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AI Powered Multi-Modal System for Diabetic Retinopathy Disease Detection

Abstract

Diabetic retinopathy is a leading cause of blindness, and early detection is crucial for preventing severe complications. However, manual diagnosis is time-consuming, subjective, and prone to errors due to variations in clinical expertise and image interpretation. This project presents a multi-modal AI system that integrates retinal images and clinical patient data to detect diabetic retinopathy and provide personalized medical suggestions. It leverages ResNet18 for retinal image analysis, BART for processing patient health records, and a fine-tuned Generative AI model for treatment recommendations.

The fusion model enhances diagnostic accuracy by integrating deep learning for image analysis and AI-driven text interpretation, reducing false negatives and false positives. ResNet18 extracts fine retinal features, ensuring high sensitivity and specificity in identifying early signs of the disease, while BART processes patient's symptoms for improved decision-making. A fine-tuned Generative AI model suggests personalized medication and lifestyle modifications based on historical treatment data and established medical guidelines.

The system significantly reduces diagnostic time, enabling faster and more reliable clinical decisions. By leveraging multi-modal data sources, the model ensures a comprehensive assessment of diabetic retinopathy, considering both visual symptoms in retinal images and underlying health conditions that may contribute to disease progression. The combination of deep learning and natural language processing (NLP) allows for a holistic approach to diagnosis, improving patient-specific predictions rather than relying solely on image-based analysis. By combining advanced AI models and deep learning techniques, this project ensures more accurate, efficient, and scalable diabetic retinopathy screening, assisting healthcare professionals in early intervention and personalized treatment planning.