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Teaching Management System for Higher Vocational and Technical Education Using Wasserstein Generative Adversarial Network Optimized by Fire Hawk Optimization

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Abstract: - The vocational education system is currently undergoing purposeful reform and innovation, recognizing the importance of vocational training in the entire educational framework. Assessing and improving teaching quality in vocational education is critical, and addressing this challenge necessitates. The utilize of AI technology, primarily deep learning, is particularly effective in addressing the diverse and sophisticated aspects of evaluating and improving teaching quality. In this research work, Teaching Management System for Higher Vocational and Technical Education Using Wasserstein Generative Adversarial Network Optimized by Fire Hawk Optimization (TMS-WGAN-FHO) is proposed. The input data are gathered from School database (Educational data),then, input data are pre-processed using Square Root Cubature Kalman Filter for cleaning data. Then, pre-processed data are given to Wasserstein Generative Adversarial Network (WGAN) for evaluating and improving the teaching quality for Higher Vocational and Technical Education. In general, WGAN does not express some adoption of optimization strategies for determining optimal parameters to evaluating, improving quality of teaching management system. Hence Fire Hawk Optimization Algorithm (FHOA) is proposed to optimize WGAN classifier which precisely evaluates the teaching quality Higher Vocational and Technical Education. The proposed TMS-WGAN-FHO method is implemented in MATLAB, and it assessed with several performance metrics likes accuracy, cross validation scores, recall, F1-score, ROC. The results show TMS-WGAN-FHO attains 25.8%, 28.5%, and 21.6% higher Accuracy, 15.1%, 17.2%, and 32.8%higher Precision, 27.5%, 24.6% and 22.3% higher Recall are analysed with existing methods such as, evaluation of the vocational education teaching reform's quality using deep learning (EVE-TRQ-DL), art higher vocational education curriculum design incorporating AI-aided virtual reality technology (AHVE-DIAI-VRT), integrating big data analysis with higher vocational education approaches to educate entrepreneurship and innovation (IBDA-HVE-EEV) methods respectively.

Keywords: Wasserstein Generative Adversarial Network, Fire Hawk Optimization Algorithm, School database, Square Root Cubature Kalman Filter.

I. INTRODUCTION

In order to provide students with professional knowledge, abilities, and moral principles required to participate in social production, vocational education is vital. The nature and forms of vocational education change in tandem with the economy's on-going development and evolution. Vocational education, which is recognized as an essential part of national education and is mostly provided by vocational institutions, depends on the thoughtful design of instructional programs to improve overall quality [1, 2]. In order to successfully transform vocational education to conform to novel economic norm, produce top-notch human capital for growing economy, teaching innovation becomes essential .The education minister of the country acknowledges the importance of high-quality instruction and highlights the necessity of efficient teaching assessments to improve the general standard of vocational education [3, 4]. Establishing top-notch teaching teams is essential since the growth of vocational education is directly impacted by the quality of vocational schools. To do this, thorough comprehension and accurate teacher evaluation are essential, inspiring educators to raise their consciousness and develop their abilities on a constant basis. Furthermore, in order to improve overall teaching quality and obtain insights into teachers' work, school administrators and managers must assess the calibre of instructors' classroom instruction [5, 6].Because of the complicated relationship that exists among teachers, students in classroom is influenced by a number of circumstances, evaluating the quality of instruction in schools is a difficult process. In order to address this, the study presents DL-depend method for evaluating quality of instruction in vocational education. The suggested approach combines a simulated annealing technique with an enhanced Back propagation (BP) algorithm to tackle nonlinear problems by utilizing the benefits of neural networks [7, 8].

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In order to enable effective, networked, intellectual evaluation of teaching quality, study establishes network topology, learning parameters and process of teaching quality assessment method. This approach is a potential step toward improving the evaluation of teaching quality in vocational education, notwithstanding the present barriers to merging deep learning technology and teaching quality assessment [9, 10].Germany has launched a number of pilot projects targeted at changing vocational education and vocational preparation in order to improve the widespread and successful implementation of action-oriented teaching activities. Within the framework of the British Vocational Education and Training Reform, one of the most important goals is the evolution of modern apprenticeship, which has its roots in traditional training [11, 12]. The contemporary British apprenticeship scheme combines classroom instruction with business training to improve all-around skills. With origins in nations like the United States, Great Britain, and Germany, the area of educational assessment is both ancient and ever-evolving [13, 14]. It began as an autonomous branch subject in the late 19th century and developed into a scientific field. There are several approaches that can be used to teach quality evaluation. Choosing the material for the assessment system and classifying instructional quality according to content scores are common evaluation techniques [15, 16]. The components of instructional quality assessment are decided upon, taking into account the difficulty of assigning particular courses or learning phases because learning and growth are continuous processes. Task complexity is increased by the complexity of varied learning settings. Instead than emphasizing course success or teaching impact, the evaluative content of the teaching process is used to gauge the teacher's involvement [17, 18]. Comparing educational processes is still difficult because of the wide range of disciplines, course kinds, connections, and instructional materials. As such, inclusion of criteria in the assessment system should be limited to those that both clearly identify teaching levels have similar construction. Indicators for current system of assessing teaching levels are created with an emphasis on elements like teaching impact, attitude, material, ability, method, teaching and educating people [19, 20].

