. Determine the fitness level of every person.

$$Fitness\ function = [Selecting\ \ Optimal\ \ Features\ ] \quad (11)$$

***Step 4*:** Exploration Phase

Considering the finest location it has located thus far, the fox searches randomly throughout this phase. During this time, the fox's ability to jump is lacking since it must move erratically in order to inspect prey in the search region.

$$tt = \frac{sum\left(Time_{S_{Tit}}\ (i,:)\right)}{\dim ension}, \quad M\,\mathrm{int}T = Min(tt) \quad (12)$$

Where $\left(Time_{S_{Tit}}\ (i,:)\right)$ represent the dimension of problematic to discovery minimum average time tt ; $MinT$ represent the minimum time variable; a is used to control this search; The fox's exploration strategy for locating novel location at search space $X_{(it+1)}$.

$$X_{(it+1)} = Best\ X_{it} * rand\,(1, \dim ention) * MinT * a \quad (13)$$

Where $Min\ T$ and a variable has represent bydynamic outcome during search phase to get a solution that is nearly superior.

Step 5: Exploitation Phase

Due to the $Jump$ value's 0.5 multiplication to move up, down, and average time, gravity and the average duration must also be multiplied by 0.5.The $Jump$ value is obtained at two different periods, which explains this. The interval [0, 1] contains the value of the arbitrary variable, p.The $Fox\_\mathrm{Pr}ey_{it}$ and c_1 value is multiplied by $Jump$ value.

$$X_{(it+)} = Dist\_Fox\_\Pr ey_{it} * Jump_{it} * c_1 \quad (14)$$

Where, the variable c_1 value is represent by [0, 0.18] and $Fox\_\Pr ey_{it}$ is represent by $Jump$ value. Hence, both $Dist\_Fox\_\Pr ey_{it}$ and $Jump_{it}$ are multiplied by c_2.

$$X_{(it+)} = Dist\_Fox\_\Pr ey_{it} * Jump_{it} * c_2 \quad (15)$$

Where, the value of c_2 are based on how far red fox jumps it either jumps northeast or nowhere at all.

Step 6: Termination

In this step, FOAcompletes, best solution obtained through each process iterations returned as output. The following data is taken from the 2015 Kauffman Entrepreneurship Education Inventory Four Year Colleges dataset: 16 characteristics were chosen by FOA. Then the specified characteristics are sent to FOA. The Kauffman Entrepreneurship Education Inventory Four-Year Colleges dataset, a subset from 2015 shown in table 2.

Table 2: Selected Features

Sl.No	**Features**	**Sl.No**	**Features**
1	Second Class	9	lecture
2	Elective course	10	Required course
3	team consciousness	11	Purse oneself
4	comprehensive quality	12	not rich enough
5	The course is boring	13	not familiar
6	no sound system	14	Not enough internship
7	Job solving	15	financial support
8	Open a new course	16	Combine professional

E. Prediction Using Efficient Predefined Time Adaptive Neural Network

In this section, Efficient Predefined Time Adaptive Neural Network (EPTANN) [32] is discussed. In higher professional institutions, EPTANN is utilised to forecast and categorise courses as either none at all or courses on innovation and business ownership education. EPTANN's efficiency makes it possible to handle massive amounts of data quickly, which speeds up the learning process for students by allowing them to swiftly acquire insights, prototype concepts, and iterate on their entrepreneurial initiatives. Students can employ learning techniques directly related to their areas of interest by using EPTANN, which can be customized to particular entrepreneurial situations and industries. This improves their comprehension and competency in innovation and entrepreneurship.

$$\lambda_{dp}(t) = \frac{w\|E(t)\|_F^p}{T} \quad (16)$$

Where $\lambda_{dp}(t)$ represents the adaptive parameter, T represents the convergence time. $\|E(t)\|_F$ represents the Frobenius norm. w is the only variable that has the ability to change the convergence time upper bound.

$$\phi_{dp} = \frac{1}{p}\exp\left(|x|^p\right)|x|^{1-2p}\, sign(x) \quad (17)$$

Where ϕ_{dp} denotes the activation function, $\frac{1}{p}$ represents the adaptive parameter, $\exp$ represents the exponential of the adaptive parameter, $|x|^j$ represents the convergence rate, $|x|^{1-2p}$ represents the convergence, $sign(\cdot)$ represents the function.

