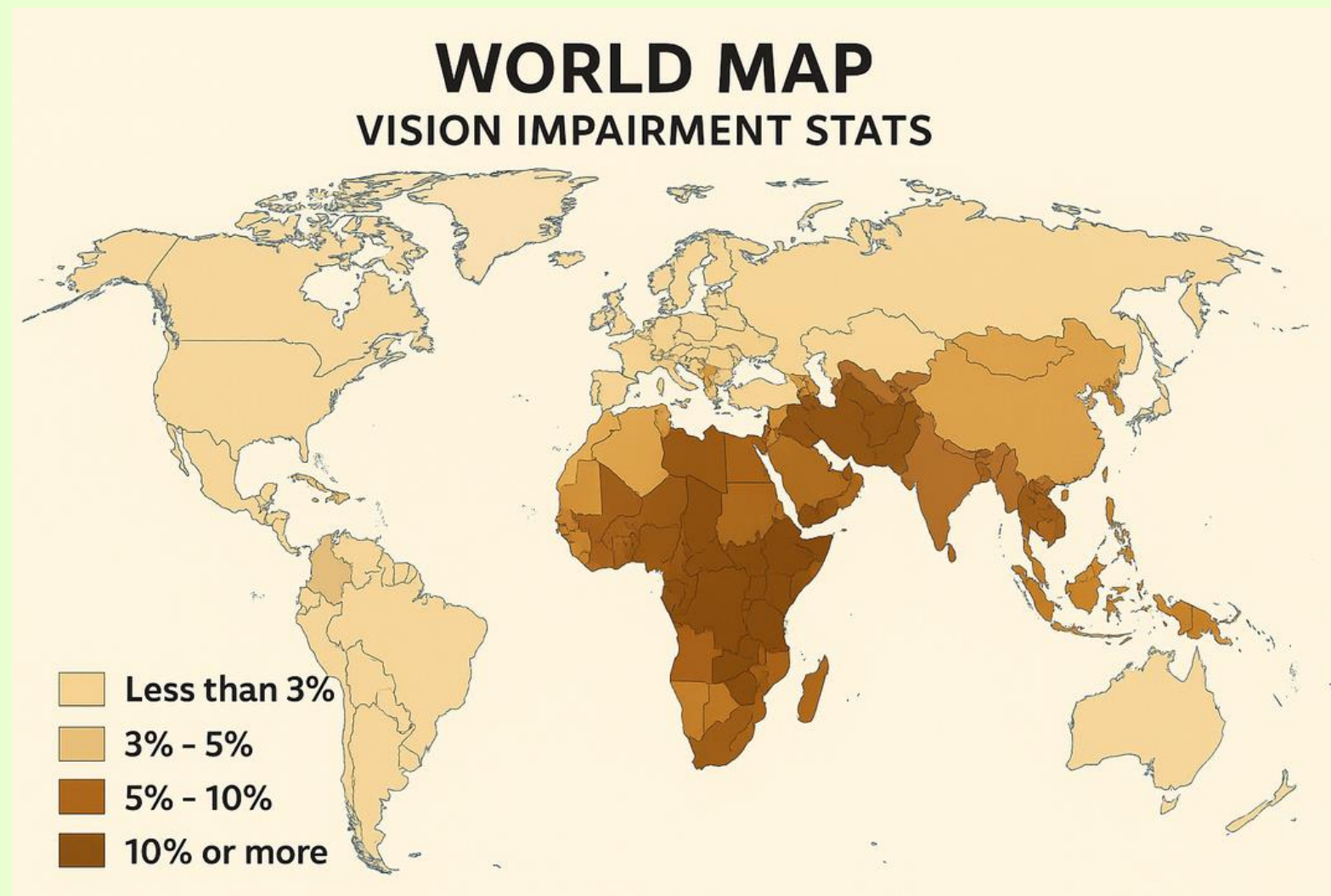


A Novel Low-Cost
and Portable Device
for the Early
Detection of Diseases
in the Retina