A. Problem statement and motivation

There are number of problems necessity to be addressed with Higher Vocational and Technical Education Teaching Management System. To meet various necessities of educators, administrators, students, system must first address the need for a more integrated, adaptable, and user-centric approach. In addition, it is critical to protect private student and teacher information, conform to data privacy laws, and create a productive system for feedback and assessment. Other problems that need to be strategically considered are achieving scalability and future-proofing the system to meet increasing user numbers and changing educational patterns.

This article provides a complete assessment method for analysing quality of vocational education and Technical Education through a careful evaluation. The research findings show that this approach is effective at evaluating a teacher's instructional quality in an impartial and equal manner, encouraging the teacher's excitement for teaching, improving teaching quality, and nurturing exceptional qualities.

The main contributions to this work are listed below:
- The Teaching Management system which is integrated with advanced analytics and deep learning insights enables students to have more tailored learning experiences.
- The teaching management system promotes a cohesive educational environment and ensures seamless connection with existing Learning Management Systems. It improves the efficiency of educational operations.
- It helps educational institutions maximize resource usage, reduce waste, and improve overall efficiency by optimizing resource allocation and scheduling.

Rest of this manuscript is organized as below: part 2 describes literature review, part 3 depicts proposed method, part 4 exhibits the outcomes with discussions, part 5 conclusion.

II. LITERATURE REVIEW

Several investigation works suggested in literatures were depend on Teaching Management System for Higher Vocational and Technical Education; few of them were reviewed here,

Ni and Wang [21] have presented quality assessment of vocational education teaching improvement depend on DL. Here, offers a rigorous approach to evaluating quality of vocational education. Research shows this approach can objectively evaluate a teacher's teaching ability, boost passion, improve quality, and foster exceptional qualities, it displays how functions of data gathering, evaluation discoveries may be realized. It provides high Accuracy, and it provides low Precision.

Cao [22] have presented study of computer assisted teaching management scheme for music appreciation course depend on network sources. This paper explains how system's homework management, personal space, virtual scene, resource managing, online examination, teacher-student communication functions were implemented using virtual reality technology. Interface diagrams and flowcharts are used to visualize the process. It provides high Precision, and it provides low Recall.

Tan and Du [23] have presented effect of quality management schemes in presentation of educational centres. Here, begins by discussing the crucial role IT may play in establishing platform, attaining information support, creating novel opportunities within educational institutions. It then identifies difficulties, likes insufficient applications, incomplete facilities, a one-sided approach to IT implementation at colleges. It provides high Recall, and it provides low F1-score.

Bahodirovich and Romilovich, [24] have presented project for training professional abilities for future teachers of technological education. In this paper examines future instructors of technology education's present professional activities as well as their practical training levels. The methodological and technological foundations for designing formation of professional ability, competencies of prospective instructors of technological education, along with scientific concerns for use of technology education in teaching scheme defined. It provides highF1-score, and it provides high Error rate.

Yeap et al. [25] have presented issues, challenges, submissions for empowering technical vocational education with training education through COVID-19 pandemic in Malaysia. Here, concerns surrounding TVET education and the challenges it experienced through COVID-19 pandemic. SCOPUS, WOS, ERIC databases utilized to choose papers about concerns, obstacles in TVET education through a pandemic epidemic at study. It provides low Error rate, and it provides low Roc.

Wafudu et al. [26] have presented validity with dependability of questionnaire advanced to search quality assurance components for teaching with learning in vocational with technical education. Here, aims to create and validate a quality assurance questionnaire for teaching with learning in vocational, technical education. Questionnaire was created using data collected through item creation interviews by quality managers, administrators, lecturers, as well as literature analysis. QATL questionnaire's content validity was evaluated through expert assessment. It provides high Roc, and it provides low Accuracy.