$$\dot{E}_{dp}(t) = -\lambda_{dp}(t)\Phi_{dp}(E(t)) \tag{18}$$

Where $\dot{E}_{dp}(t)$ represents the evolution formula. $\Phi_{dp}(\cdot)$ represents the activation function. $E(t)$ represents the error function. $\lambda_{dp}(t)$ represents the adaptive parameter. Higher professional colleges' courses on innovation and business ownership are categorised as courses in equation (19).

$$\dot{E}_{et}(t) = -\lambda_{et}\Phi_{et}(E(t)) \tag{19}$$

When the error function is denoted by $E(t)$. The parameter for convergence is represented by λ. The activation function array is represented by $\Phi(\cdot)$. The matrix's elements are represented by $\dot{E}_{et}(t)$. Higher professional institutions' courses on innovation and business ownership education are categorised as none at all by Equation (20).

$$\varepsilon\ (t) = -\lambda_{et}\Phi_{et}(E(t)) + \lambda_{dp}\Phi_{dp}(E(t)) = \dot{E}_{et}(t) - \dot{E}_{dp}(t) \tag{20}$$

Where $\varepsilon\ (t)$ represents the measurement error. $\Phi_{dp}(\cdot)$ represents the activation function. $\dot{E}_{et}(t)$ symbolises the matrix's constituent parts. At the end, EPTANN identified courses on innovation and company ownership at higher professional institutions and categorised them as either course or non-course. In this research, Fractional Pelican African Vulture Optimization(FPAVO)is assigned to enhance EPTANN. Here, FPAVO is assigned for turning weight parameter of EPTANN.

F. Optimization Using Fractional Pelican African Vulture Optimization

In this section, Optimization using Fractional Pelican African Vulture Optimization (FPAVO) [33] is utilized to enhance weights parameters (ϕ_{dp} and $\varepsilon\ (t)$) of EPTANN. Students can learn about innovation and entrepreneurship concepts in addition to optimization techniques by implementing FPAVO in educational environments. Having first hand familiarity with such sophisticated algorithms can improve their analytical and problem-solving capabilities. Through the use of advanced optimization methods such as FPAVO, educational establishments may cultivate an innovative culture.

Step 1: Initialization

A randomly formed swarm is the first step in the FPAVO iteration process.

$$V = \{V_{1,}V_{2,}....V_{q,}...V_p\} \tag{21}$$

Where V_p and V_q stand for the vulture's p^{th} solution and the entire amount of solutions, respectively.

Step 2**:** Random Generation

Through FPAVO, the input fitness function acquired randomization upon initialization.

Step 3: Fitness Function

Based on the present best location, the initialised parameters are determined. Determine the fitness level of every person.

$$Fitness\,Function = optimize(\phi_{dp}, \varepsilon\ (t)) \tag{22}$$

Where ϕ_{dp} represent the higher accuracy and $\varepsilon\ (t)$ represent the lower MSE.

Step 4: Explore the Suitable Vulture ϕ_{dp}

When all solutions have their parameters computed and the population initialization is finished, the suitable solution is known as the optimum vulture. The total population is updated after every iteration.

$$\phi_{dp} = \begin{cases} BV_1 & if \;\; P_\rho = \alpha_1 \\ BV_2 & if \;\; P_\rho = \alpha_2 \end{cases} \tag{23}$$

Where, the parameters that need to be determined before to the search process are represented by the numbers α_1 and α_2, and they fall between [0, 1]. Furthermore, the sum of the α_1 and α_2 parameters is 1. With the use of a roulette wheel, the likelihood of selecting each of the best options is calculated.

Step 5: Compute the Vultures Starvation Rate $\varepsilon\ (t)$

Constantly looking for current sources, vultures can reach their maximum capacity when they are satisfied, enabling them to soar great distances in search of food. When they are extremely hungry, they try to take over strong vultures' food and become very aggressive. The mathematical representation of the rate of satisfaction mode looks like this:

$$\varepsilon\ (t) = (2 \times rand_1 + 1) \times r \times \left(1 - \frac{iteration_\rho}{\max iterations}\right) + t \qquad (24)$$

Where $\varepsilon\ (t)$ represent the vulture's contentment behaviour. $iteration_\rho$ represent the current iteration number. $\max iterations$ represent the overall count of iterations. r represent the uneven value.

