ISSN: 2320-5407
ISSN NO. 2320-5407
International Journal of Advanced Research
Publisher's Name: Jana Publication and Research LLP
www.journalijar.com

REVIEWER'S REPORT

Manuscript No.: IJAR-55787

Title: COMPARATIVE ANALYSIS OF MACHINE LEARNING AND DEEP LEARNING APPROACHES FOR PREDICTING STUDENT DROPOUT IN HIGHER EDUCATION: A CASE STUDY OF THE VIRTUAL UNIVERSITY OF IVORY COAST

Recommendation:
Accept

Rating	Excel.	Good	Fair	Poor
Originality	Yes			
Techn. Quality	Yes			
Clarity	Yes			
Significance		Yes		

Reviewer Name: Dr. Ashish Yadav

Detailed Reviewer's Report

Reviewer's Comment for Publication.
Acceptance Comment are mentioned below suitable for the paper titled "COMPARATIVE ANALYSIS OF MACHINE LEARNING AND DEEP LEARNING APPROACHES FOR PREDICTING STUDENT DROPOUT IN HIGHER EDUCATION: A CASE STUDY OF THE VIRTUAL UNIVERSITY OF IVORY COAST"

Reviewer Comments: Accept

Reviewer Comments –

1. Introduction
The manuscript entitled *"Comparative Analysis of Machine Learning and Deep Learning Approaches for Predicting Student Dropout in Higher Education: A Case Study of the Virtual University of Ivory Coast"* addresses a highly relevant and timely problem in higher education analytics. Student dropout remains a persistent challenge affecting academic governance, institutional efficiency, and national education policies, particularly in digitally mediated learning environments. The authors clearly articulate a focused research question aimed at identifying effective predictive models and key variables for early detection of at-risk students. The study is well-motivated, logically structured, and grounded in real institutional data, enhancing its practical relevance and policy significance. The case study of UVCI provides valuable insights for developing countries and virtual universities, where scalable early warning systems are critically needed.

2. Literature Review and Theoretical Positioning
The literature review demonstrates a solid understanding of existing research on student dropout prediction using data-driven approaches. The authors appropriately situate their work within prior studies employing traditional machine learning techniques and emerging deep learning models. A key strength of the manuscript is its clear identification of research gaps—namely, the lack of comprehensive

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comparative studies that rigorously benchmark classical machine learning models against advanced deep learning architectures within the same institutional context. The review effectively justifies the inclusion of diverse models, including transformer-based and hybrid ensemble approaches, and highlights the need for robust mathematical formulations and imbalance-aware evaluation frameworks. Overall, the literature review is coherent, relevant, and adequately supports the research objectives.

3. Solution Approach and Methodological Rigor

The proposed methodology is one of the strongest aspects of the paper. The authors rigorously define the dropout prediction problem as a binary classification task with class imbalance correction, which reflects real-world educational data distributions. The dataset of 9,881 student records with 14 features is sufficiently large and well-preprocessed using systematic procedures such as null-column detection and text normalization. The selection of nine predictive models—spanning both machine learning and deep learning paradigms—is comprehensive and well-justified. The mathematical modeling, feature importance analysis, and evaluation protocol using precision, F1-score, and AUC-ROC metrics demonstrate methodological robustness and reproducibility. The study is technically sound and aligns with best practices in educational data mining and learning analytics.

4. Results and Discussion

The results are clearly presented and convincingly demonstrate the superior performance of deep learning models over traditional machine learning approaches. The Neural Network model achieves outstanding predictive accuracy (F1 = 0.9888, accuracy = 0.9930), significantly outperforming Gradient Boosting, the best-performing classical model. The identification of key predictive variables—final grade average, uncompleted courses, completion rate, failure rate, and age—is both intuitive and empirically supported, offering meaningful interpretability despite the use of complex models. The discussion appropriately contextualizes these findings within the broader literature and highlights their implications for early intervention strategies. The comparative analysis is thorough, transparent, and statistically persuasive.

5. Conclusion and Overall Recommendation

The manuscript makes a substantial contribution to the field of higher education analytics by providing a rigorous, comparative evaluation of machine learning and deep learning models for student dropout prediction. Its integration of mathematical modeling, real institutional data, and advanced deep learning architectures lays a strong foundation for AI-driven early warning systems in virtual and traditional universities alike. The conclusions are well-supported by empirical evidence and emphasize both theoretical advancement and practical applicability.