

WORLD CONGRESS ON RECENT ADVANCES IN OPHTHALMOLOGY & VISION RESEARCH

April 28-29, 2025 | VIENNA, AUSTRIA



Madhura Prakash Manjunath^{1*}, Deepthi K. Prasad¹, Venkatakrishnan Srinivasan¹

¹Research and Development, Image Processing and Analysis, Forus Health Private Ltd., Bengaluru 560070, India

A Multi-Stage Framework for Cardiovascular Risk Assessment from Retinal Images Using a Fusion of Deep Learning and Computer Vision Techniques

Abstract:

Cardiovascular diseases (CVDs) are a leading cause of mortality worldwide, highlighting the need for early detection and accurate risk assessment. This study presents a novel multi-stage approach for CVD risk prediction using retinal fundus images, leveraging the correlation between retinal microvascular changes and systemic vascular health. The proposed framework integrates handcrafted vascular features derived through mathematical computation with deep learning (DL)-based feature extraction to enhance predictive accuracy. The methodology employs state-of-the-art computer vision techniques to extract key vascular parameters, including vessel caliber, tortuosity, and branching patterns. A DL-based binary classification model further refines risk prediction. A dataset comprising fundus images and clinical metadata from trials is used for model training and validation. The proposed system achieves an accuracy of 85%, demonstrating its potential for early CVD risk stratification. Interpretability is enhanced through visualization techniques that highlight retinal regions contributing to risk predictions. Clinical validation underscores the approach's effectiveness in identifying vascular abnormalities that may precede cardiovascular events. As a non-invasive and cost-effective modality, fundus imaging presents a scalable solution for large-scale screening programs. This research contributes to precision medicine by offering an innovative tool for proactive cardiovascular health management. Future work will focus on improving model robustness, incorporating additional risk factors, and validating performance across diverse clinical settings.

Keywords: Cardiovascular diseases, retinal fundus imaging, deep learning, computer vision, risk assessment, vascular analysis.

Biography: Dr. Madhura Prakash M is a Senior Technical Leader at Forus Health Private Limited, Bengaluru, with over 12 years of experience in industrial and academic research. She specializes in Computer Vision, Image Processing, and Deep Learning, focusing on AI-driven medical diagnostics. Madhura holds a Ph.D. in Computer Science from Visvesvaraya Technological University, India, and has a strong publication record. Her research includes classification and segmentation of ocular diseases in retinal images, such as age-related macular degeneration and diabetic retinopathy. Passionate about innovation and mentorship, she actively contributes to workshops and training programs in AI-enabled medical imaging.