# CNN-based Classification of Diabetic Retinopathy Stages in Fundus Images

TEAM- P7132

# Team Members


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## GUIDE

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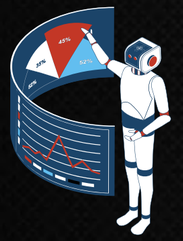
# Contents

# AIM OF THE PROJECT

**The objective of this project is to leverage convolutional neural network (CNN) architecture with TensorFlow/Keras to develop a robust system for the early detection and precise classification of diabetic retinopathy, advancing diagnostic capabilities in healthcare.**

# Objectives



Develop a convolutional neural network (CNN) model using TensorFlow/Keras to automatically detect diabetic retinopathy in images

Implement data preprocessing techniques such as rescaling, image augmentation, and filtering to enhance the quality and diversity of the training dataset.

Enhance the scalability of disease detection efforts by implementing technology-driven solutions, aiming to alleviate the burden on highly trained medical personnel.

Finally, create a precise machine learning model for classifying the severity of diabetic retinopathy on a scale from 0 to 4. This model will serve as a valuable tool for clinicians, aiding in early detection and intervention, and categorizing severity levels from 'No DR' to 'Proliferative DR.'

# Abstract Model

1

## Project Overview

This project is employed to address the critical health challenge posed by diabetic retinopathy (DR), aiming to provide a reliable tool for classifying DR severity levels and facilitating prompt clinical decision-making.Diabetic retinopathy (DR) is a significant health challenge with widespread prevalence and potential vision-threatening consequences. Timely detection is crucial for effective intervention and halting the progression of DR.

2

## Methodological Approach

Our project adopts a methodological approach using Convolutional Neural Networks (CNNs) to automatically extract features from retinal images, improving the model's discernment of diabetic retinopathy severity levels. The training process involves optimizing the CNN architecture with a diverse dataset and rigorous validation techniques for robust performance.

3

## User-Friendly Interface and Benefits for Diabetic Retinopathy Diagnosis:

"Our intuitive interface empowers clinicians to swiftly assess diabetic retinopathy severity levels with automated scores, expediting diagnostics, optimizing resources, and ensuring fair, accurate evaluations for all patients."

# LITERATURE REVIEW

- The literature survey for the Diabetic Retinopathy project involves reviewing existing research on the application of Convolutional Neural Networks (CNNs) in the automated detection and classification of diabetic retinopathy from fundus images.
- Previous studies emphasize the significance of early diagnosis using machine learning techniques and highlight the challenges of classifying retinal images into different severity levels.
- Techniques such as image preprocessing, data augmentation etc are used and Gaps in current research underscore the need for robust, scalable, and interpretable models for effective diabetic retinopathy screening.

# Existing System

## U-Net

**Drawbacks:**

- Poor feature representation from the initial layer.
- Inability to Capture Long-Range Dependencies
- Sensitivity to Hyperparameters.

