Retinal OCT Image Classification

Presented by
Garima, Ritika, Sumedha

Western Science

Master of Data Analytics

Introduction

Problem Statement

Retinal diseases such as Diabetic Macular Edema (DME), Choroidal Neovascularization (CNV), and Drusen are among the primary causes of vision impairment and blindness globally.

Current Diagnostic Challenges

Optical Coherence Tomography (OCT), a non-invasive imaging technique, is widely used for diagnosing these diseases. However, manual interpretation of OCT scans come with its own challenges.

Objective

This project aims to harness the power of Artificial Intelligence (AI) to develop an automated classification system for retinal disease detection using OCT images.

Applications of the Project

1

Support for Ophthalmologists

AI ensures critical cases are flagged and urgent patients prioritized in high-volume settings.

2

Addressing Resource Shortages

In underserved areas, AI aids initial eye screenings where specialists are scarce.

3

Improved Patient Outcomes

Faster diagnosis enables timely treatment, reducing disease progression and vision loss.

Dataset Overview

Source: Kaggle

Structure:

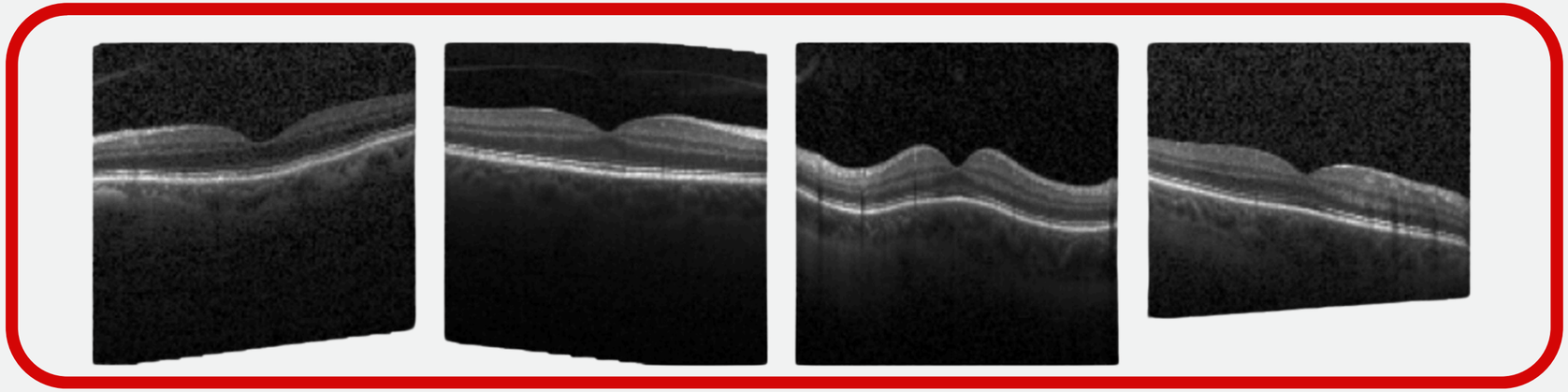
Folders

- Divided into three main folders: train, test, and validation (val).
- Folders contain subdirectories for the four categories.

Images:

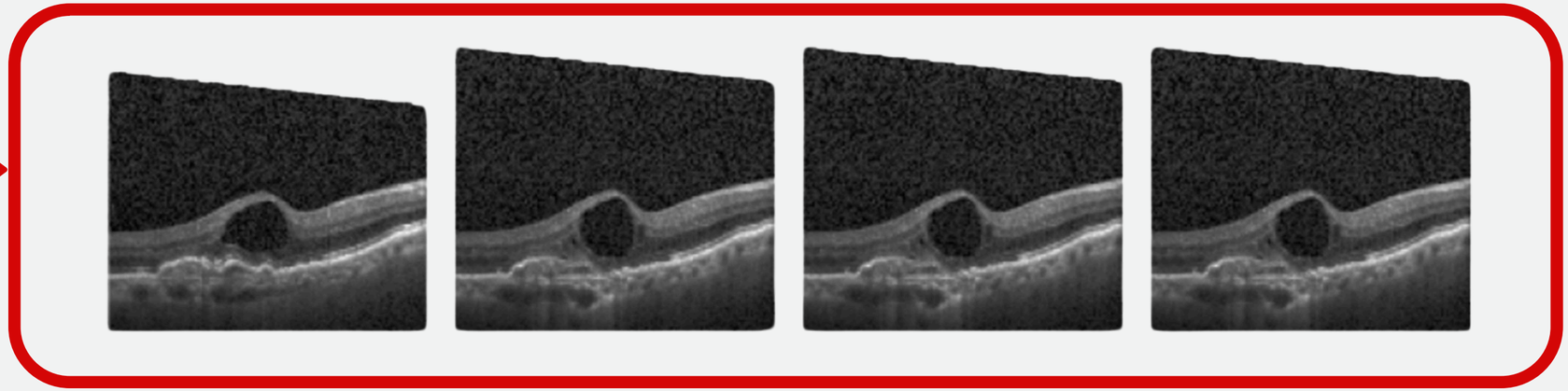
- 84,495 high-resolution OCT images in JPEG format are available.
- The images are labeled in the format: (disease)-(randomized patient ID)-(image number by this patient).