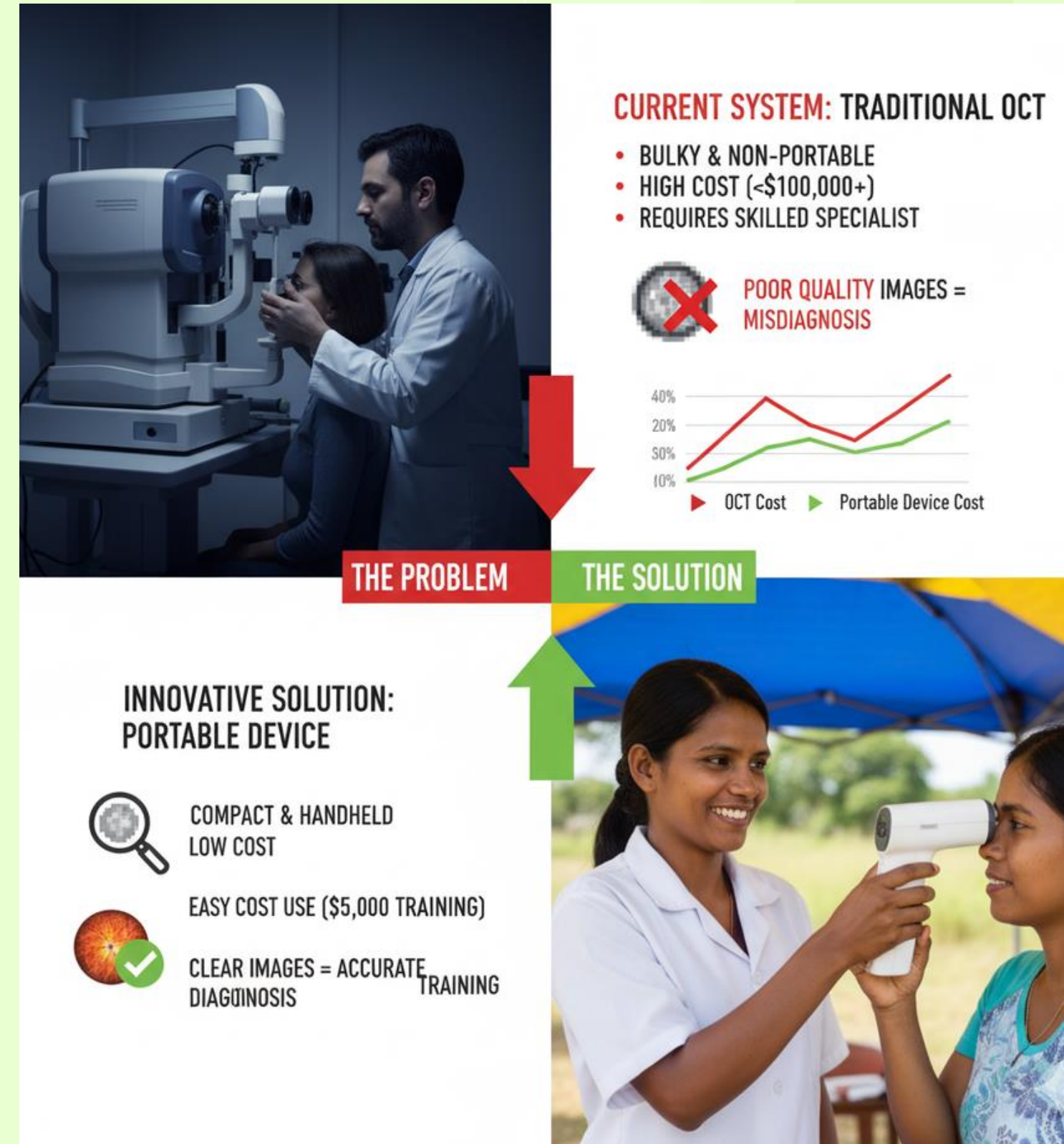
The Global Vision Crisis

- Over 2.2 billion people worldwide live with visual impairment — and nearly 1 billion of those cases are preventable or treatable. Yet, quality retinal imaging remains inaccessible for many communities.



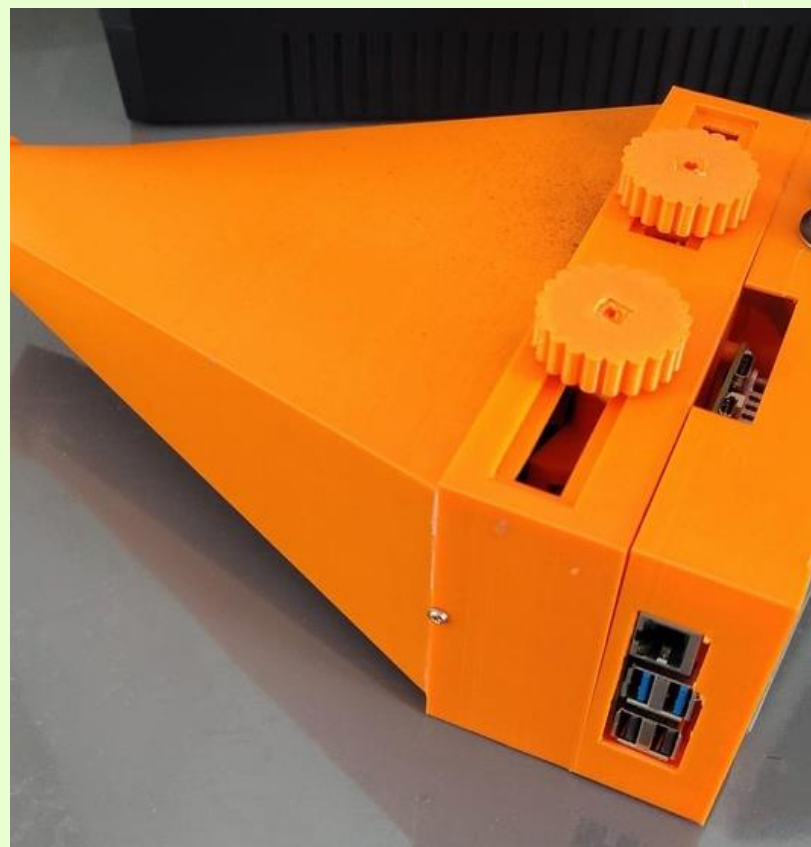
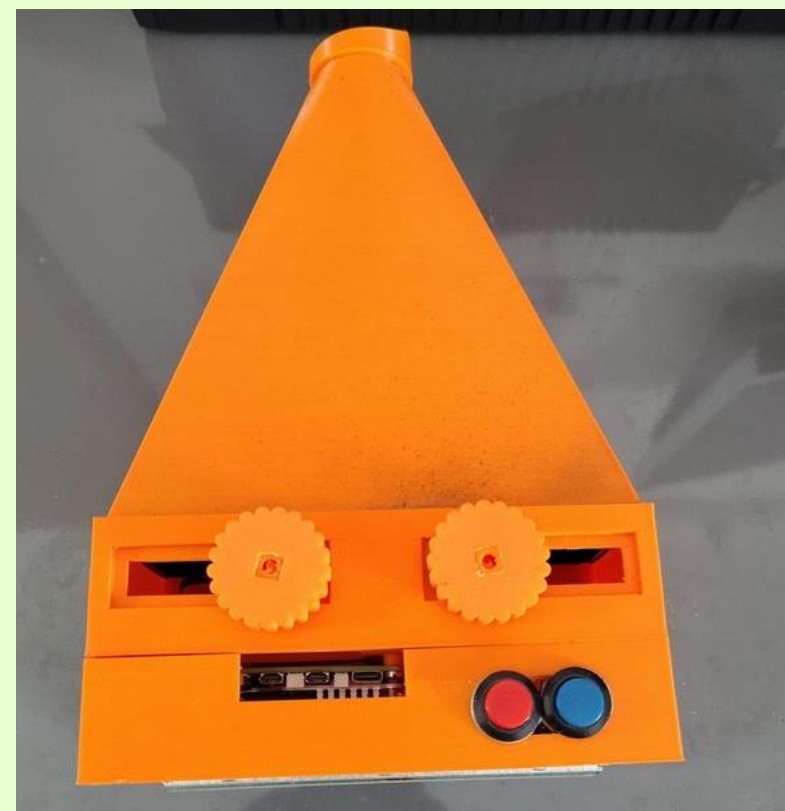
The Accessibility Gap

