

Title: Cross-Cultural Insights in Health: Integrating Machine Learning and Deep Learning for Early Predictive Diabetes Detection

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Abstract: Diabetes, a potentially life-threatening condition if undetected, necessitates an early and accurate diagnosis. This study evaluates traditional machine learning (ML) models and deep neural networks (DNNs) for diabetes prediction, utilizing the Pima Indians Diabetes Dataset (PIDDD) and the Sylhet Diabetes Hospital dataset (SDHD). We optimized six ML models—Logistic Regression, Decision Trees, Random Forests, Gradient Boosting, Support Vector Machines, and K-Nearest Neighbors—using GridSearchCV and ensemble learning, and deployed DNNs with varied train-test splits (90-10%, 80-20%, and 70-30%). Evaluations on accuracy, precision, recall, F1-score, and AUC-ROC highlighted RF's outstanding performance after GridSearchCV on the SDHD with Accuracy: 98%, Precision: 100%, Recall: 96%, F1 Score: 98%, AUC: 100% and on PIDDD with Accuracy: 76%, Precision: 63%, Recall: 80%, F1 Score: 70%, AUC: 81%. This underscores advanced ML's effectiveness in handling complex datasets and enhancing early diabetes detection strategies.

Key words: Diabetes Prediction Machine Learning (ML) Deep Neural Networks (DNNs) Pima Indians Diabetes Dataset (PIDDD)

DOI: [10.1109/ICCIT64611.2024.11022194](https://doi.org/10.1109/ICCIT64611.2024.11022194)

https://www.researchgate.net/publication/392564725_Cross-Cultural_Insights_in_Health_Integrating_Machine_Learning_and_Deep_Learning_for_Early_Predictive_Diabetes_Detection