Pathogenic Forecasting: An AI-Integrated Dual-Environment Smart System for Real-Time Prediction of Hypertension and Chronic Kidney Disease

Aljawarneh, Malik (School: Yarmouk University Model School)
Mayyas, Abdallah (School: Yarmouk University Model School)
Alshyab, Ibrahim (School: Yarmouk University Model School)

Most healthcare efforts focus on diagnosis, followed by treatment, and subsequently the post-treatment phase. However, only a limited subset of individuals who prioritize their health pay attention to the pre-disease phase: prevention. One contributing factor is the absence of systems capable of analyzing multiple variables to predict disease onset. In this study, we present a research project designed to predict diseases using artificial intelligence (AI) and to provide an AI-powered preventative plan. The initial implementation targeted the prediction of hypertension and chronic kidney disease (CKD), both of which are considered silent diseases that often develop without individual awareness due to misdiagnosis or delayed diagnosis. Structured medical records and health indicators were collected from Kaggel, in conjunction with a research collaboration, and analyzed using XGBoost, a high-accuracy machine learning algorithm. The system comprises two applications: a desktop application deployed in hospitals for disease prediction, and a mobile application utilized by individuals to deliver preventative care plans at home. Three machine learning models were evaluated for hypertension prediction, with XGBoost achieving the highest accuracy of 91.42%. For CKD prediction, XGBoost alone was employed, yielding an accuracy of 98.75%. These results underscore the transformative potential of AI-driven healthcare, facilitating a shift from reactive treatment to proactive early detection and prevention, particularly in low-resource settings. Future research will aim to enhance model interpretability, expand datasets, and integrate real-time patient monitoring functionalities to maximize both clinical and preventative impact.

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