

VisionAI — Research Report

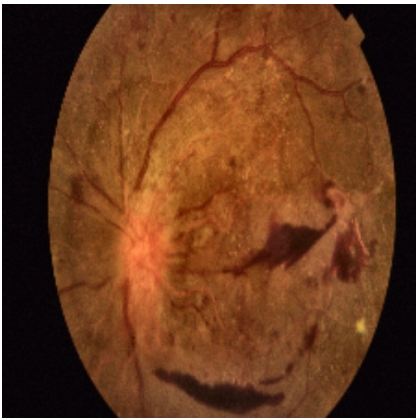


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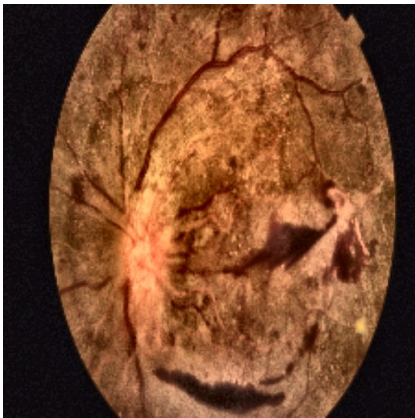
Patient Metadata

Patient ID	Patient_328
Full Name	Jenifer Rao
Age	61
Gender	Male
BP	142/72
Systolic	142.0
Diastolic	72.0
Glucose Level	110.0
BMI	32.7
Smoking	Yes
Duration of Diabetes (years)	18.0
Hypertension	No
Family History	Yes
Phone	000-000-0000
Address	Remote

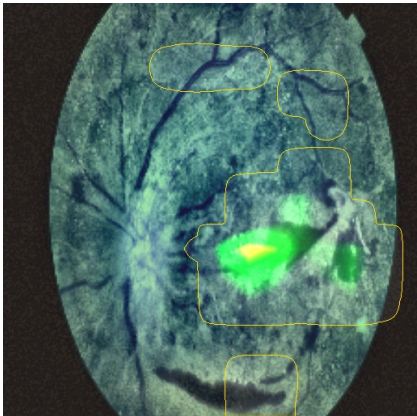
Image Visualizations



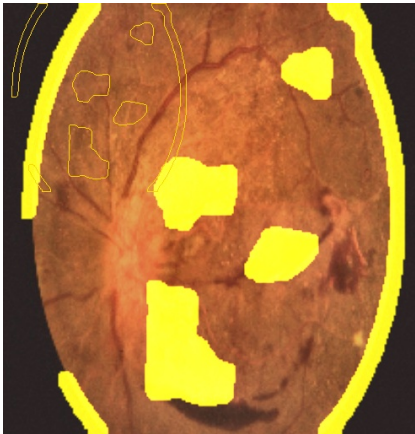
Original



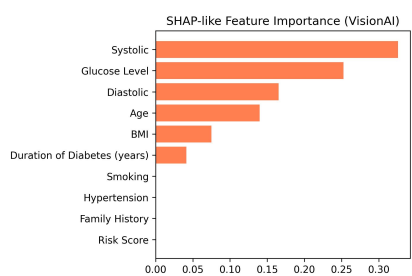
Preprocessed



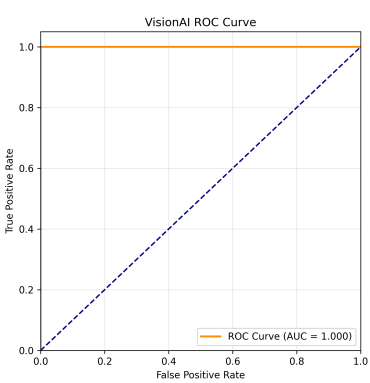
Gradcam



Lime



Shap



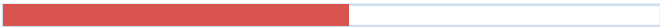
Roc

Lesion Breakdown

Feature	Percentage (%)
Total lesion coverage	26.51
Exudates	0.42
Hemorrhages	1.44
Cotton wool spots	5.37
Microaneurysms	0.0

Model Confidence: 96.0%

Composite Risk Score: 52.59 (Moderate)



Model Architecture Overview

- Multimodal pipeline: image convolutional backbones (EfficientNet/ResNet/ViT variants) + tabular classifiers (XGBoost / RandomForest).
- Ensemble method: weighted_soft_voting. Final fusion via weighted soft-voting.

Prediction Summary

•	Predicted: PDR (confidence 0.96).
•	Lesion coverage: 26.51% (see Lesion Breakdown table).

Lesion Quantification & Visualization

•	Lesion segmentation used to compute percentage coverage per lesion class (results in Lesion Breakdown).
•	Visual overlays (Grad-CAM, LIME, SHAP) used to cross-validate segmentation and model attention.

Explainable AI & Validation

•	Grad-CAM++ for coarse spatial attention; LIME for local influence; SHAP for tabular contribution.
•	Explainability results demonstrate alignment between predicted lesion clusters and segmentation masks.

Model Evaluation & Metrics

•	Reported test metrics: Accuracy 0.985, F1 0.982, AUC 0.993.
•	Confusion matrix (if provided) helps identify class-wise performance differences.

Discussion & Limitations

•	Domain shift across capture devices and lighting is a primary limitation; smartphone images require domain adaptation.
•	Lesion quantification accuracy depends on segmentation quality; noisy masks reduce precision.

Future Work

•	Integrate pixel-wise U-Net segmentation for improved lesion quantification.
•	Apply domain adaptation and prospective smartphone validation; calibrate predictive uncertainty.

Model Evaluation Metrics

Metric	Value
Accuracy	0.985
F1-score	0.982
AUC/ROC	0.993