- Current retinal imaging systems like fundus cameras and OCT are effective but bulky, expensive, and require trained specialists.
- In rural centers, poor-quality images and missed diagnoses are common.



Introducing Vision Guardian

- A compact, affordable retinal imaging device costing just ₹19,451 — nearly 100× cheaper than OCT systems.
- Portable (16.4×27.9×10.3 cm), powered by Raspberry Pi 5, and built for accessibility.



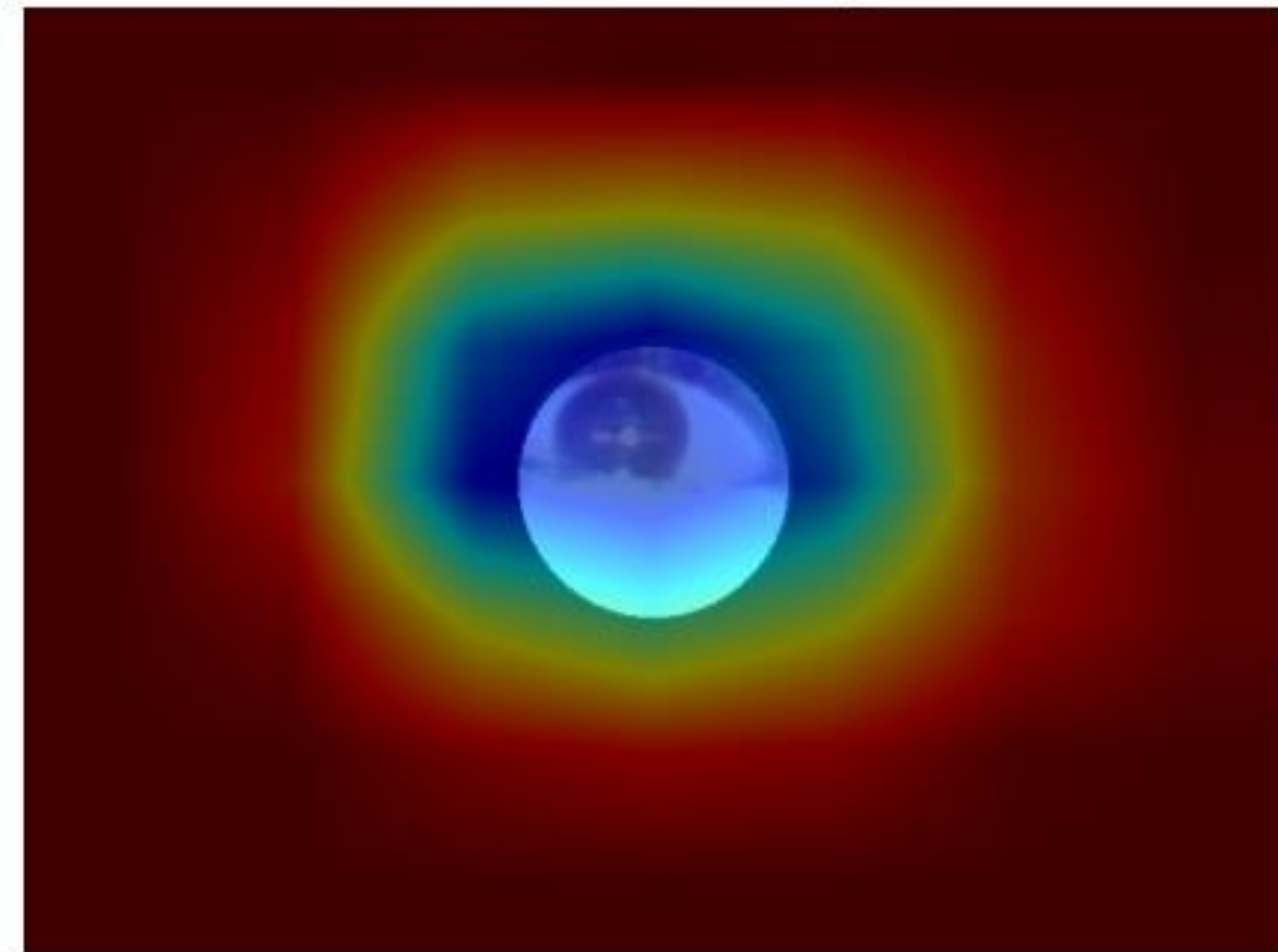
How It Works — Dual Camera Fusion

- Infrared and HD cameras capture retinal details which are fused via computer vision to enhance blood vessel visibility.
- Produces results comparable to hospital-grade systems.

