

Diabetic Retinopathy Detection and Classification

A Deep Learning Based Project Summary

Project Title & Team

Title: Diabetic Retinopathy Detection and Classification Using Deep Learning

Team: Team 3

Objective

- Develop a CNN model to detect and classify stages of Diabetic Retinopathy (DR).
- Aid early diagnosis and assist ophthalmologists.
- Use a structured pipeline: preprocessing, segmentation, classification.

Motivation

Diabetic Retinopathy is a leading cause of blindness in diabetic patients. Early detection can significantly improve treatment outcomes. Manual screening methods are time-consuming and prone to errors. This project leverages deep learning to build an automated, accurate, and fast DR detection system.

System Architecture

1. Input: Retinal fundus image
2. Preprocessing: Resizing, normalization
3. Segmentation: Patch-wise segmentation of the retina
4. Feature Extraction: CNN extracts relevant features
5. Classification: Multi-class classification into DR stages
6. Output: Stage of Diabetic Retinopathy

Methodology

- Dataset: APTOS 2019 Blindness Detection (from Kaggle)
- Preprocessing: Image resized to 224x224
- CNN: Conv2D, MaxPooling, Dense, Dropout using TensorFlow/Keras
- Activation: ReLU and Softmax

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Evaluation Metrics

Accuracy, Precision, Recall, F1-Score, Confusion Matrix

Results

- Accuracy around 82%
- Good performance on 'No DR' and 'Severe' classes
- Minor confusion between 'Moderate' and 'Severe'
- Visuals include accuracy/loss graphs and confusion matrix

Deployment

- Backend: FastAPI
- Frontend: React
- Model: final_model.keras
- Integrated UI for upload and prediction display

Future Enhancements

- Improve accuracy using larger datasets and augmentation
- Mobile app integration
- Visual explanations using Grad-CAM
- Real-time video feed detection

References

Kaggle Dataset, Research Papers, TensorFlow Documentation