Shang and Sivaparthipan [27] have presented interactive teaching utilizing human-machine interaction for high education schemes. Here, investigates ITF-HMI for online higher education schemes. Essential hypotheses employed in earlier investigation were ad hoc methods for approval technologies, knowledge system presentation studies, unified ideology of ITM organization, technology usage, dissemination of progress theories. It provides high recall, error rate.

III. PROPOSED METHOD

The TMS-WGAN-FHO is discussed. The block diagram of proposed TMS-WGAN-FHO showed in Figure 1, dataset, pre-processing, classification, and optimization are processes make up this procedure. Therefore, a full description of all stage is given below,
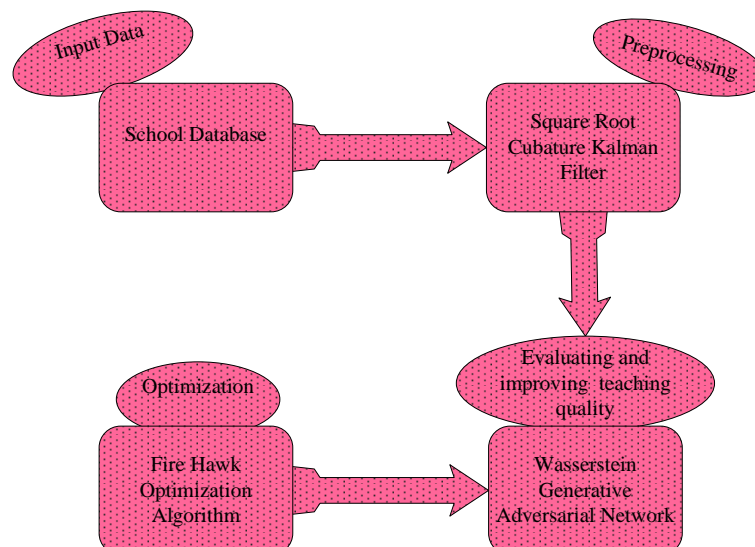

Figure 1: Block Diagram of TMS-WGAN-FHO for Evaluating and improving the Teaching Quality

A. Data Acquisition

Input data is gathered from school database (Education data) [28]. A school database is a complete and structured digital repository that contains and manages critical information about an educational institution. It contains student and faculty profiles, academic records, course descriptions, exam results, financial information, library resources, attendance records, and information on extracurricular activities. The database simplifies administrative work, improves communication, and aids decision-making inside the institution. Managed through systems such as a Teaching Management System (TMS), it improves overall operational efficiency by offering a consolidated platform for organizing, retrieving, and analyzing critical data about students, staff, courses, and other elements of school administration.

B. Pre-processing using Square Root Cubature Kalman Filter

The pre-processing using SRCKF [29] is discussed for cleaning data. The SRCKF serves as optimal state estimator grounded in deterministic sampling mechanism. To be further specific, it joins square root prediction error covariance, posteriori error covariance during filtering process. This ensures covariance matrix's symmetry, positive definiteness. The discrete system method designated in equation (1)

$$\begin{cases} K(x) = s(x-1, K(x-1)) + d(x-1) \\ M(x) = u(x, K(x)) + e(x) \end{cases} \tag{1}$$

where, $K(x)$ is the state vector, $M(x)$ represents observation vector, (x) is discrete time, $s(.)$ represents the nonlinear system function, $u(.)$ represents the observation function, $d(x-1)$ is the process data and $e(x)$ is the measurement data. For specific system parameters, initialization of estimated system states, measured states is determined using the equation (2)

$$K = \left[(\delta Y \, \delta \lambda \, \delta u) \times (\delta I_r \, \delta I_a \, \delta I_h) \times (\varphi_r \, \varphi_a \, \varphi_h) \times (\nabla_{rk} \, \nabla_{rl} \, \nabla_{rm}) \times (\varepsilon_{rk} \, \varepsilon_{rl} \, \varepsilon_{rm}) \right]^G \tag{2}$$

where, $\left[\delta Y \, \delta \lambda \, \delta u \right]^G$ is the position error vector, $\left[\delta I_r \, \delta I_a \, \delta I_h \right]^G$ is the velocity error vector, $\left[\varphi_r \, \varphi_a \, \varphi_h \right]^G$ represents the platform angle error vectors, $\left[\nabla_{rk} \, \nabla_{rl} \, \nabla_{rm} \right]^G$ is the accelerometer bias vector, and $\left[\varepsilon_{rk} \, \varepsilon_{rl} \, \varepsilon_{rm} \right]^G$ is the gyro bias vector. The SRCKF includes the position and velocity information's measured by INS, GPS. In equation (3) SRCKF has cleaned the data successfully.