Original Image

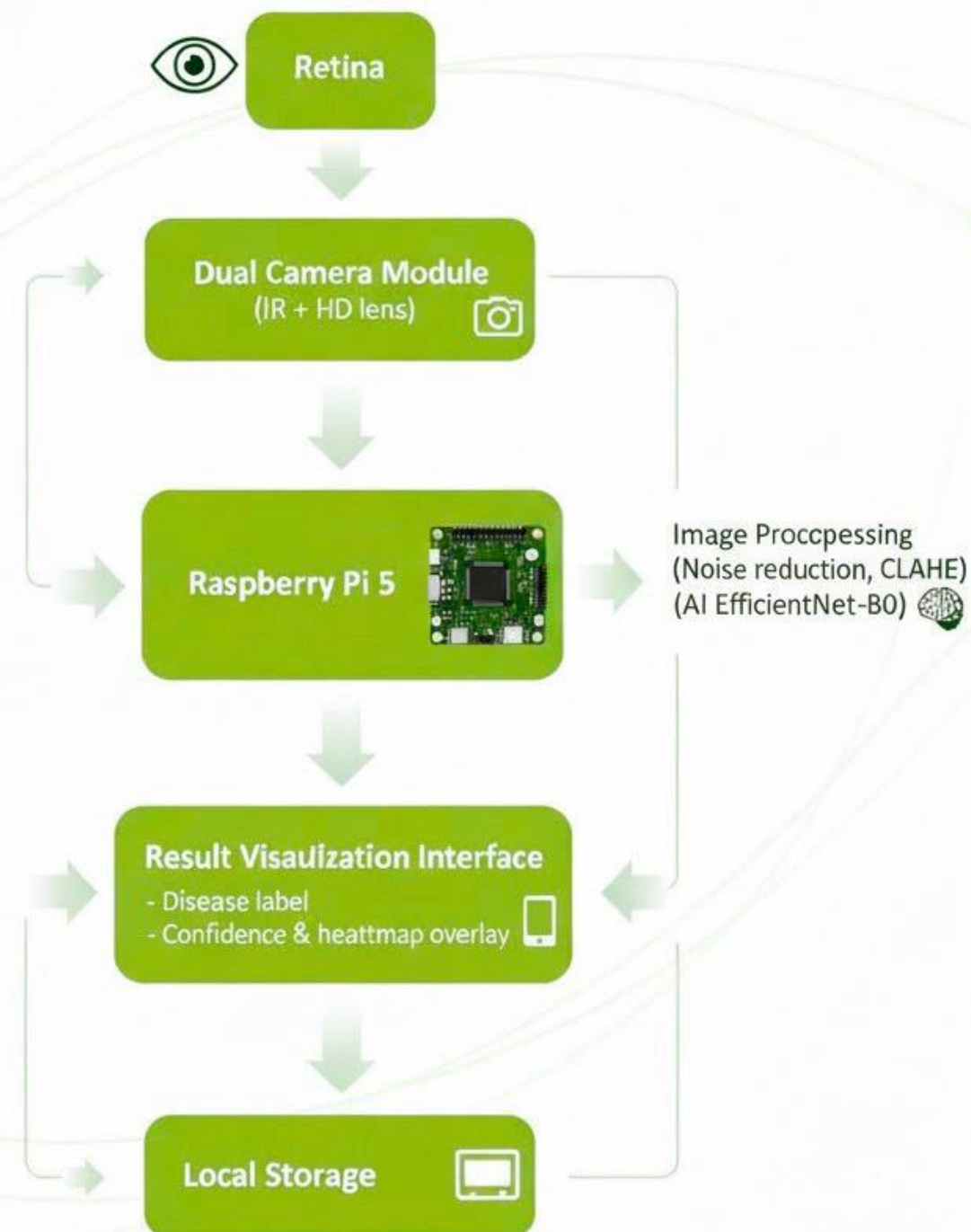


Grad-CAM Overlay



Key Features of Our Device

Vision Guardian – System Architecture



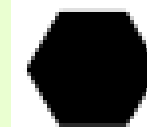
Affordable camera integrated with AI



Detects diabetic retinopathy and glaucoma

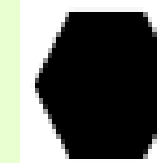
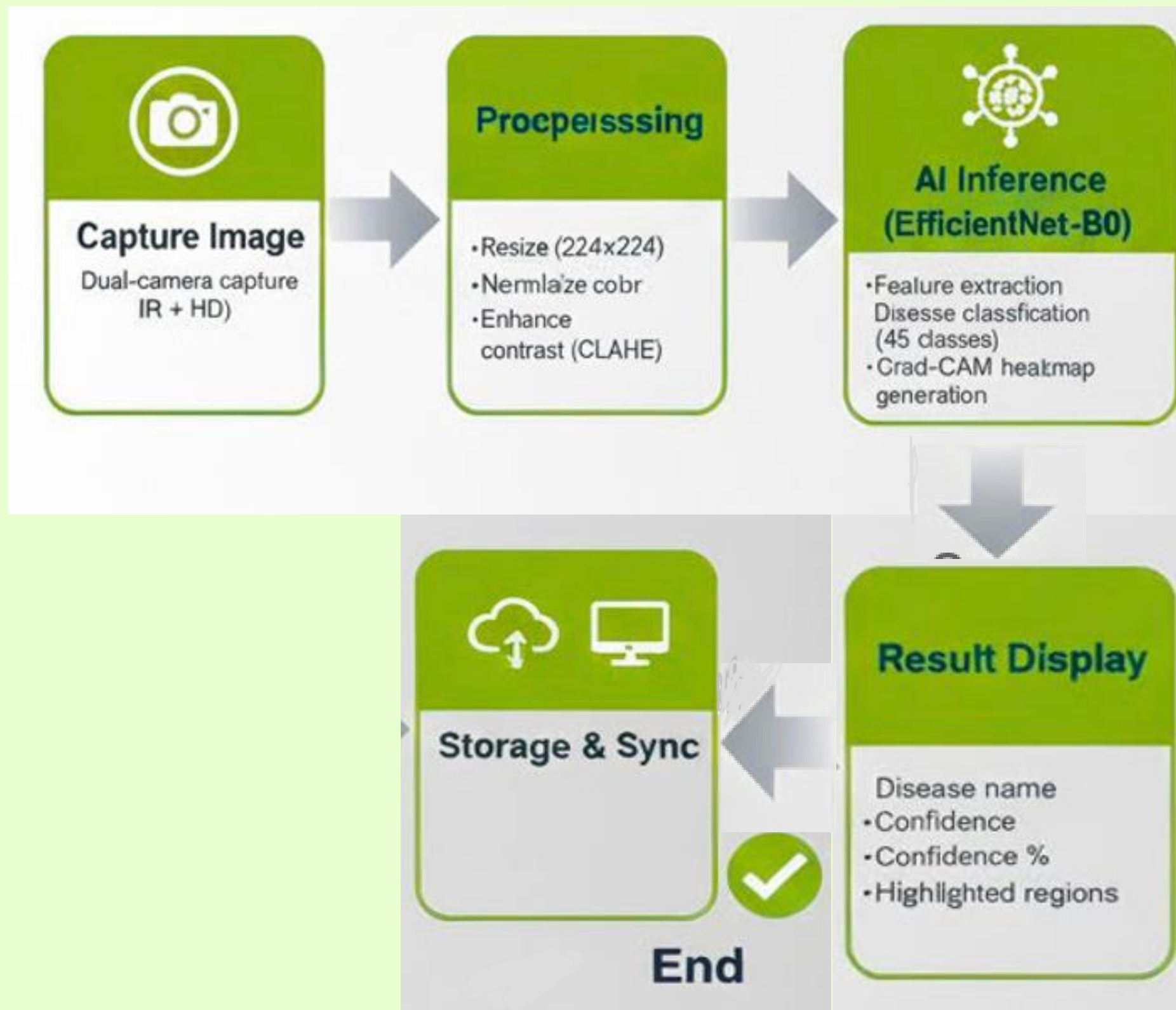


