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Predicting Employee Engagement Through Extreme Gradient Boosting (XGBoost): An Explainable AI Approach

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1. Round 1

1.1. Reviewer 1

Reviewer:

The paragraph beginning with "A substantial body of research has investigated the antecedents of employee engagement…" identifies multiple predictors but does not clearly explain why the final variables included in the predictive model were selected while other known engagement determinants were excluded. The authors should provide a systematic variable-selection rationale supported by prior empirical findings and theoretical relevance.

In the paragraph stating "Leadership has likewise been identified as a fundamental determinant of employee engagement," the authors focus primarily on transformational leadership. A stronger justification is needed for excluding alternative leadership constructs such as servant leadership, authentic leadership, ethical leadership, or inclusive leadership, all of which have been shown to influence engagement in recent organizational literature.

The paragraph beginning with "Despite significant advances in engagement research, methodological limitations remain evident within the literature" correctly highlights limitations of traditional statistical methods. However, the manuscript should more explicitly articulate the specific research gap that XGBoost addresses beyond improved predictive accuracy. For example,

the authors could discuss whether prior engagement studies failed to identify nonlinear interactions or whether predictive performance has remained inadequate.

The sentence “Hyperparameter optimization was performed using randomized grid search procedures” is insufficiently detailed for replication. The manuscript should include the search space, parameter ranges, number of iterations, optimization criterion, and final selected hyperparameter values, preferably in a dedicated table.

Table 1, “Descriptive Statistics of Study Variables,” presents means and standard deviations but omits important distributional indicators such as skewness, kurtosis, and missing-data percentages. Including these statistics would provide readers with a more comprehensive understanding of data quality and variable distributions.

Authors revised the manuscript and uploaded the new document.

1.2. Reviewer 2

Reviewer:

In the paragraph stating “Among contemporary machine learning techniques, Extreme Gradient Boosting (XGBoost) has gained substantial attention…” the rationale for choosing XGBoost should be strengthened by citing studies that directly compare XGBoost with other algorithms in human resource analytics or organizational behavior research. Currently, the justification appears generic rather than domain-specific.

The final paragraph of the Introduction beginning with “The application of explainable machine learning to employee engagement prediction remains relatively underdeveloped…” would be improved by presenting explicit research questions or hypotheses. Although machine learning studies are often prediction-oriented, clearly stated research objectives would enhance methodological transparency and reader understanding.

In the Methods section, the sentence “Participants were selected through stratified random sampling to ensure adequate representation across industries, organizational levels, age groups, and gender categories” requires further methodological detail. The manuscript should explain how strata were defined, how participants were recruited within each stratum, and whether proportional or disproportional allocation was applied.

The paragraph reporting sample characteristics, beginning with “The final sample consisted of employees ranging in age from 21 to 64 years…”, should provide additional information regarding organizational size, geographic distribution within South Africa, and industry-specific sample proportions. These contextual details are important for evaluating the external validity of the predictive model.

In the paragraph “Employee engagement was measured using the Utrecht Work Engagement Scale (UWES-17)”, the authors report psychometric properties from previous studies but do not present reliability or validity statistics for the current sample. Cronbach’s alpha, composite reliability, and confirmatory factor analysis results should be reported for all scales used in the study.

The paragraph beginning with “In addition to psychometric instruments, demographic and organizational variables were collected…” lacks operational definitions for several variables such as workload, training participation, performance ratings, remote work frequency, and promotion history. The authors should clearly explain how each variable was measured, coded, and incorporated into the predictive model.

The statement “Missing observations accounting for less than 5% of the dataset were handled using multiple imputation techniques” requires substantially greater detail. The authors should specify the imputation method employed, the number of imputations performed, convergence diagnostics, and whether imputation occurred before or after train-test splitting to avoid data leakage.

In the paragraph “The dataset was randomly divided into training and testing subsets using an 80:20 ratio”, the methodology should clarify whether the test dataset remained completely unseen during hyperparameter tuning. Without a clear separation between training, validation, and testing stages, there is a risk of optimistic performance estimation.

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2. Revised

Editor's decision after revisions: Accepted.
Editor in Chief's decision: Accepted.

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