Classes Identification



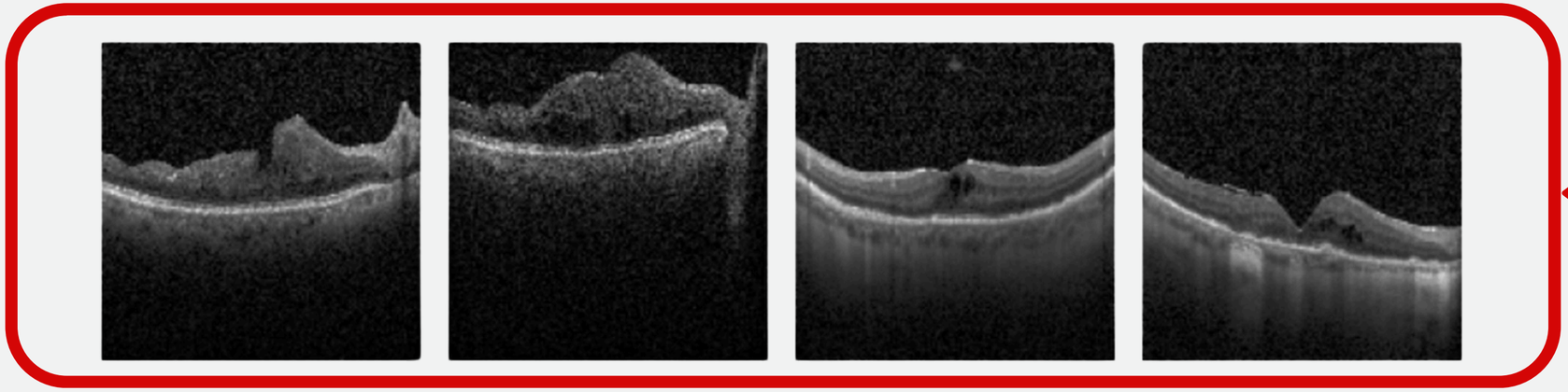
Normal

CNV



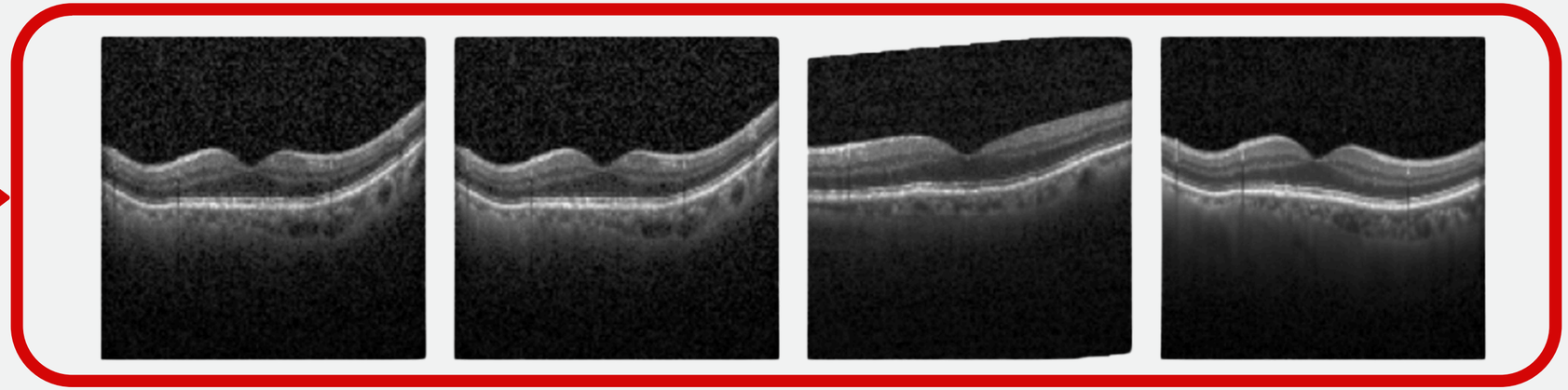
Western Science

Classes Identification



DME

DRUSEN

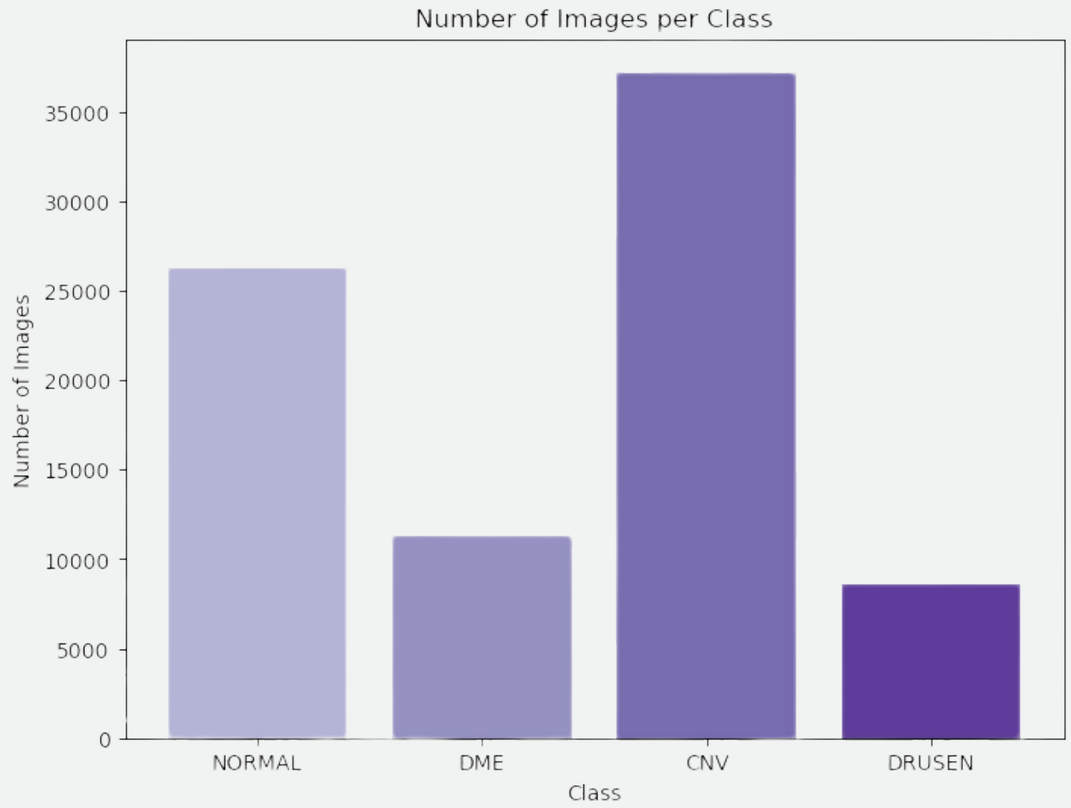


Data Preprocessing

Load images from respective folders (NORMAL, CNV, DME, DRUSEN)

Resize images to 128x128 pixels

Store processed data for training



Western Science

Class Imbalance

Class	Weight
Normal	0.9923
CNV	0.9923
DME	1.0348
DRUSEN	0.9822

- The dataset is well-balanced overall.
- There is minimal risk of bias or poor performance for any class.