Step 6: Exploration Phase

In general, vultures have good vision, are adept at finding food, and can recognize diseased carcasses. But vultures confront extremely having trouble locating food. To do this, it spends a lot of time closely examining their past and travels great distances in search of live sources.

$$P(p+1) = \frac{C(p)(1 - Y \times E)(1 - rand\, m) - rand\, z(p).E}{1 - rand\, m - E} \qquad (25)$$

Where E represent the vulture's contentment behaviour. $P(p+1)$ depict the vector for the vulture's location in the following iteration. $C(p)$ represent the one of the optimal vultures. Y is created using the formula $Y = 2 \times rand$ and used as a vector coefficient to increase the irregular motion.

Step 7: Exploitation Phase

A spiral motion is commonly created by vultures using their circular flight, and all vultures produce this spiral gesture. This is provided by

$$P(p+1) = C(p) \times (\delta_1 + \delta_2) \qquad (26)$$

Where $C(p)$ represent theone of the optimal vultures. $P(p+1)$ represent the vulture's position vector in the next iteration. δ_1 and δ_2 represent the vultures' updated positions.

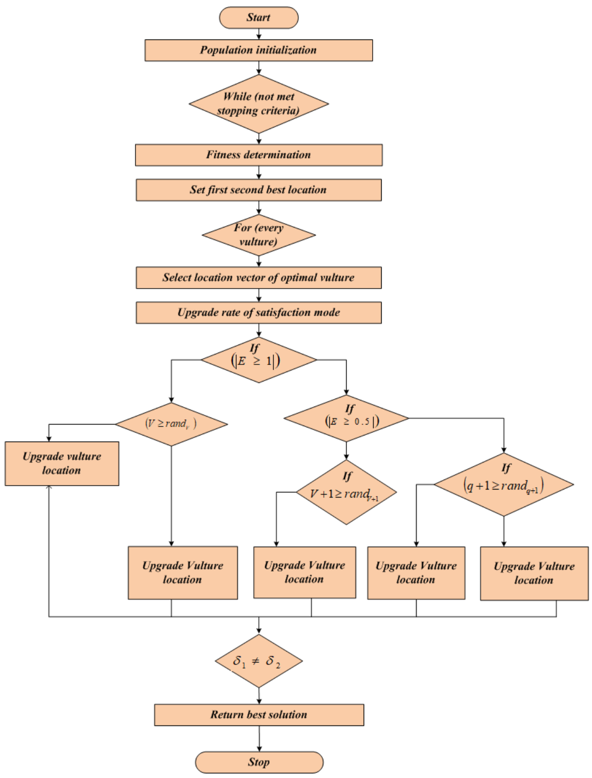

Figure 2: Flow Chart for FPAVO

Step 8: Termination

The parameter (ϕ_{dp} and $\varepsilon(t)$) from EPTANN optimized with FPAVO, will continue till the position information is obtained $V = V + 1$ is met. The flow chart for FPAVO is shown in figure2. Then finally, IEAECS-HVCU-NEBS-EPTANN classified the very accurate business ownership and innovation education courses offered by higher professional universities.

IV. RESULT WITH DISCUSSION

This sector discusses the outcomes of the proposed technique. The proposed IEAECS-HVCU-NEBS-EPTANN method is then simulated in Python and compiled utilizing Jupiter notebook and executed in Mac Book Pro along Intel core i7 processor of 2.7 GHz, 8GB of RAM speed. The obtained outcome of the proposed IEAECS-HVCU-NEBS-EPTANN approach is analysed with existing systems like IEEP-HVCU-SVM, IEEU-EBD-FCM and CSE-HEAIE-SEM correspondingly.

A. Performance Measures

Selecting the best classifier requires taking this critical step. Performance is assessed using performance indicators such as MSE, ROC, F1-score, Accuracy, Precision, and Recall. The performance metric is deemed in order to scale the metrics. The performance metric cannot be scaled without the True Positive, True Negative, False Negative, and False Positive samples.