Portable design for easy transport



User-friendly interface for healthcare workers

Key Features of Our Technology



Trained on thousands of retinal images



Provides real-time feedback to users

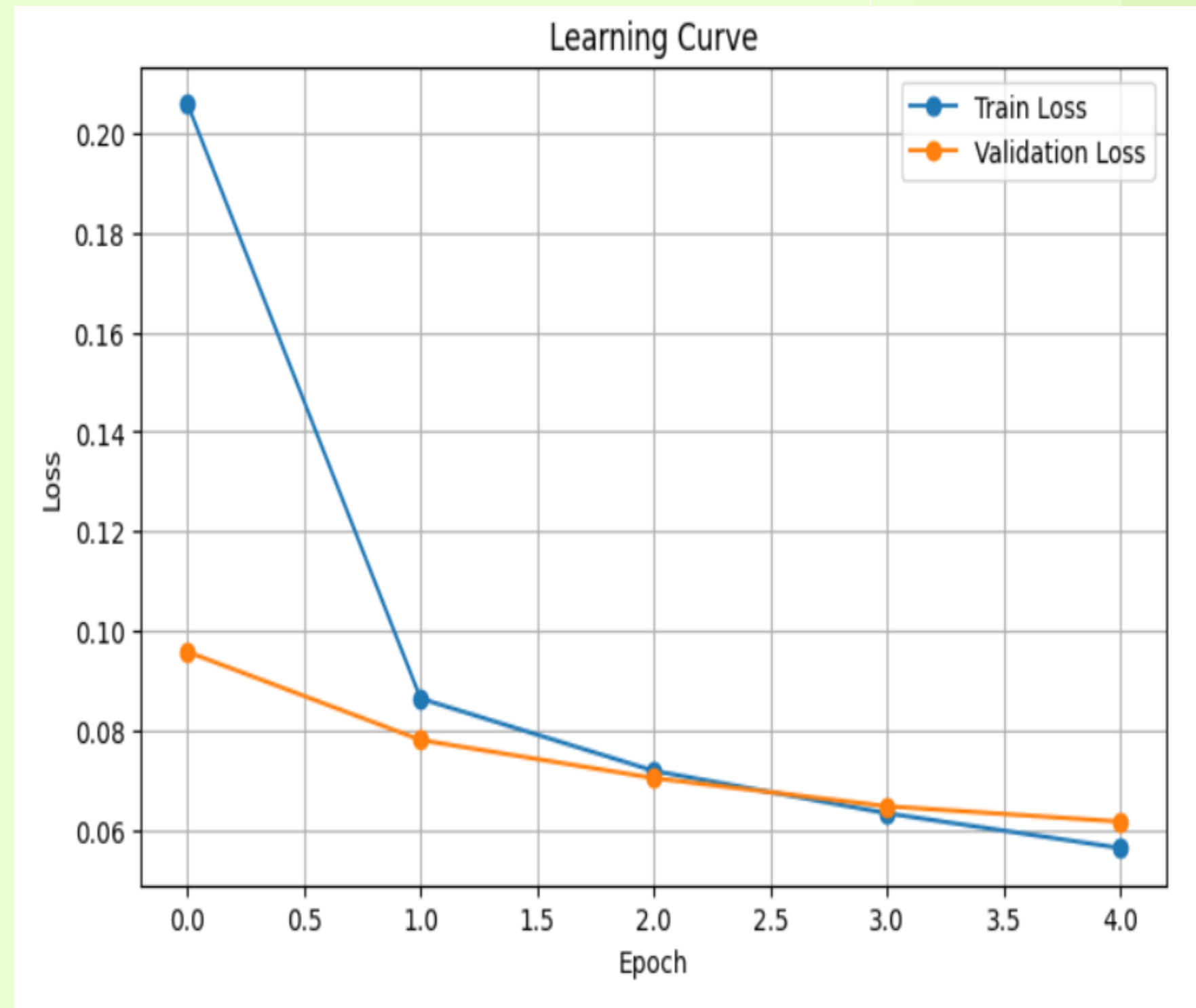


Portable and easy to operate

Results and Accuracy of Our AI Model

A glimpse into the reliability of our innovative screening technology.