## ResNet

**Drawbacks:**

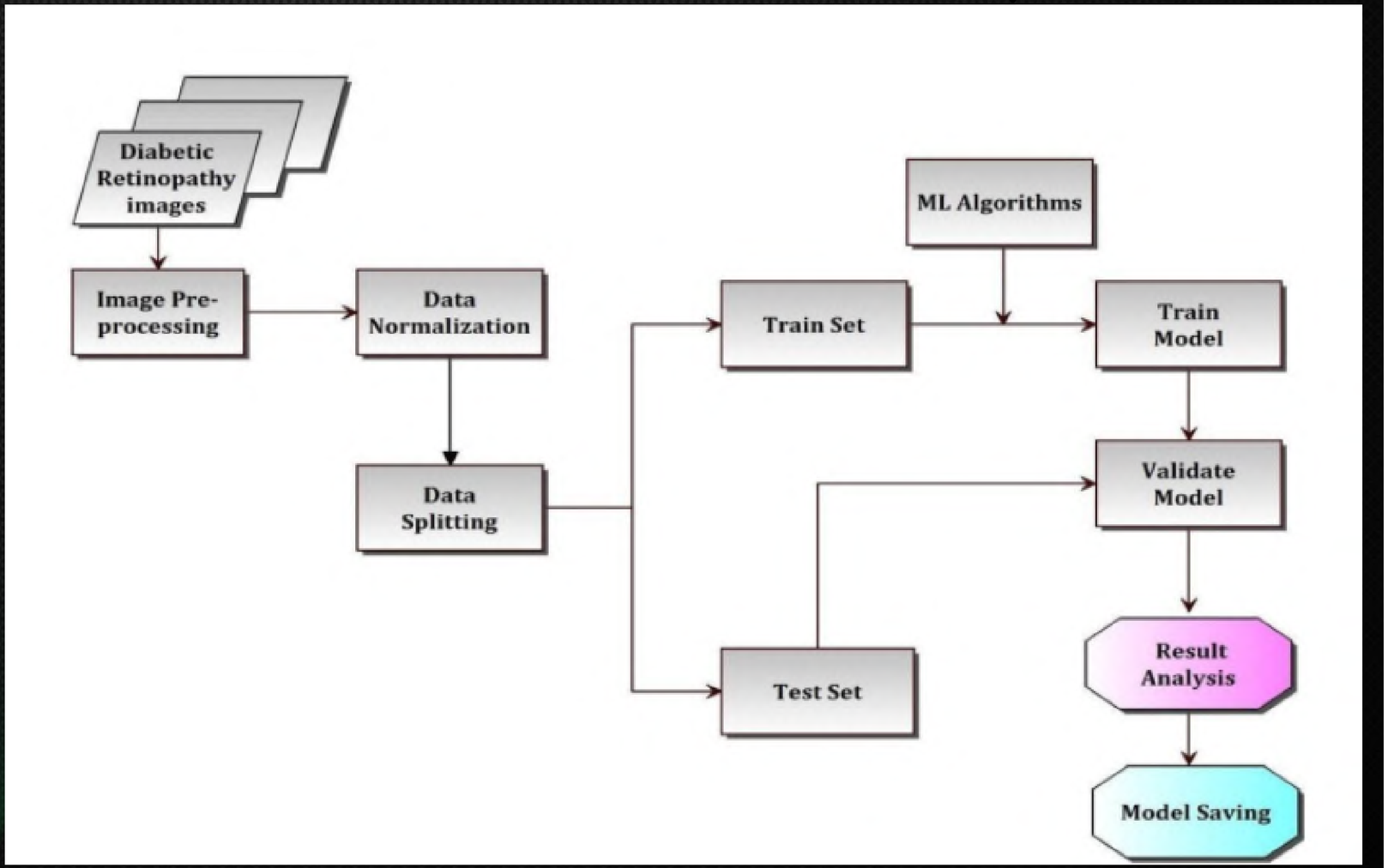
- Limited Representation of Image Features
- Overfitting.
- Sensitivity to Small Variations.