- True positive (TP): courses at higher professional universities that teach company ownership and innovation are accurately classified as courses
- True Negative (TN): courses in company ownership and innovation education at higher professional universities are accurately classified as having no course.
- False Positive (FP): Courses on company ownership and innovation at higher professional universities have been incorrectly classified as courses.
- False Negative (FN): Higher professional colleges' courses on innovation and firm ownership were inadvertently labelled as nonexistent.

1) Accuracy

The formula (27), which evaluates accuracy, provides the percentage of samples (both positive and negative) relative to the whole amount of samples.

$$Accuracy = \frac{TP + TN}{TP + TN + FP + FN} \tag{27}$$

2) Precision

Precision is the percentage of pertinent recommendations among all the recommendations the model generates, which assesses the model's capacity to provide pertinent recommendations. It is determined by dividing all positive forecasts by the number of actual positive forecasts. To calculate precision, use equation (28).

$$\text{Pr}ecision = \frac{TP}{TP + FP} \tag{28}$$

3) Recall

Recall is a statistic that determines the number of accurate positive forecasts based on the total number of positive forecasts. Eq (29), is used to determine the measurement.

$$\text{Re}call = \frac{TP}{TP + FN} \tag{29}$$

4) F1-score

The model's total performance may be fairly assessed using the F1-score, which is the harmonic mean of accuracy and recall. The F1-score is found using equation (30).

$$F1 - Score = 2 * \frac{precision * recall}{precision + recall} \tag{30}$$

5) Mean Squared Error (MSE)

A common measure called MSE determines the average of the squares of the errors or deviations between the values in a dataset that are predicted and those that are real. The following formula may be used to determine MSE:

$$MSE = \left(\frac{1}{n}\right) * \sum \left(x_i - \hat{x}_i\right)^2 \tag{31}$$

6) ROC

Equation (32) provides the ratio of the erroneous negative to the genuine positive area.

$$ROC = 0.5 \times \left(\frac{TP}{TP+FN} + \frac{TN}{TN+FP}\right) \tag{32}$$

B. Performance Analysis

Figure 3 to 8 portrays the simulation results of proposed IEAECS-HVCU-NEBS-EPTANN method. Then, the proposed IEAECS-HVCU-NEBS-EPTANN method is likened with existingIEEP-HVCU-SVM, IEEU-EBD-FCM and CSE-HEAIE-SEMmethods respectively.

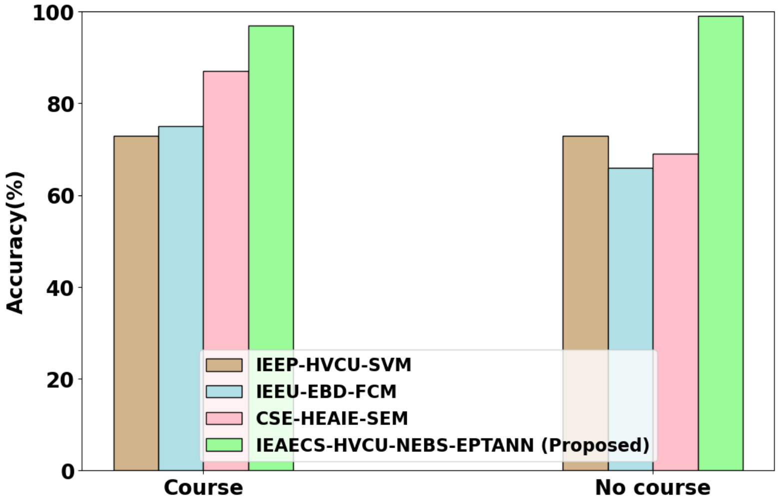

Figure 3: Performance Analysis of Accuracy

Figure 3 displays Accuracy analysis.Universities and Higher Vocational Colleges evaluate the accuracy of their Building Issues with Programmes for Innovation and Entrepreneurship Education using the EPTANN methodology. This suggests that the classification of courses pertaining to innovation and entrepreneurship was predicted with a high degree of accuracy. The proposed IEAECS-HVCU-NEBS-EPTANN method attains 29.9%, 28.5% and 26.8% higher accuracy for course and 27.5%, 29.3% and 25.5% higher accuracy for no course estimated to the existing IEEP-HVCU-SVM, IEEU-EBD-FCM and CSE-HEAIE-SEMmodels respectively.