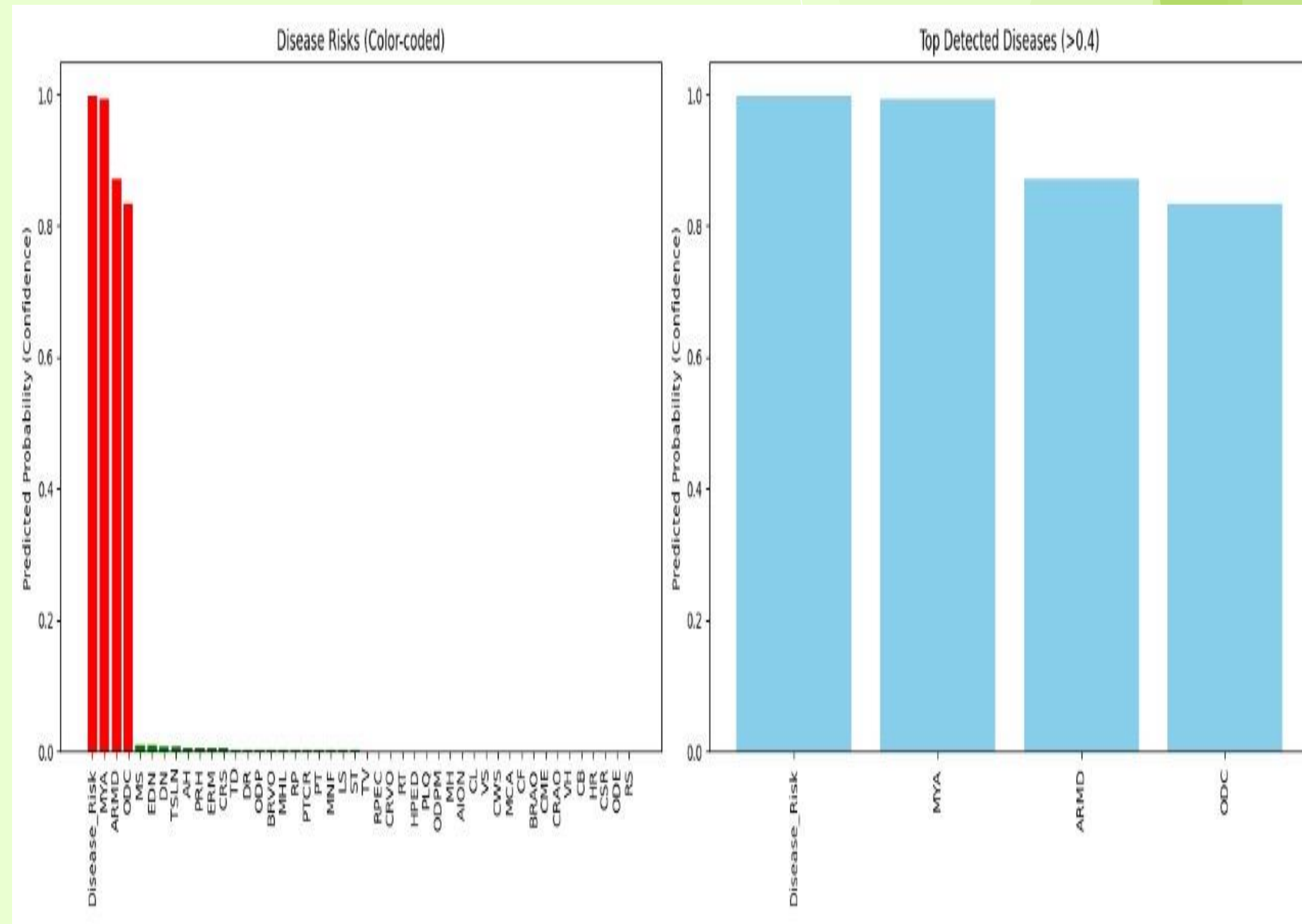
- The model achieved an impressive accuracy of **approximately 94%**, demonstrating its effectiveness in detecting retinal diseases. Cross-validation on the Kaggle dataset confirmed these results, with a confusion matrix highlighting the model's strong predictive capabilities for both diabetic retinopathy and glaucoma.



