Cataract Detection for Early Diagnosis and Vision Health Management

Introduction

- Cataracts are a leading cause of blindness globally.
- Early detection is essential for effective treatment.
- This project evaluates multiple deep learning models, including VGG19, ResNet101, ResNet152, DenseNet121, and DenseNet169, to automate cataract diagnosis from eye fundus images.

Data Overview

1. Dataset: ODIR-5K (Ocular Disease Intelligent Recognition).
2. Total Images: ~5,000.
3. Classes: Normal and Cataract.
4. Preprocessing: Resizing, normalization, data cleaning, and augmentation.

Model Selection and Architectures

Models Evaluated:

- VGG19: 19-layer CNN with a simple, sequential architecture.

- ResNet: Uses residual connections to handle deeper networks efficiently. Variants tested: ResNet101 and ResNet152.

- DenseNet: Each layer is connected to every other layer for improved feature reuse. Variants tested: DenseNet121 and DenseNet169.

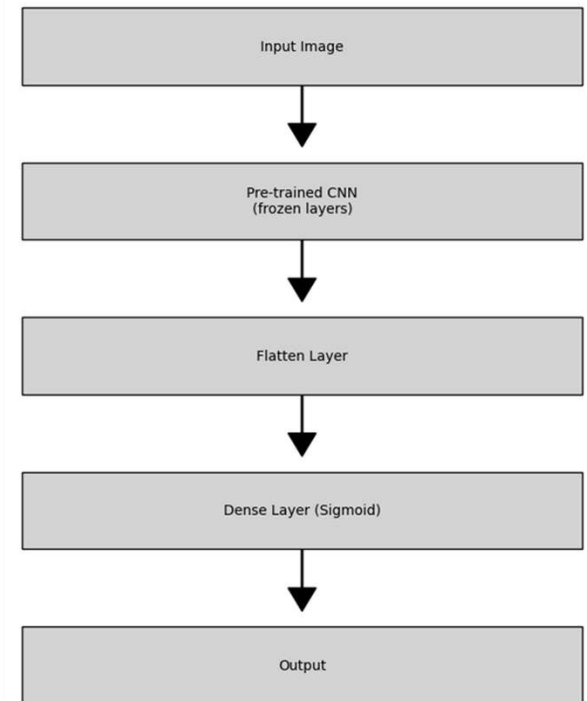## Training Process

Data Split: 80% training, 20% testing.

Optimizer: Adam.

Loss Function: Binary Cross-Entropy.

Regularization: Dropout layers added to prevent overfitting.

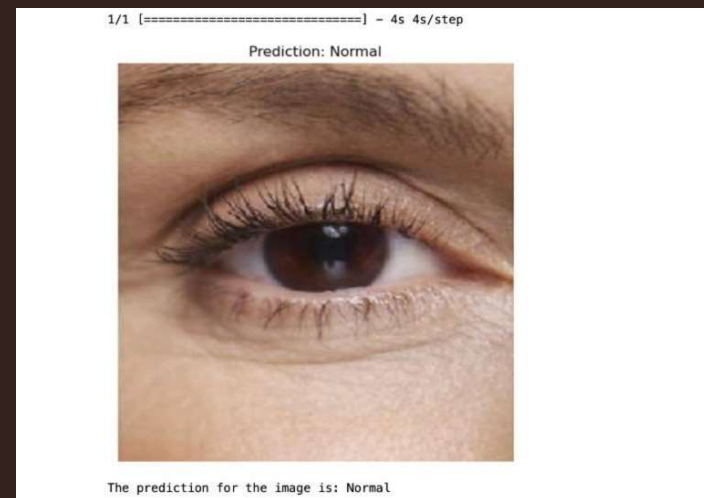Validation: 5-fold cross-validation to ensure generalizability.

CNN Flow Diagram

Input Image

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Pre-trained CNN (frozen layers)

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Flatten Layer

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Dense Layer (Sigmoid)

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Output

RESULTS

Model	Accuracy (%)	Precision (Cataract)	Recall (Cataract)	AUROC (%)
VGG-19	**95.4**	**0.96**	0.95	**98.01**
ResNet101	49.4	0.46	0.09	72.08
ResNet152	79.5	0.88	0.86	72.2
DenseNet121	94.6	0.92	0.94	76.5
DenseNet169	66.5	0.80	0.95	72.6

PREDICTIONS

1/1 [==============================] - 0s 148ms/step

Prediction: Cataract

The prediction for the image is: Cataract

1/1 [==============================] - 4s 4s/step

Prediction: Normal

The prediction for the image is: Normal

FUTURE WORK

- Dataset Expansion
- Multi-Class Classification
- Explainability
- Lightweight Models
- Hyperparameter Optimization

THANK YOU