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Predictive Analytics and Data-Driven Decision Making for Early Detection of Diabetic Retinopathy

Abstract

Diabetic retinopathy (DR) is a leading cause of vision impairment among individuals with diabetes, often progressing without symptoms until irreversible damage occurs. This paper explores the application of predictive analytics and data-driven decision-making techniques for the early detection and management of DR. Leveraging advances in artificial intelligence (AI), machine learning (ML), and deep learning, automated systems now enable accurate forecasting of DR risk based on clinical, imaging, and demographic data. Tools such as DeepDR Plus and ChatGPT-integrated risk calculators offer high diagnostic performance, allowing for timely intervention and personalized screening strategies. Furthermore, real-world implementations, including AI-based screening programs in India and clinical decision support systems, demonstrate the practical impact of these technologies. This study emphasizes the potential of accessible AI platforms to empower healthcare providers, improve diagnostic accuracy, and enhance patient outcomes, particularly in underserved populations. The integration of predictive models into routine diabetic care marks a transformative step toward proactive and equitable ophthalmic healthcare.

Keywords:

Artificial Intelligence, Clinical Decision Support Systems, Data-Driven Decision Making, Deep Learning, Diabetic Retinopathy, Early Detection, Predictive Analytics, Risk Prediction.

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