Data Augmentation

Rescaling

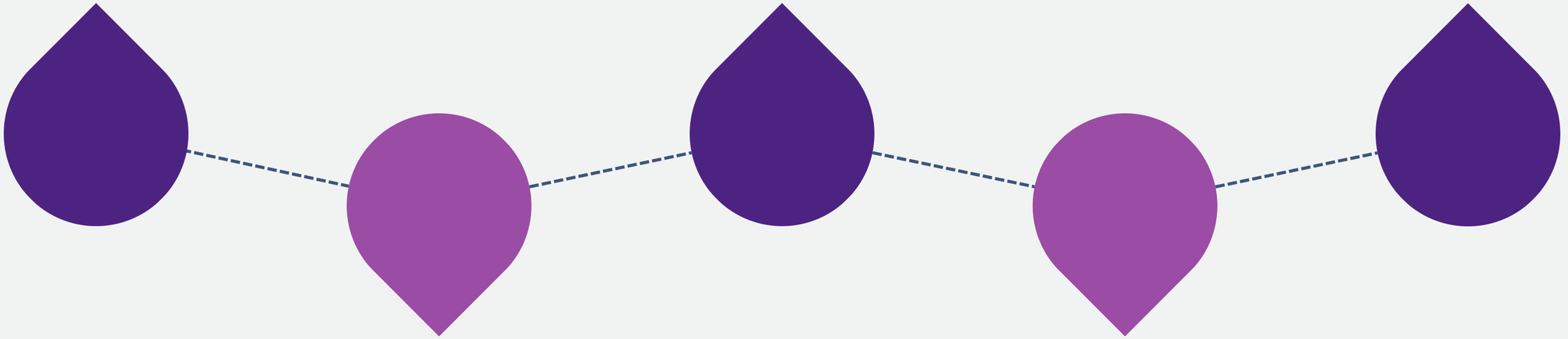
Normalized pixel values to [0, 1]