$$\hat{K}(x|x) = \hat{K}(x|x-1) + X(x)\left((M(x) - \hat{M}(x|x-1)) \right) \tag{3}$$

here, $\left(\hat{M}(x|x-1) \right)$ denotes as prior observation, $(x|x-1)$ signifies square root of posterior covariance, $\hat{K}(x|x-1)$ is a cubature points, $(X(x))$ denotes KF gain and $(\hat{K}(x|x))$ is a posterior state, Here, SRCKF has cleaned the data. The pre-processed data is given to DTWGAN.

C. Evaluating and Improving Teaching Quality Using Wasserstein Generative Adversarial Network (WGAN)

In this session Evaluating and Improving Teaching Quality using WGAN [30] is discussed. WGAN has evaluating and improving the quality for higher vocational and technical education. It enables educators to design virtual settings that closely resemble real classrooms, resulting in a realistic simulation of teaching scenarios. This realistic simulation considerably improves the legitimacy of teacher evaluations. WGAN delivers data-driven insights into teaching effectiveness. This vital data helps educators understand the influence of their instructional tactics on student achievement. It enables the development of adaptive assessments that dynamically modify based on individual student performance, guaranteeing that evaluations are exactly matched to each student's learning needs. This adaptive approach improves the accuracy of measuring educational effectiveness. This is shown in Equation (4),

$$\mathrm{E}_{(K \approx C(K))}\left[\log Q(K) \right] + \mathrm{E}_{(M \approx Q(M))}\left[\log(1 - Q(T(M))) \right] \tag{4}$$

where, (M) denotes random vector from latent space, (K) signifies unique training data, $(Q(K))$ is the output from the discriminator for real training data, $(Q(T(M)))$ is the output of the discriminator when the input comes from the generator, and $(T(M))$ is a generator. Thus, the generator tries to minimize the following equation (5),

$$\mathrm{E}_{(M \approx C(M))}\left[\log(1 - Q(T(M))) \right] \tag{5}$$

A GAN make data from random numbers sampled from latent space. It has like distribution to unique data utilized for training. It trained utilizing only images attained for non-faulty signal. Once GAN successfully trained, complete loss function of GAN network given in equation (6),

$$\underset{\theta_T}{Min}\,\underset{\theta_Q}{Max}\Big[E_{(R\approx C(M))}\big[\log Q(K)\big]+E_{(M\approx C(R))}\big[\log(1-Q(T(M)))\big]\Big] \tag{6}$$

where, (θ_T) denotes as generator parameter, (θ_Q) is a discriminator parameter, and (M) is a latent space.

By selecting random numbers from latent space, GAN can produce data, and the data it produces closely look like distribution of unique data that was used for training. The discriminator, generator loss function were shown in equation (7),

$$\nabla_\omega \frac{1}{z}\sum_{i=1}^{z}\Big[f\big(k^{(i)}\big)-f\big(T\big(m^{(i)}\big)\big)\Big] \tag{7}$$

where, (f) is denoted as final layer, (T) is the latent space, batch size (z) and (m) refers training data. The WGAN evaluated and improved the quality for teaching management system; this can be expressed in equation (8).

$$Y=\underset{\tilde{k}\approx P_t}{E}\big[Q(\bar{k})\big]-\underset{\tilde{k}\approx P_e}{E}\big[Q(k)\big]+\lambda\underset{\hat{k}\approx P_{\hat{e}}}{E}\big[\big(\big\|\nabla_{\hat{e}}Q(\hat{e})\big\|_2-1\big)^2\big] \tag{8}$$

here, $(\hat{e})$ is sampled from $(\tilde{e})$ and (e), the gradient penalty coefficient (λ) and (Y) denotes optimizer hyper parameter. Finally WGAN has evaluated and improved the teaching quality for higher vocational and technical education. Due to its convenience, pertinence, AI-depend optimization approach is taken into account in WGAN classifier. The FHOA is employed to enhance WGAN optimum parameters (f,Y). Thus, FHOA is employed for turning weight, bias parameter of WGAN.