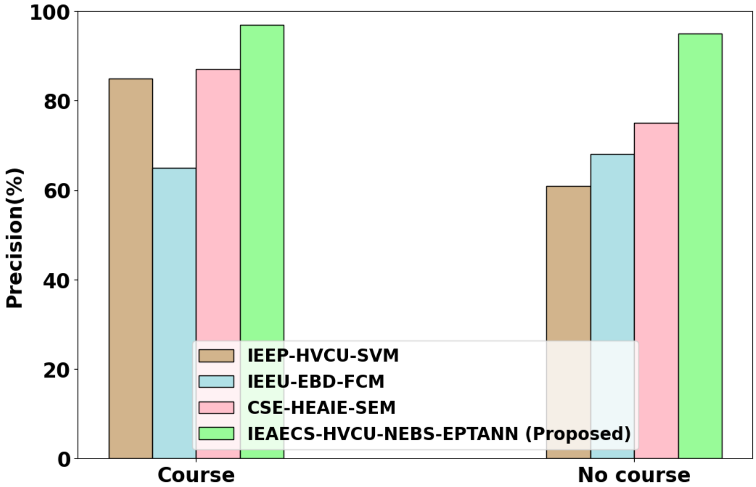

Figure 4: Performance Analysis of Precision

Figure 4 displays Precision analysis. Positive predictions of the model, including effective innovation and entrepreneurship education programs, are found to be accurate of the time, according to the precision analysis presented in the paper. This high precision number shows how well the model predicted favorable results from entrepreneurship and innovation education. The proposed IEAECS-HVCU-NEBS-EPTANNmethod attains 28.2%, 24.8% and 27.5% higher precision for course and 21.2%, 24.7% and 28.5% higher precision for no course estimated to the existing IEEP-HVCU-SVM, IEEU-EBD-FCM and CSE-HEAIE-SEM models respectively.

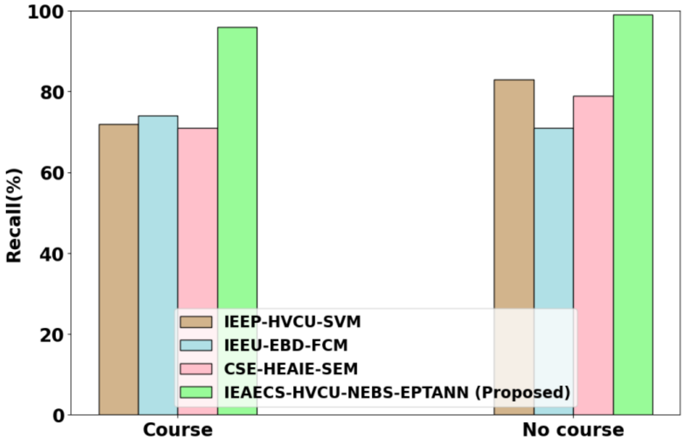

Figure 5: Performance Analysis of Recall

Figure 5 displays Recall analysis. The recall percentage, which shows the percentage of positive examples that each model accurately detected. The more the bar, the more accurate the model is in capturing pertinent examples of successful outcomes in innovation and entrepreneurship education initiatives. With a reported recall value of 0.905, the model can accurately identify the good occurrences of innovation and entrepreneurship education programs. The proposed IEAECS-HVCU-NEBS-EPTANN method attains 26.2%, 27.75% and 26.3% higher recall for course and 25.2%, 26.6% and 28.7% higher recalls for no course estimated to the existing IEEP-HVCU-SVM, IEEU-EBD-FCM and CSE-HEAIE-SEM models respectively.