Shifting

Width and height shifts up to 20%

Flipping

Horizontal flips for added variation



Rotation

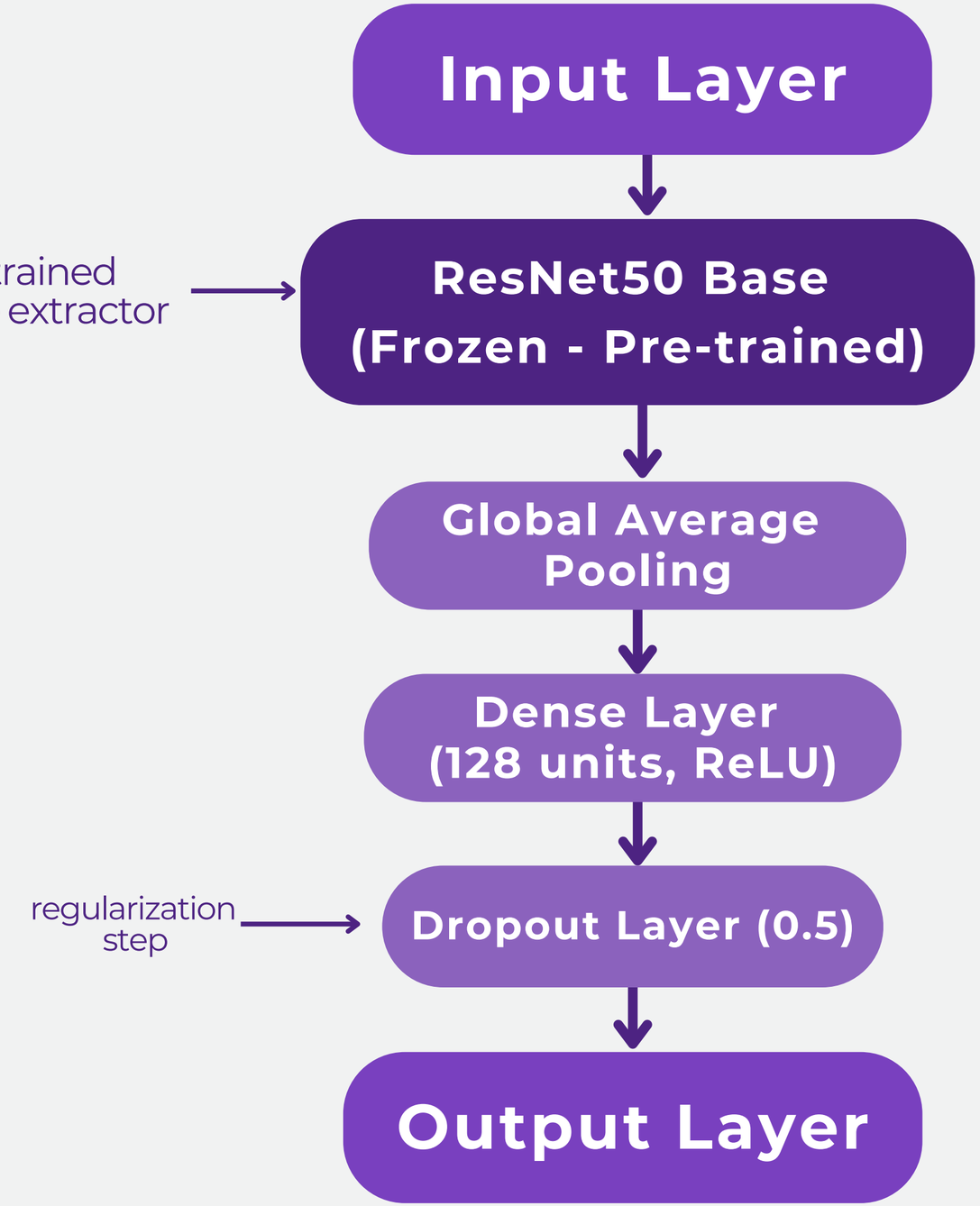
Random rotations up to 10°

Zooming

Random zoom-in and zoom-out (20%)

Baseline Model: ResNet50

Metric	Value
Accuracy	65%
Loss	1.1209