D. Optimization Using Fire Hawk Optimization Algorithm (FHOA)

The weight parameters (f,Y) of proposed WGAN are optimized using the proposed FHOA [31] is discussed. Algorithms that are capable of adapting to changes in the problem or environment are extremely valuable. Fire Hawk Optimization may be beneficial in dynamic optimization circumstances if it is adaptive. Fire Hawk intentionally started or caused by lightning, spread people with other reasons, growing susceptibility of local landscape, species. Also, whistling kites, black kites, brown falcons are responsible for spreading fires crosswise country another source that only lately discovered. Especially, the absence of a transfer parameter during the transition from the exploration phase to the exploitation phase directly influences the algorithm's performance. The initiation of involves the initialization step.

1) Stepwise procedure of FHOA

Here, step by step procedure is defined to get ideal value of WGAN based on FHOA. Initially, FHOA makes the equally distributing populace to optimize parameter WGAN. Ideal solution promoted using FHOA algorithm, linked flowchart given Figure 2.
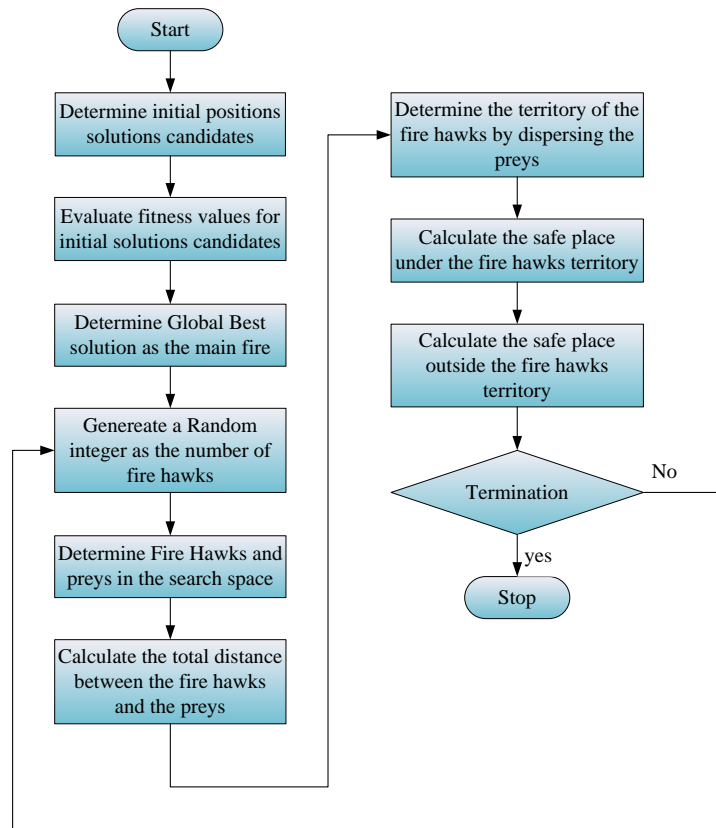
Figure 2: Flowchart for FHOA for optimizing WGAN parameter

Step 1: Initialization

The FHO process simulates hawk foraging behavior taking into account process of building, spreading fires as well as collecting prey. It is used to detect initial locations of such vectors at search space. This space is evaluated in equation (9)

$$X = \begin{bmatrix} X_1 \\ X_2 \\ \cdots \\ X_i \\ \cdots \\ X_N \end{bmatrix} = \begin{bmatrix} x_1^1 & x_i^2 & \cdots & x_1^j & \cdots & x_1^d \\ x_2^1 & x_2^2 & \cdots & x_2^j & \cdots & x_2^d \\ \cdots & \cdots & \cdots & \cdots & \cdots & \cdots \\ x_i^1 & x_i^2 & \cdots & x_i^j & \cdots & x_i^d \\ \cdots & \cdots & \cdots & \cdots & \cdots & \cdots \\ x_N^1 & x_N^2 & \cdots & x_N^j & \cdots & x_N^d \end{bmatrix} \tag{9}$$

here, (X) denotes number of solution candidates, (N) denotes total solution candidates at search space, (x_i^i) signifies initial location of solution candidates. Chosen Fire Hawks are used to spread fires about target at search space, creating hunting easier.

Step 2: Random Generation

Input parameters made at randomly. Best fitness value selection is depending upon obvious hyper parameter condition.