## Support Vector Machine

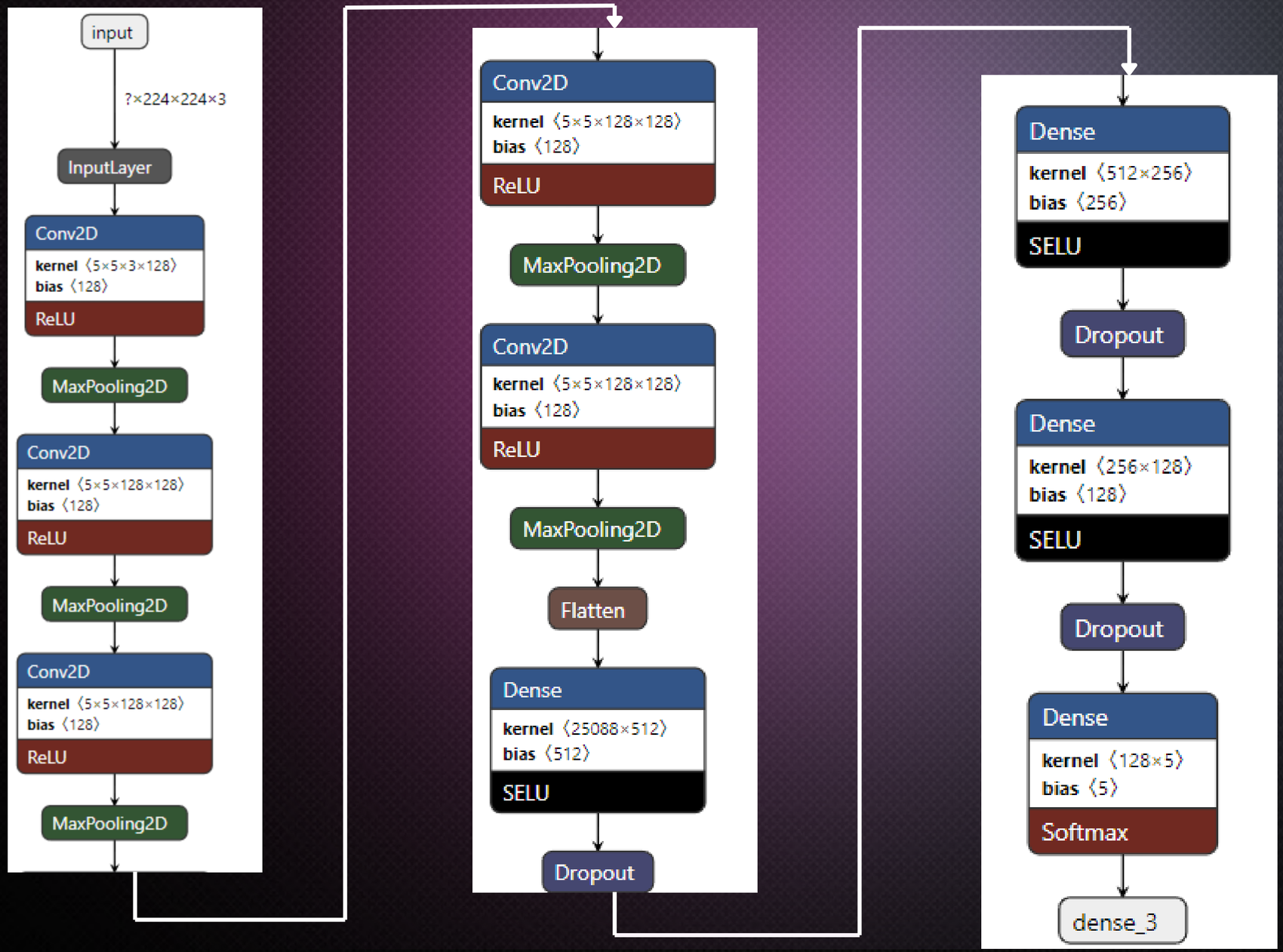
**Drawbacks:**

- Dependency on Feature Extraction.
- High Sensitivity to Noise and Variability.
- Overfitting.
- Need for Manual Feature Engineering.

