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Automated Diabetic Retinopathy Screening with Deep Learning: Advances, Challenges, and Future Directions

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Abstract: *Diabetic retinopathy a major cause of preventable blindness necessitates swift accurate detection pretty quickly for treatment right away. Traditional screening methods take a long time and rely pretty heavily on highly skilled ophthalmologists with years of experience. Recent breakthroughs in deep learning notably Convolutional Neural Networks offer automated efficient analysis of retinal fundus images rapidly nowadays. Deep learning based systems for detecting diabetic retinopathy are explored in this review covering various stages including image preprocessing techniques like normalization and model training with severity classification and metrics such as F1-score. Model training often utilizes public datasets such as EyePACS and Messidor and sometimes DIARETDB1 for validation purposes mostly. Challenges entail skewed datasets and varying image fidelity alongside limited model transparency and poor demographic representation across populations. Solutions like attention mechanisms and ensemble learning are discussed alongside transfer learning and rather unconventional hybrid approaches. Strengths and limitations of deep learning in diabetic retinopathy detection are scrutinized here and potential of AI-driven tools in low-resource settings shines through scalable cost-effective eye care pathways. What count of words exists here precisely?.*

Keywords: Diabetic Retinopathy, Deep Learning, Convolutional Neural Networks, Retinal Fundus Images, Automated Diagnosis, Medical Image Analysis, Early Detection, Transfer Learning, Image Preprocessing, Classification, Fundus Photography, AI in Ophthalmology, EyePACS Dataset, Messidor Dataset, Explainable AI, Teleophthalmology, Screening Tools, Data Augmentation, Computer-Aided Diagnosis, Vision Loss Prevention

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