CLINICAL-GRADE DIABETIC RETINOPATHY AI

NHS-Validated Grading and Lesion Detection for High-Volume Triage in Remote and Virtual Eye Care Settings

Pradipta Chowdhury | DRAGS — Diabetic Retinopathy Automated Grading System | Bangladesh

❓ Problem & Goal

Can diabetic retinopathy AI be redesigned for referral-driven screening in high-volume settings like Bangladesh?

Deliver scalable, referral-ready DR AI for efficient screening in Bangladesh and similar settings

What we will do:

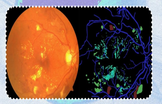
Built a deep learning model aligned to NHS DESP grading, with lesion-level detection, optimized for mass triage and virtual care

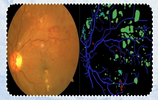
✔ DESP is action-based

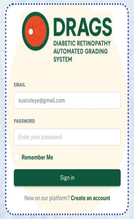
✔ ETDRS is descriptive

Clear referrals matter when specialists are limited

Developed with a Moorfields DR specialist







🌏 Target Population

TARGET POPULATION

Tribal communities in the Chittagong Hill Tracts

Photo: A Part of Marma Tribal Village

Photo: Murong Tribal Village

⚙️ Model Architecture

MODEL ARCHITECTURE

- Ret-Found Foundational Model
- Dino-v2 Backbone

TRAINING DATA

63,077 fundus images graded using NHS DESP (R0–R3, M0–M1) for severity assessment

18,533 fundus images with lesion-level annota-tions covering 10 DR pathologies

LEARNING STRATEGY

- Severity Grading: Softmax + Focal Loss
- Lesion Detection: Sigmoid + Binary Cross-Entropy

PREPROCESSING & TRAINING

```
# Define the labels
output_labels = {
  0: "R0M0 — Normal Eye",
  1: "R1M0 — Mild NPDR",
  2: "R2M0 — Mild NPDR with Maculopathy",
  3: "R3M0 — Moderate NPDR",
  4: "R2M1 — Moderate NPDR with Maculopathy",
  5: "R3M0 — Severe NPDR",
  6: "R3M1 — Severe NPDR with Maculopathy",
  7: "R4M0 — PDR",
  8: "R4M1 — PDR with Maculopathy",
  9: "Not DR (Other Retinal Disease)"
}

# Load the model
model_path = "/content/drive/MyDrive/Medical/models/foundation/checkpoints/convnext201_model_improved.h5"
loaded_model = tf.keras.models.load_model(model_path, compile=False)
print("Model loaded successfully!")

# Function to preprocess image for prediction
def preprocess_image(image_path, target_size=(224, 224)):
    Preprocess image for ConvnextR201 model.

    Args:
        image_path: Path to the image file
        target_size: Target size for the image (default: (224, 224) for ConvnextR)

    Returns:
```

```
import cv2
import numpy as np
import tensorflow as tf
import matplotlib.pyplot as plt

# Constants
IMG_SIZE = (224, 224)  # Resize to match the model input
LABELS = ["hardexudatesimages", "Hemorrhageimages", "Microaneurysmsimages", "softexudatesimages"
THRESHOLD = 0.981  # Lesion-level threshold
```

EXPLAINABILITY

- Grad-CAM heatmaps validate both lesio detection and severity grading decisio

📱 Smartphone AI Workflow

🔬 DR Severity Classification — 94.2% Accuracy

DR SEVERITY CLASSIFICATION (NHS

NH

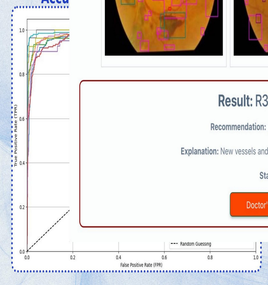
Barts Hea

NHS T

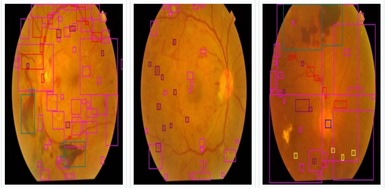
DESP

94.2

Accu



Right Eye



Result: R3-M1-PDR — 99.99%

Recommendation: Immediate referral (within 1 week)

Explanation: New vessels and macula involved. Sight-threatening emergency.

Status: Emergency

Doctor's Feedback for Right Eye

📊 Lesion Detection — Mean AUC 0.981

LESION DETECTION RESULTS

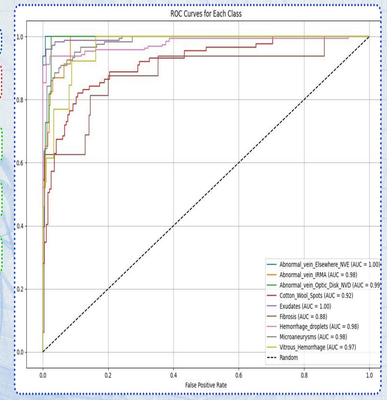
Most Challenging:

IRMA 93.8%

TRD: 92.2%

MEAN AUC 0.981

- Exudates 98.8%
- Microaneurysms: 98.4%
- Hemorrhages: 97.9%



🏕️ Real-World Deployment — First AI Eye Camp

🏆 Bangladesh's First Retina AI System