# Our Architecture

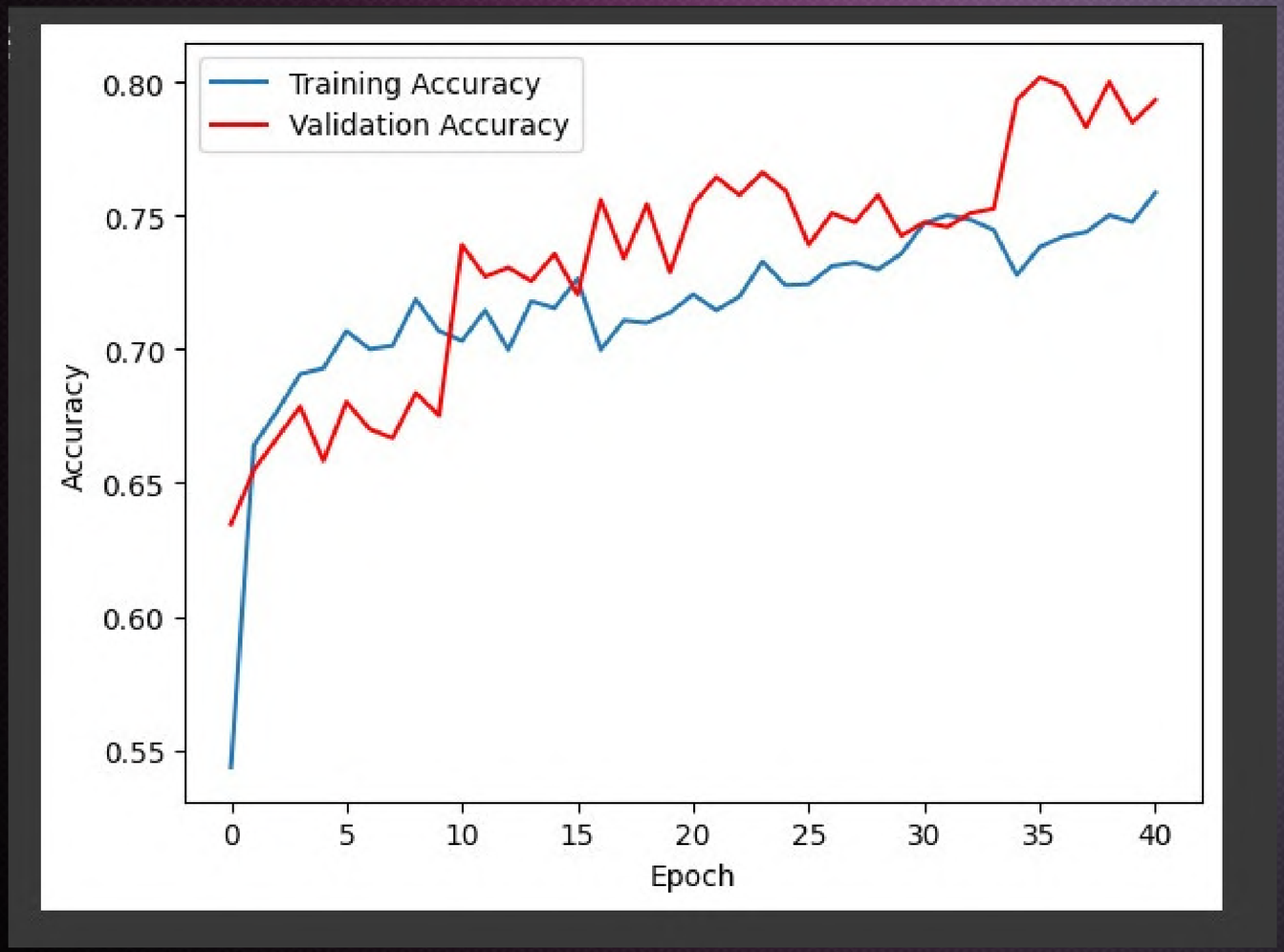


# IMPLEMENTATION




[Link to the Colab]

