

An AI-Based Predictive Framework for Early Detection of Chronic Health Conditions Using Patient Lifestyle and Behavioral Data

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Abstract

Chronic diseases such as diabetes, cardiovascular disorders, and obesity contribute significantly to global healthcare burdens. Early detection and intervention can dramatically improve patient outcomes. In this study, we propose an AI-driven predictive model for preventive healthcare that leverages individual behavioral patterns, wearable device data, and electronic health records (EHRs) to forecast the risk of chronic conditions. The framework integrates machine learning algorithms such as Random Forest and Gradient Boosting, alongside deep learning architectures for time-series analysis (e.g., LSTMs) to capture personalized health trends. The system is trained on a synthesized dataset containing health metrics, physical activity, sleep patterns, and dietary habits. Our model achieved a predictive accuracy of 92% on risk assessment tasks, outperforming traditional statistical methods. We also employ SHAP-based explainability tools to interpret the model's decisions, ensuring transparency for healthcare providers. This research demonstrates the potential of intelligent systems in preventive medicine by promoting early lifestyle interventions and reducing unnecessary clinical visits. Future work includes integrating this system with real-time mobile health apps and expanding it for population-level health forecasting.

Keywords

Artificial Intelligence, Preventive Medicine, Predictive Modeling, Chronic Disease, Deep Learning, Patient Behavior, Health Informatics, Explainable AI