Results and Accuracy of Our AI Model

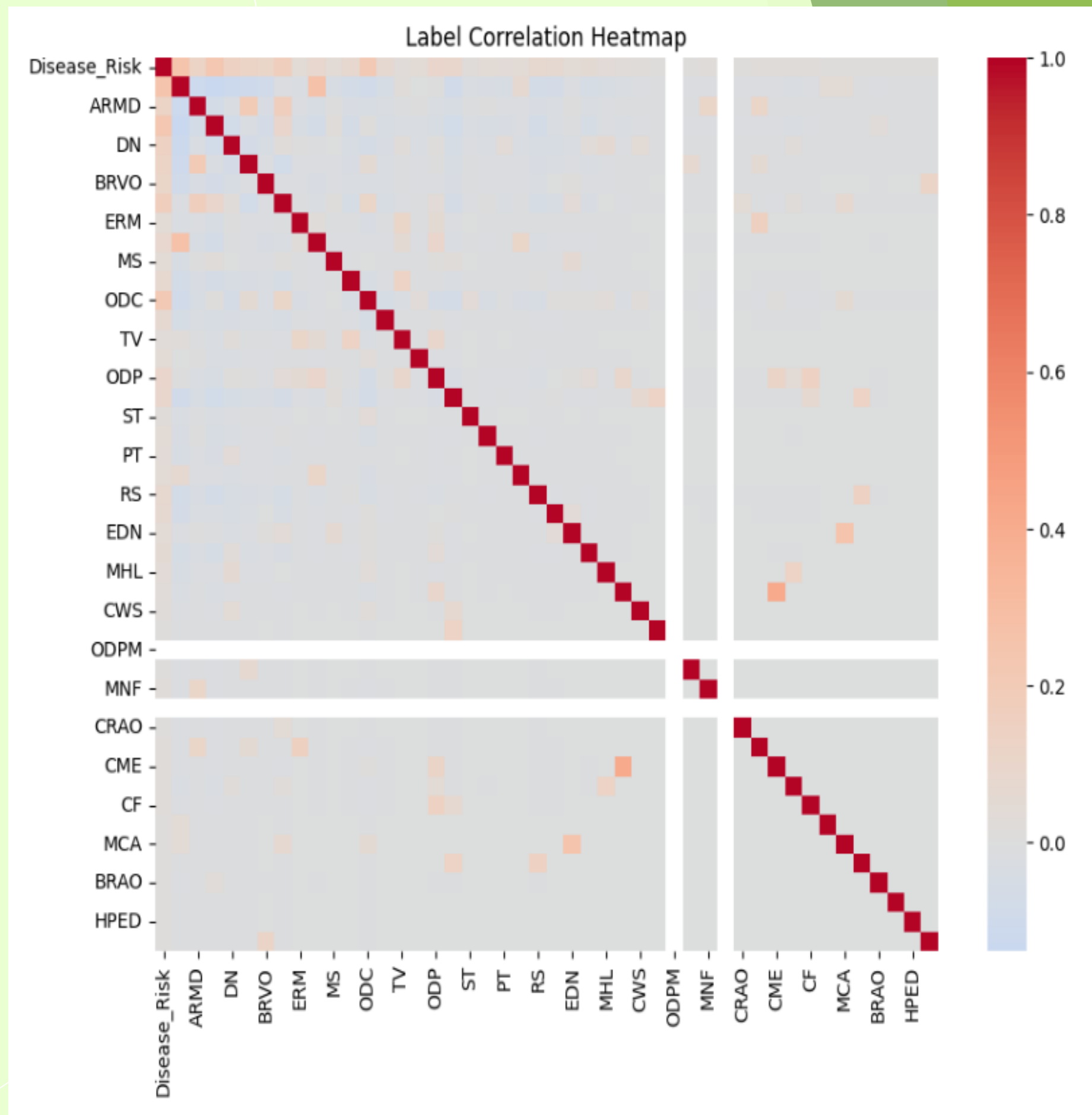
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AI-Powered Disease Detection

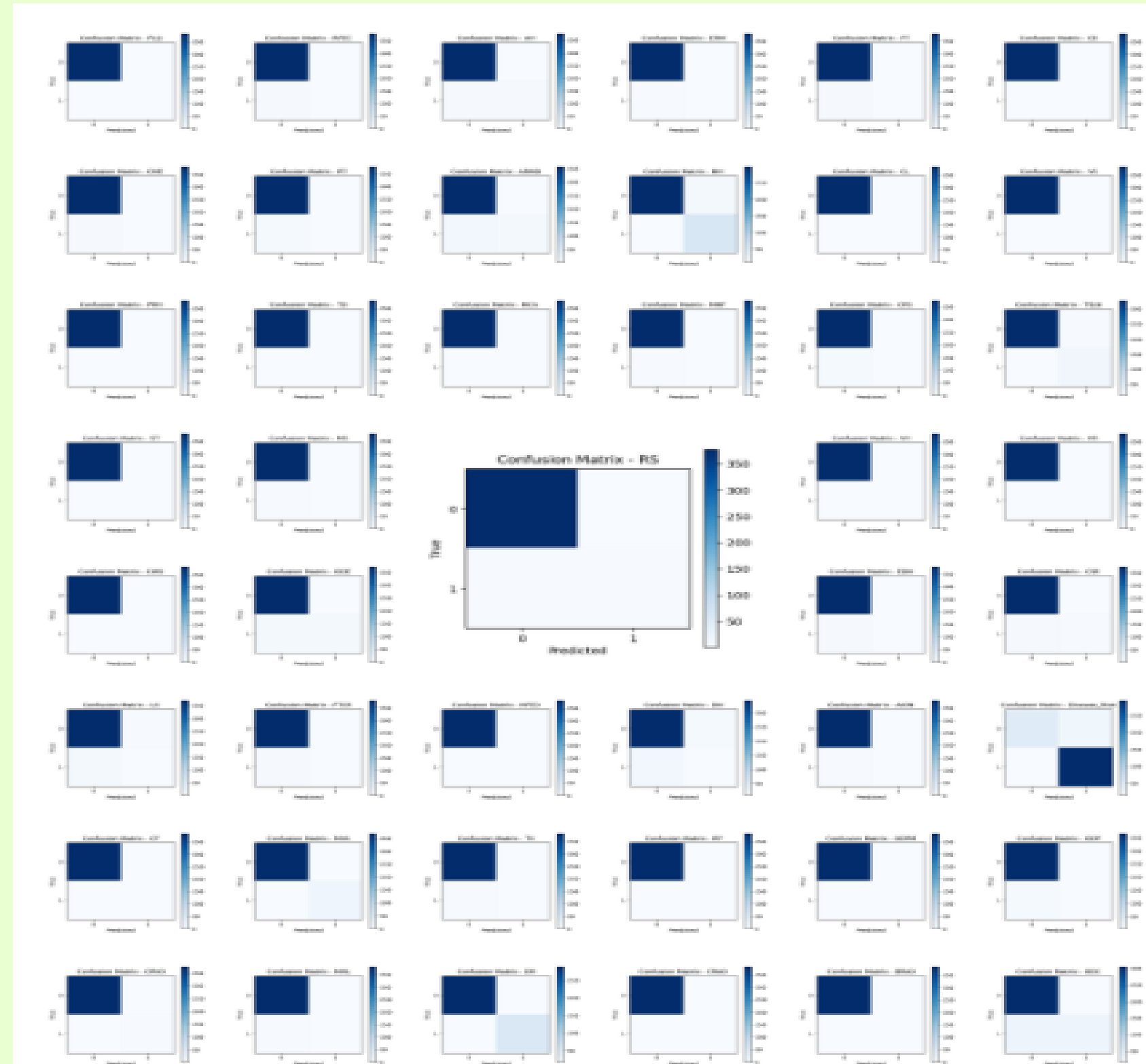
- An EfficientNet-B0 deep learning model trained on the RFMiD dataset detects 45 retinal diseases including diabetic retinopathy and glaucoma with 94% accuracy.