Step 3: Fitness Function

The outcome comes from initialized assessments, random response. Then fitness is calculated by the equation (10)

$$Fitness\,Function = Optimizing\,(f,Y) \tag{10}$$

Step 4: Exploration Phase

In exploration phase of process, total distance between Fire Hawks, prey is estimated. Fire Hawks gather flaming sticks from main fire set fire to selected region. During that stage, all bird takes up burning stick with drops it specific region, forcing prey to flee quickly. This can be indicated in the following equation (11)

$$GI_1^{new} = GI_1 + (r_1 \times HA - r_2 \times GI_{Near}) \tag{11}$$

where (GI_1^{new}) denotes novel position vector of (i^{th}) Fire Hawk, (HA) signifies global best solution at search space deliberated as main fire, (GI_{Near}) is other Fire Hawks in the search space, $(r_1 \ and \ r_2)$ 2 are uniformly distributed random numbers.

Step 5: Exploitation Phase for optimizing (f, Y)

Exploitation phase of process, movement of prey within territory of all Fire Hawk is regarded an important feature of animal behaviour for location updating process in following phase of process. When Fire Hawk drops burning stick, prey will hide, flee, or run to Fire Hawk by mistake. Such activities deliberated location updating process in equation (12)

$$f_Y^{new} = f_Y + (r_3 \times GI_1 - r_4 \times f(Y)) \tag{12}$$

where, (f) denotes initial location of solution candidates, (f_Y^{new}) denotes new position vector, $(f(Y))$ is a safe place, $(r_3 \ and \ r_4)$ 4 denotes uniformly distributed random numbers, Based on idea that a safe area in nature is location where most animals congregate to be safe, sound through hazard.

Step 6: Termination

The weight parameter values (f, Y) of generator from DTWGAN is enhanced by support of FHOA, repeat step 3 until fulfil halting conditions $X = X + 1$ is met. Then WGAN evaluating and improving the teaching quality with higher accuracy lessening computational time with error.

IV. RESULT WITH DISCUSSION

Experimental results of TMS-WGAN-FHO technique have evaluating and improving the teaching quality for Higher Vocational and Technical Education. In Implementation work was carried out in MATLAB with a PC containing 16 GB of RAM, Core i7 CPU. It is evaluated by utilizing several performance metrics likes accuracy, precision, recall, FI-score, error rate, ROC are analysed. The outcomes of TMS-WGAN-FHO technique are analysed with existing methods like EVE-TRQ-DL, AHVE-DIAI-VRT and IBDA-HVE-EEV.

A. Performance metrics

It is analysed to scale effectiveness of proposed technique. To achieve this, following confusion matrix is crucial.

1) Accuracy

It is determines as ratio of number of samples exactly characterized by system with total samples. It is given in equation (13),

$$Accuracy = \frac{(TP + TN)}{(TP + FP + TN + FN)} \tag{13}$$

where, (TP) denotes true positive, (TN) refers true negative, (FP) denotes false positive, (FN) signifies false negative.

2) Precision

It analyses predictive value of sample, it positive/negative depends upon class for which is computed; in other terms, it estimates samples' predictive power. It is given in equation (14).

$$\Pr ecision = \frac{TP}{(TP + FP)} \tag{14}$$

3) F1 - score

A composite scale named F1-score that benefits methods with better sensitivity, challenges for methods with better specificity. It is formulated in equation (15),

$$F1 Score = \frac{TP}{\left(TP + \frac{1}{2}[FP + FN] \right)} \tag{15}$$

4) Recall

It is a metrics that determines predictions made by correct number of positive predictions made by total positive forecasts. It is given in equation (16),

$$R = \frac{TP}{TP + FN} \tag{16}$$

5) Error rate

The error rate indicates the proportion of processing errors generated by a department. Minimizing processing errors is critical, as the cost of correcting these errors is substantially higher than getting it right the first time. This is computed by equation (17),

$$ErrorRate = 100 - Accuracy \tag{17}$$

6) ROC

ROC stated as ratio among changes in one variable comparative to equivalent change in another, graphically that rate of change represents slope of line. It is given in equation (18)

$$ROC = 0.5 \times \left(\frac{TP}{TP + FN} + \frac{TN}{TN + TP} \right) \tag{18}$$

