

Predictive Analytics for The Early Detection of Diabetic Foot Ulcers: Investigating Several Machine Learning Algorithms

Neeraj Kumar Parashar¹, Dr. Yogesh Kumar Jakhar²

^{1,2}University of engineering and management jaipur, Rajasthan, India

Abstract

Diabetes patients face a serious health risk from diabetic foot ulcers (DFUs), which can result in serious consequences like infections, hospital stays, and even amputations. Improving patient outcomes and putting prompt preventative measures in place depend on the effective early diagnosis of risk variables linked to DFUs. The purpose of this research is to investigate how predictive analytics, using a variety of machine learning algorithms, can be used to detect and track risk variables that lead to the development of DFUs in diabetic patients.

This study compares several machine learning models, such as logistic regression, decision trees, random forests, support vector machines (SVM), and deep learning approaches, using a large dataset that includes electronic health records, demographic data, clinical parameters (e.g., HbA1c levels, neuropathy status, and peripheral vascular conditions), and patient histories. Every model is trained to look for patterns and correlations in the data that indicate a higher risk of ulcer development.

Each algorithm's efficacy is assessed using performance metrics, including accuracy, precision, recall, F1-score, and the area under the receiver operating characteristic curve (AUC-ROC). To find out which risk factors have a major impact on ulcer predictions, we also do feature importance analysis. According to our research, ensemble approaches—in particular, random forests and gradient boosting algorithms—repeatedly outperform conventional models in identifying patients who are at risk, delivering excellent predictive accuracy and dependability.

The results of this study highlight the possibility of incorporating predictive models based on machine learning into standard clinical procedures for the proactive treatment of diabetic foot health. We also discuss the difficulties caused by bias and poor data quality, highlighting the necessity of ongoing model validation and improvement across a range of patient populations. To sum up, our study shows that using predictive analytics to detect diabetic foot ulcers early can help medical professionals identify high-risk patients, which will ultimately lower the incidence and consequences of DFUs and improve diabetes care overall.

Keywords: *diabetes management, logistic regression, random forests, early diagnosis, risk variables, predictive analytics, machine learning, diabetic foot ulcers, and electronic health records.*