AI Model & Results - EfficientNet-B0 for Retinal Disease Detection

Model: EfficientNet-B0 (lightweight CNN)

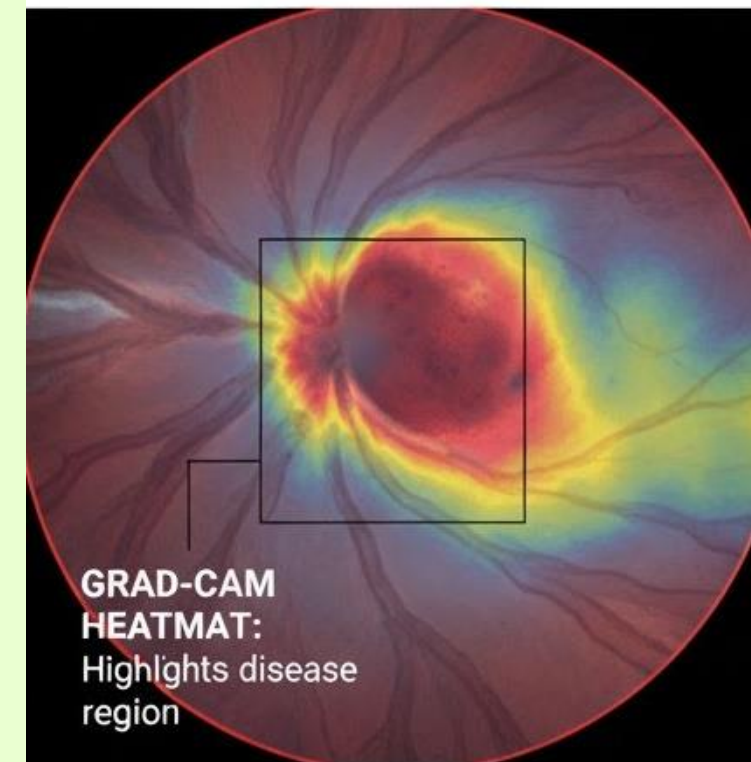
- Dataset: RFMiD (45 retinal disease classes)
- Accuracy: 94%, Precision: 0.86, Recall: 0.87, F1-score: 0.86
- Inference: 1.7s per image on Raspberry Pi 5
- Grad-CAM highlights diseased regions



Interpretable & Efficient AI

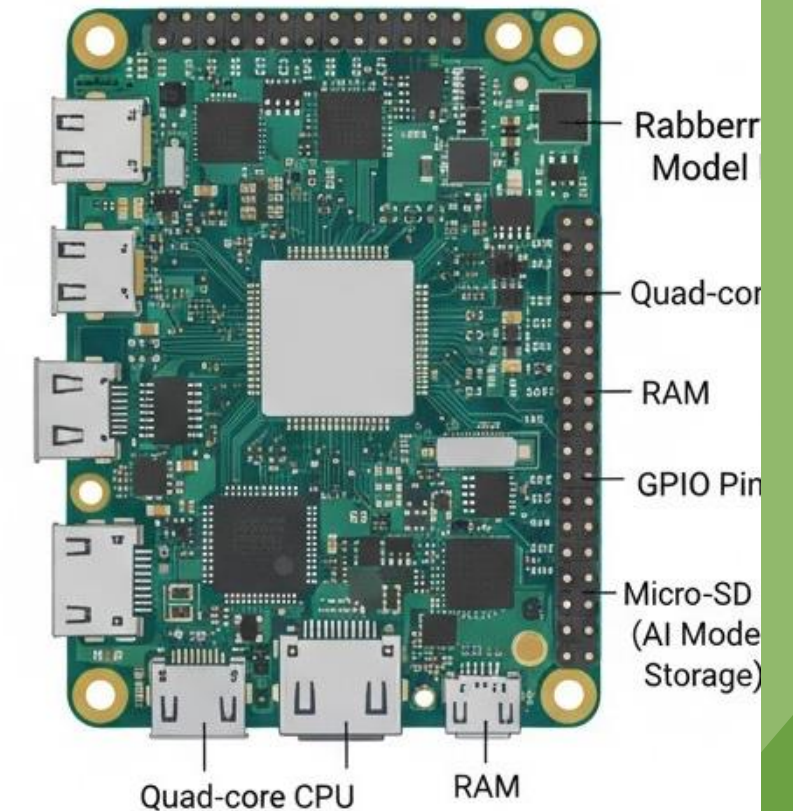
- Lightweight and interpretable model highlights key retinal regions for clinical insight.
- Works offline on Raspberry Pi.

GRAD-CAM HEATMAP EXPLANATION



Explains HOW the AI model makes its decision

EMBEDDED AI HARDWARE



Compact, low-power processing unit

Run AI Model ON DEVICE

Real-World Impact

- Deployable in schools, villages, and community health camps.
- Enables early screening, preventing avoidable blindness and safeguarding the gift of sight.



Results & Validation

- Achieved hospital-comparable image clarity and accurate disease detection.
- Code and results available:
- Github: <https://github.com/Kee801/retinal-disease>

Vision Guardian Protecting Sight, Empowering Lives

This project bridges technology and accessibility, ensuring no one loses vision due to lack of early diagnosis.