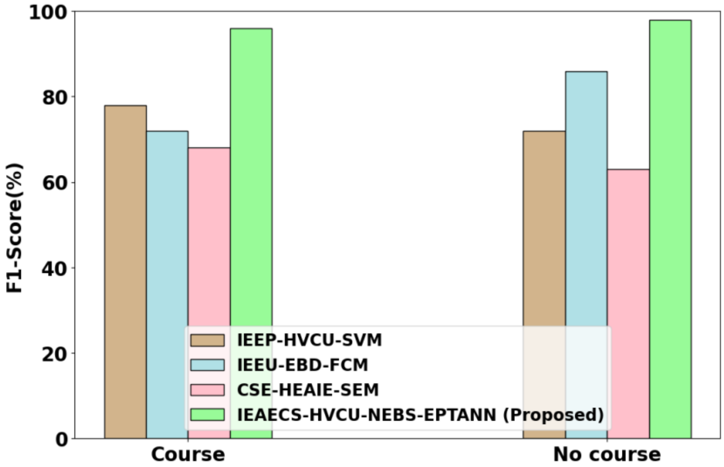

Figure 6: Performance Analysis of F1- score

Figure 6 depicts the performance analysis of F1-Score.A metric that balances recall and precision is the F1-score analysis, which is used to build challenges with innovation and entrepreneurship education programmes at higher vocational colleges and universities. A high degree of accuracy in forecasting favourable outcomes associated with innovation and entrepreneurship education programs is shown by the F1-score value .Here, proposed IEAECS-HVCU-NEBS-EPTANNtechnique attains 27.46%, 25.68% and 18.79% higher F1-Score forcourse and 27.79%, 22.51% and 14.81% higher F1-Score for no course estimated to the existing IEEP-HVCU-SVM, IEEU-EBD-FCM and CSE-HEAIE-SEM models respectively.

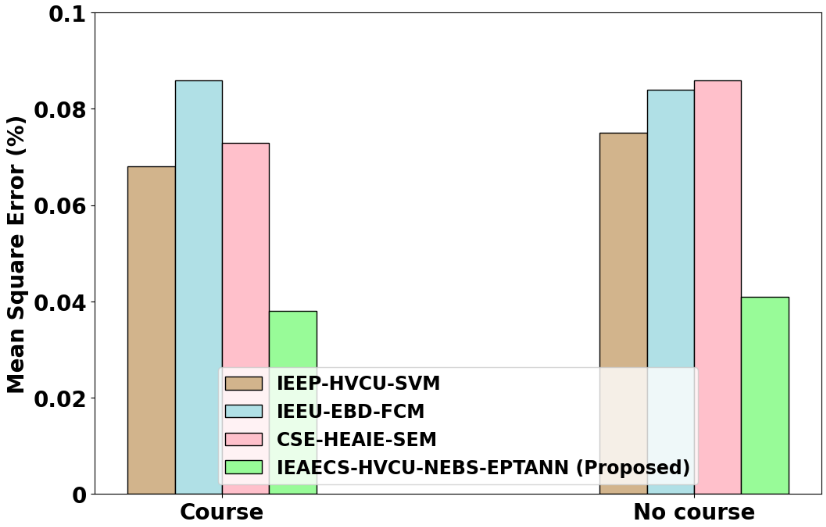

Figure 7: Performance Analysis of MSE

Figure 7 depicts the performance analysis of MSE. The research on the Mean Squared Error (MSE) of Construction Problems of Innovation and Entrepreneurship Education Programmes calculates the average squared difference between the actual and predicted values. The MSE score indicates that there is only a little degree of inaccuracy in the model's predictions for courses that teach innovation and entrepreneurship. A reduced MSE indicates that the model accurately predicts outcomes by comparing its predictions to the actual values. Here, proposed IEAECS-HVCU-NEBS-EPTANN technique attains 24.46%, 25.68% and 27.79% lower MSE forcourse and 15.79%, 18.51% and 24.61% lower MSE for no course estimated to the existing IEEP-HVCU-SVM, IEEU-EBD-FCM and CSE-HEAIE-SEMmodels respectively.

