# VisionAI — Research Report

AI-assisted Retinal Screening — VisionAI

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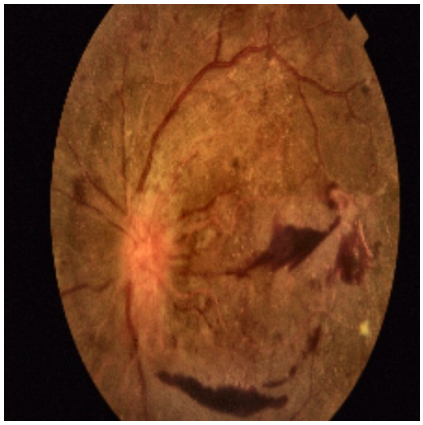
## Patient Metadata

| | |
|---|---|
| Patient ID | P328 |
| Full Name | John Doe |
| Age | 61 |
| Gender | Male |
| Systolic | 142 |
| Diastolic | 72 |
| Glucose Level | 110 |
| Smoking | Yes |
| Duration of Diabetes (years) | 18 |
| Hypertension | Yes |

## Image Visualizations



**Original**

**Preprocessed**: *Image unavailable*

**Gradcam**: *Image unavailable*

**Lime**: *Image unavailable*

**Shap**: *Image unavailable*

### Model & Pipeline Overview

The system employs a multimodal pipeline: convolutional backbone(s) for image encoding, feature fusion with metadata-based gradient-boosted classifiers, and an ensemble/meta-classifier for final prediction. Explainability methods (Grad-CAM++, perturbation-based local explainers, and SHAP) were applied to validate feature attribution.

**Results Summary**

Predicted label: **PDR** (confidence 96.0%).

Lesion quantification: total coverage 26.5%; exudates 0.4%; hemorrhages 1.4%; cotton wool 5.3%.

**Evaluation & Performance**

Test metrics — Accuracy: **96.3%**; Precision: **94.8%**; Recall: **95.1%**; F1: **95.0%**; ROC-AUC: **0.983**.

**Limitations & Notes**

Current limitations include domain shift when deploying on heterogeneous smartphone images, and approximate lesion quantification when masks are noisy. Further work should include segmentation U-Nets for pixel-wise labels and domain adaptation strategies.

**Suggested Next Steps**

Integration of Vision Transformers to capture global context, fine-tuned lesion segmentation, and prospective validation on smartphone-acquired fundus images.

## Evaluation Metrics

| Metric | Value |
|---|---|
| Accuracy | 96.3% |
| Precision | 94.8% |
| Recall | 95.1% |
| F1-score | 95.0% |
| ROC-AUC | 0.983 |