Test Loss	1.3656
Test Accuracy	50%



CNN Model Architecture

Activation Functions

Relu: Used in all convolutional and dense layers (except the output layer) to introduce non-linearity.

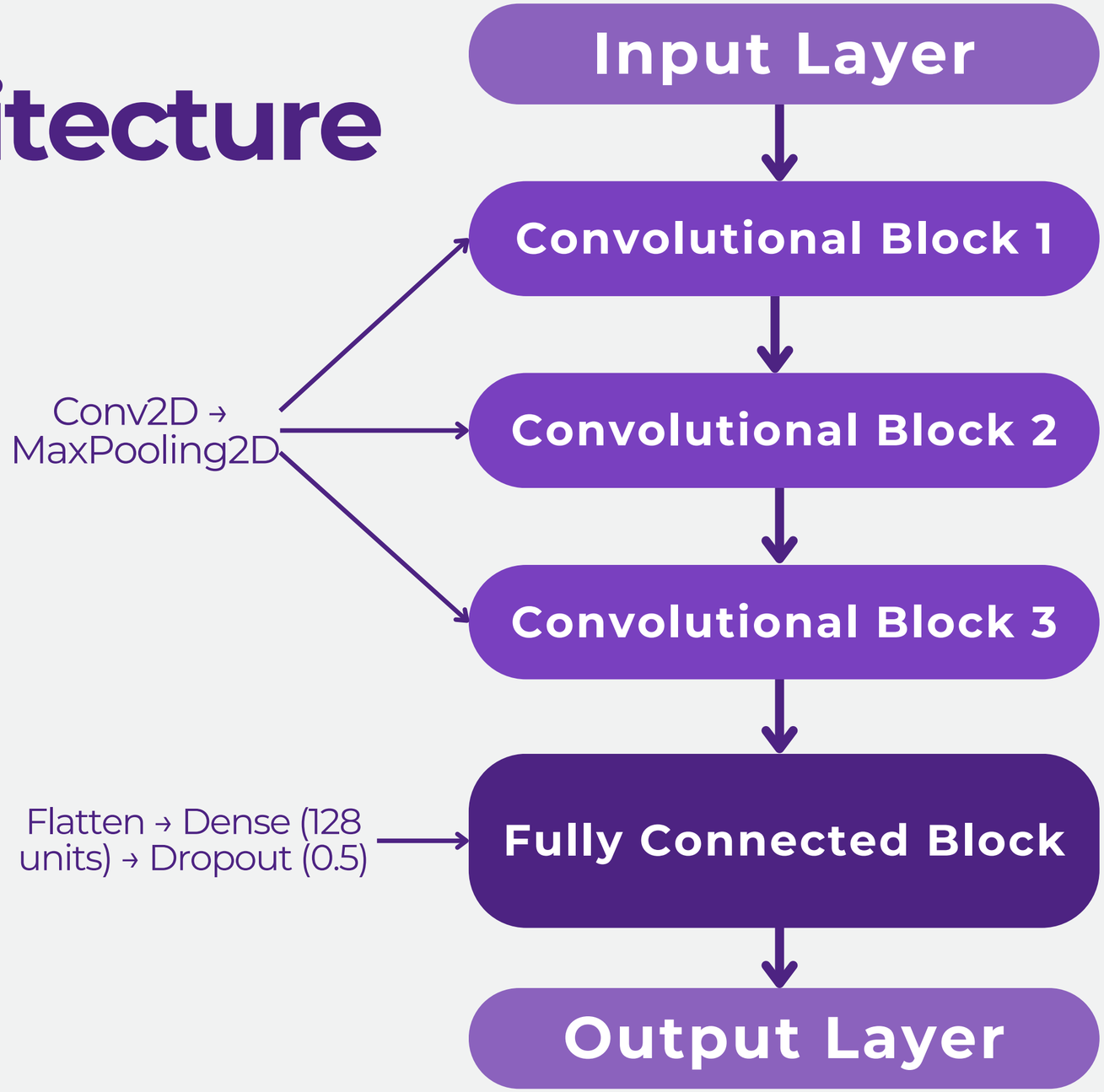
Optimizer: Adam optimizer was used for efficient training.