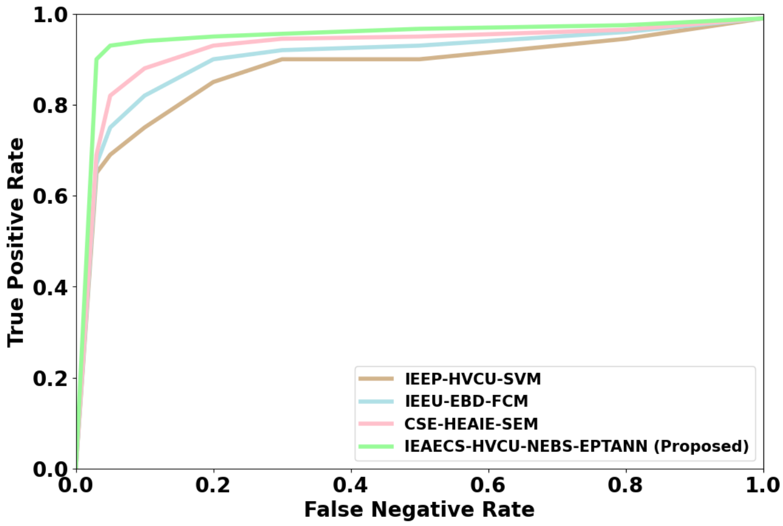

Figure 8: Performance Analysis of ROC

Figure 8 depicts the performance analysis of ROC. The ROC curve shows the trade-off between the genuine positive rate and the false positive rate. The area under the curve (AUC) of the ROC curve, which shows how well education programs for innovation and entrepreneurship can distinguish between favourable and unfavourable results. An increased AUC value indicates that the model is good at making predictions and has good discriminatory power. Here, proposed IEAECS-HVCU-NEBS-EPTANNtechnique attains 23.46%, 19.68% and 17.59% higher ROC for Estimates from higher professional universities' company ownership and innovation education courses predict that the existing IEEP-HVCU-SVM, IEEU-EBD-FCM and CSE-HEAIE-SEMmodels respectively.

C. Discussion

Using Bayesian statistics, this research develops innovation and entrepreneurship methods as well as ability enhancement strategies for college students at higher vocational colleges and universities in the new era (IEAECS-HVCU-NEBS-EPTANN).The research incorporates data on the creation of these courses in higher vocational universities and colleges, and this examines the situation and issues surrounding the instruction of courses in innovation and entrepreneurship from the perspective of higher vocational students' psychological sequence. The EPTANN attains higher accuracy of 99.8% comparing with the existing SVM, FCM and SEM algorithms. Because of the progressive increase in transaction support, this IEAECS-HVCU-NEBS-EPTANN model has a substantially higher running efficiency when the minimum support is altered than the existing models. Regression analysis is also used in this research to investigate the effects of curriculum creation for the purpose of teaching innovation and entrepreneurship at higher education-granting universities and vocational schools. There exists a noteworthy correlation between students' overall proficiency in innovation and entrepreneurial activities, as well as the goal, design, content, execution, and assessment of the curriculum, as demonstrated by the results. IEAECS-HVCU-NEBS-EPTANN classified the very accurate business ownership and innovation education courses offered by higher professional universities.

V. CONCLUSION

This section describes the effective implementation of IEAECS-HVCU-NEBS-EPTANN. The proposed IEAECS-HVCU-NEBS-EPTANN approach is implemented in Python. The performance of the proposed IEAECS-HVCU-NEBS-EPTANN approach contains 29.9%, 28.5% and 26.8% higher accuracy, 27.46%, 25.68% and 18.79% higher F1-Score and15.79%, 18.51% and 24.61% lower MSE when analysed to the existing methods like CM-DP-DNN, EDADD-MRI-CNN and DCMRI-CDV-XGB methods respectively. Future research in higher education's topic of entrepreneurship and innovation at universities and vocational colleges might concentrate on improving how digital technologies like big data analytics and artificial intelligence are incorporated into the curriculum. Furthermore, investigating the effects of industrial collaborations and practical projects on student learning outcomes may yield insightful information. The usefulness of various teaching approaches and evaluation techniques in developing students' entrepreneurial mind sets and abilities could likewise be the subject of further research.

Acknowledgements

(1) 2021 Higher Education Teaching Reform Research and Practice Project in Henan Province : Remolding and Upgrading of Grain and Oil Characteristic Process Equipment and Control Engineering Specialty for Double First-class Construction and Practice. 2021SJGLX392

(2) 2021 Higher Education Teaching Reform Research and Practice Key Project in Henan Province: The Key Project of Higher Education Teaching Reform Research and Practice in Henan Province, "Research and Practice on 'Six in One' Innovation and Entrepreneurship Education in Agriculture-related Universities" 2021SJGLX093

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