B. Performance analysis

The simulation results of TMS-WGAN-FHO method showed in Figure 3 to 7. The TMS-WGAN-FHO approach is compared to existing EVE-TRQ-DL, AHVE-DIAI-VRT and IBDA-HVE-EEV models.
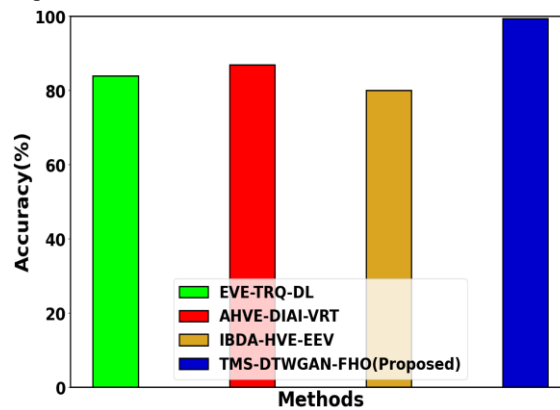

Figure 3: Accuracy analysis

Figure 3 shows accuracy analysis.It is deliberate as ratio of number of samples accurately classified scheme with total samples.TMS-WGAN-FHO method attains 25.8%, 28.5%, and 21.6% higher accuracy; as analysed with existing methods EVE-TRQ-DL, AHVE-DIAI-VRT and IBDA-HVE-EEV respectively.
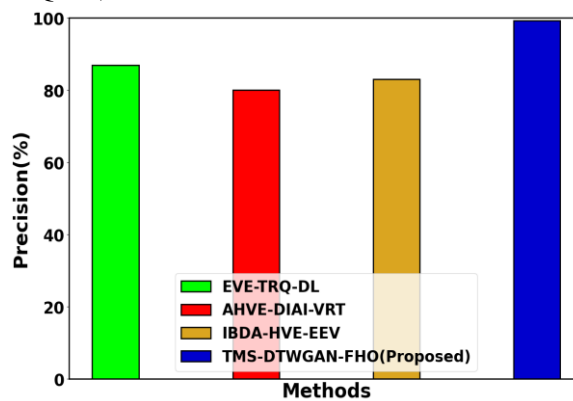

Figure 4: Precision analysis

Figure 4 shows precision analysis. It predictive value of sample, it positive or negative depends upon class. The TMS-WGAN-FHO method attains 15.1%, 17.2%, and 32.8% higher Precision; as analysed with existing techniques such as EVE-TRQ-DL, AHVE-DIAI-VRT and IBDA-HVE-EEV respectively.

Figure 5 shows F1-score analysis. The approaches with better sensitivity and challenges with better specificity. Here, TMS-WGAN-FHO method attains 29.7%, 26.5%, and 23.2% higher F1-score; analysed with existing methods like EVE-TRQ-DL, AHVE-DIAI-VRT and IBDA-HVE-EEV respectively.
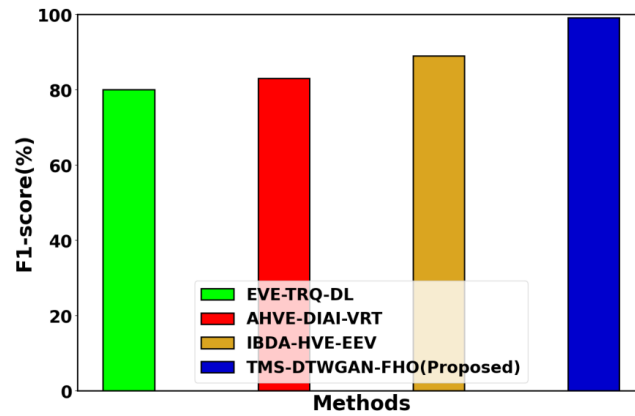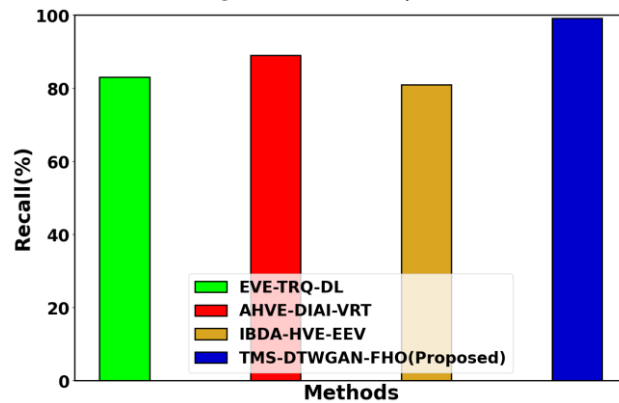
Figure 5: F1-score analysis