Accuracy: **91%**

Loss: **0.2703**

val_accuracy: **97%**

val_loss: **0.0477**

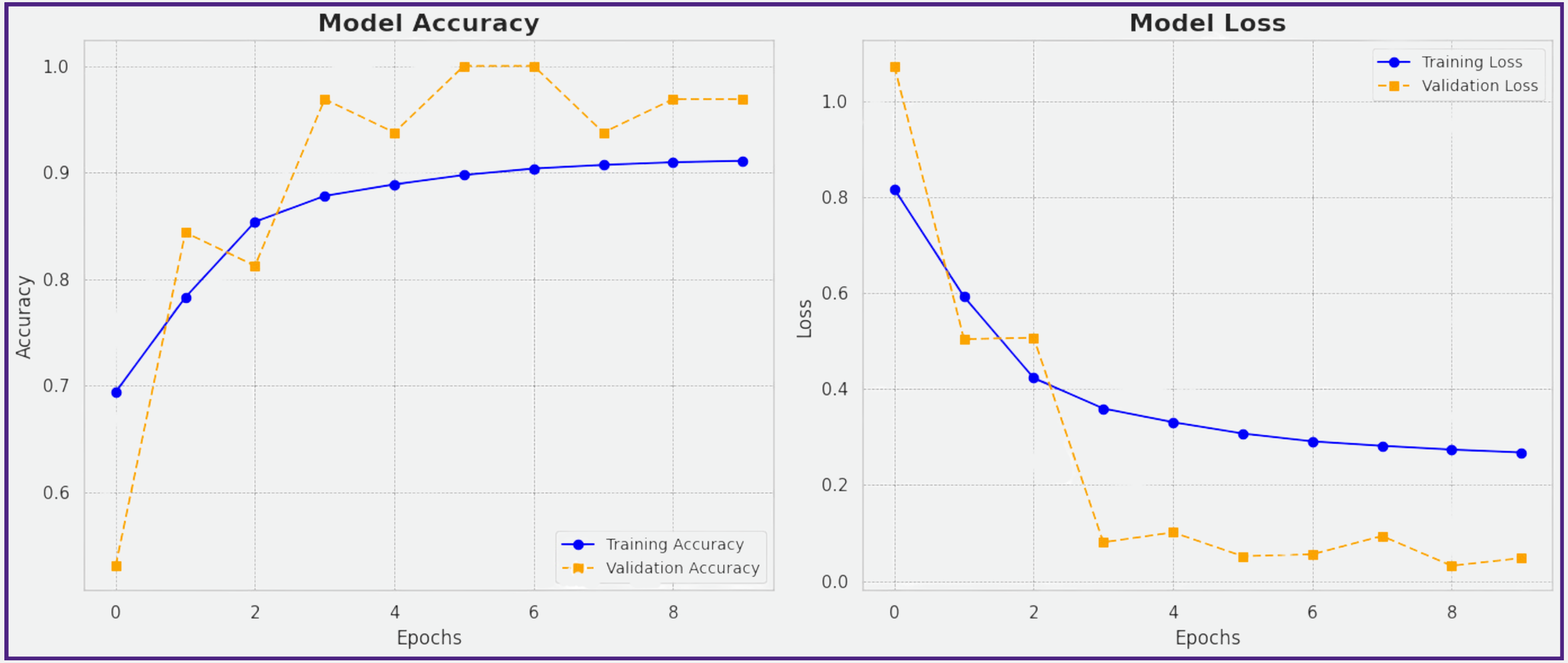


Western Science

Classification Report

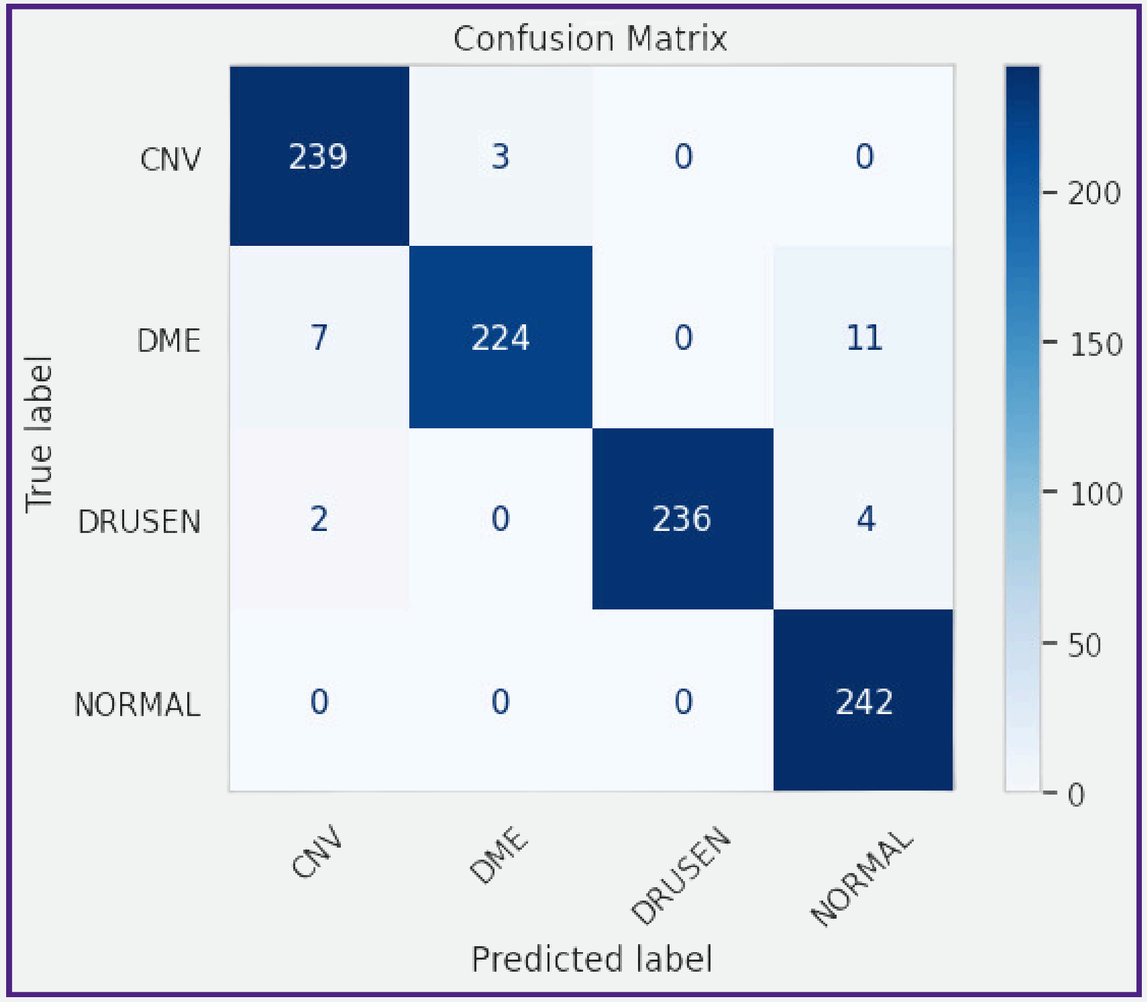
-	Precision	Recall	F1-Score
CNV	0.96	0.99	0.98
DME	0.99	0.93	0.96
DRUSEN	1.00	0.98	0.99
NORMAL	0.94	1.00	0.97
Accuracy	-	-	0.97
Macro Avg	0.97	0.97	0.97
Wght Avg	0.97	0.97	0.97

Results



The model shows high training accuracy with minimal overfitting, but validation loss fluctuations indicate potential noise or data imbalance.

Results



The model demonstrates excellent classification accuracy with minimal misclassifications across all classes.

Future Scope

Fine-Tuning Pre-Trained Layers for ResNet Model

Improved Data Augmentation

Learning Rate Optimization

Thank you !

Any Questions?