Figure 6: Recall analysis

Figure 6 shows recall analysis. It is a metrics that computes forecasts made by correct number of positive predictions made total positive predictions. In this context, the proposed TMS-WGAN-FHO method attains 27.5%, 24.6% and 22.3% higher recall; analysed with existing techniques such as EVE-TRQ-DL, AHVE-DIAI-VRT and IBDA-HVE-EEV respectively.
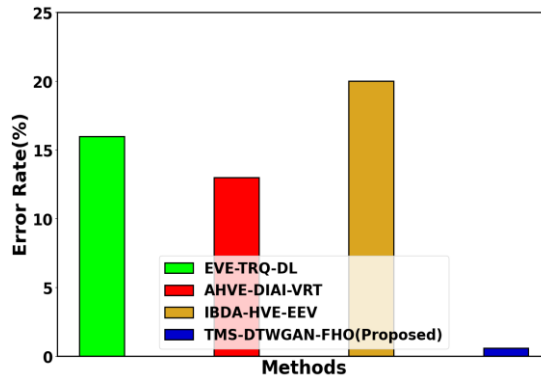

Figure 7: Error rate analysis

Figure 7 shows error rate analysis. It is used to measure degree of prediction error of a model. In this context, the proposed TMS-WGAN-FHO method attains 23.2%, 18.5%, 26.4% lesser error rate; when analysed with existing techniques such as EVE-TRQ-DL, AHVE-DIAI-VRT and IBDA-HVE-EEV respectively.
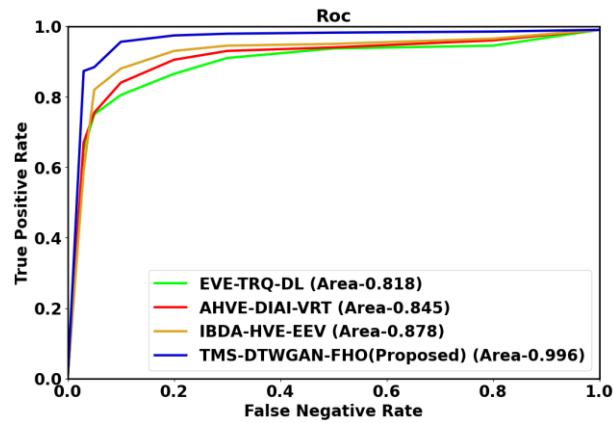
Figure 8: ROC analysis

Figure 8 displays ROC analysis. It ratio among changes in one variable comparative to equivalent change in another. TMS-WGAN-FHO attains 25.80%, 14.62%, and 22.94% higher ROC; when analysed with existing techniques such as EVE-TRQ-DL, AHVE-DIAI-VRT and IBDA-HVE-EEV respectively.

C. Discussion

This paper examines into the use of deep learning to evaluate vocational education and Technical Education, focusing on the widely used Back propagation, which is known for its exceptional nonlinear learning capabilities and resilience to noisy input in data mining applications. The study delves deeply into commonly used deep learning approaches, with a particular emphasis on network method structure, learning process. To solve concerns such as delayed convergence and local minimum points, an improved version of NN is given, which incorporates the simulated annealing approach to create an original algorithm. This approach takes into account both the precision of connection weight alterations in the algorithm and the unpredictability and heuristics used in the simulated annealing approach. Recognizing the variety of students' course preferences and the limits of relying simply on human qualities in teacher evaluations, the study employs deep learning to measure teaching quality. It introduces a framework for assessing vocational education quality and demonstrates the appropriate use of data gathering, assessment findings. Teaching quality evaluation method, which makes use of neural networks' nonlinear learning ability, fault tolerance, provides a novel and robust technique to measuring vocational education quality.

V. CONCLUSION

In this section, Teaching Management System for Higher Vocational and Technical Education Using Wasserstein Generative Adversarial Network Optimized by Fire Hawk Optimization (TMS-WGAN-FHO) was effectively executed. The TMS-WGAN-FHO is executed in MATLAB. The TMS-WGAN-FHO is used to Evaluating and improving the quality TMS for Higher Vocational with Technical Education. Evaluating the performance of approach, the results highlight distinct improvements and achieving29.7%, 26.5%, and 23.2% higher F1-Score, 23.2%, 18.5%, 26.4% lower error rate , 5.80%, 4.62%, and 2.94% higher ROC are analysed with existing methods like EVE-TRQ-DL, AHVE-DIAI-VRT, and IBDA-HVE-EEV respectively. In future the development of TMS for Higher Vocational and Technical Education should prioritize an approach that is integrated, flexible, and focused on the needs of the user. As new technologies such as gamification, virtual labs, and features for continuous professional development for teachers emerge, the TMS must also adapt to meet the changing needs of vocational and technical education.

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