# RESULT



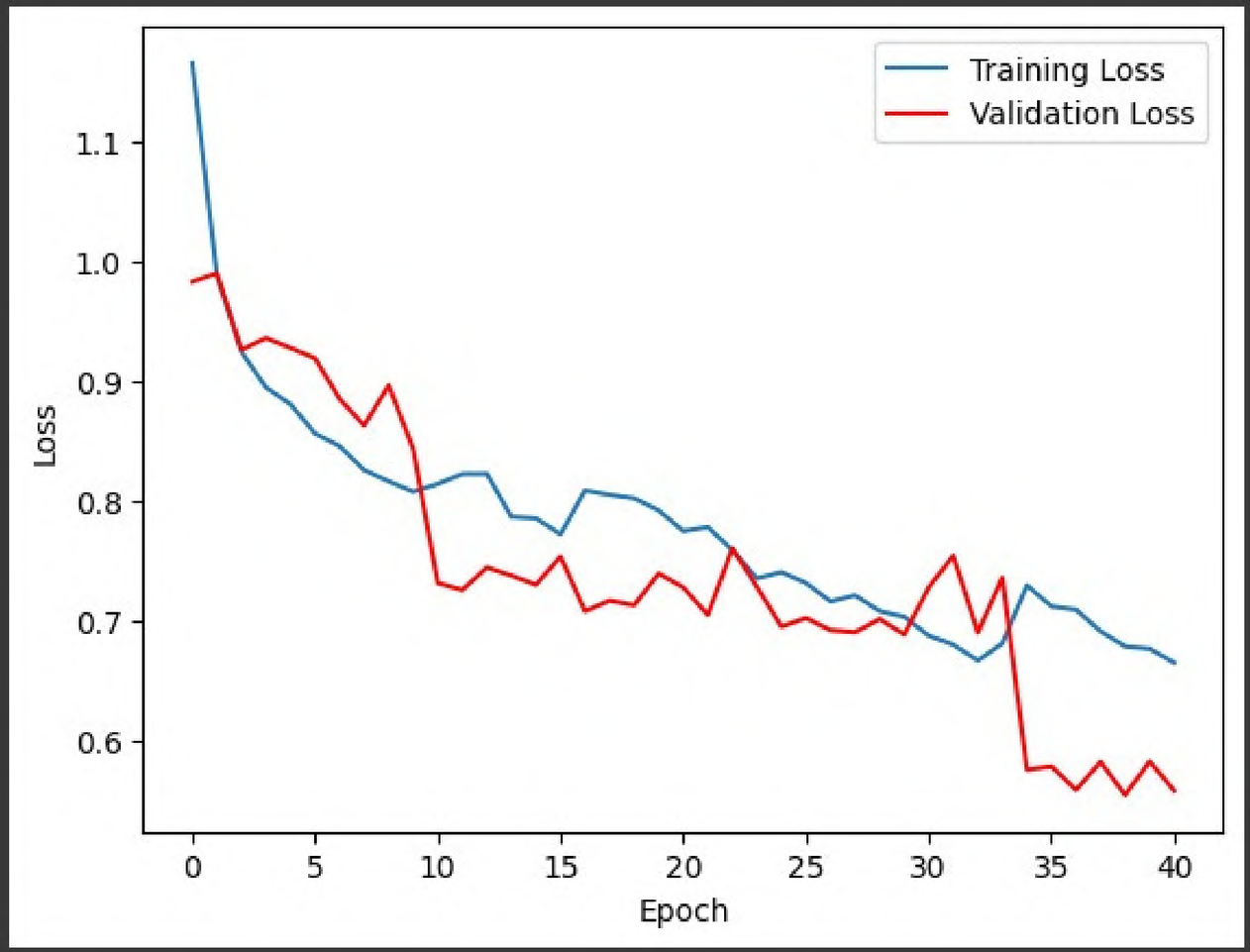

Accuracy of the Model

Number of Epochs

## Representation of Model Accuracy

# RESULT

Value of Loss function




Number of Epochs

Representation of Model Loss

# Software Components

## Python

The entire project is implemented in Python, so we need a Python interpreter installed on your computer.

## Integrated Development Environment (IDE)

Jupyter Book, Colab

## Libraries

TensorFlow, OpenCV, Pandas, Matplotlib, tqdm

## Dataset

APTOS-2019 Blindness dataset

# Hardware Components

## Computer

Computer with sufficient processing power and memory to run the model training and provide accurate results

## Storage

Minimum 8 GB disk space to download and install.

## GPU

Access to a powerful GPU as can significantly speed up the training process since the dataset is large

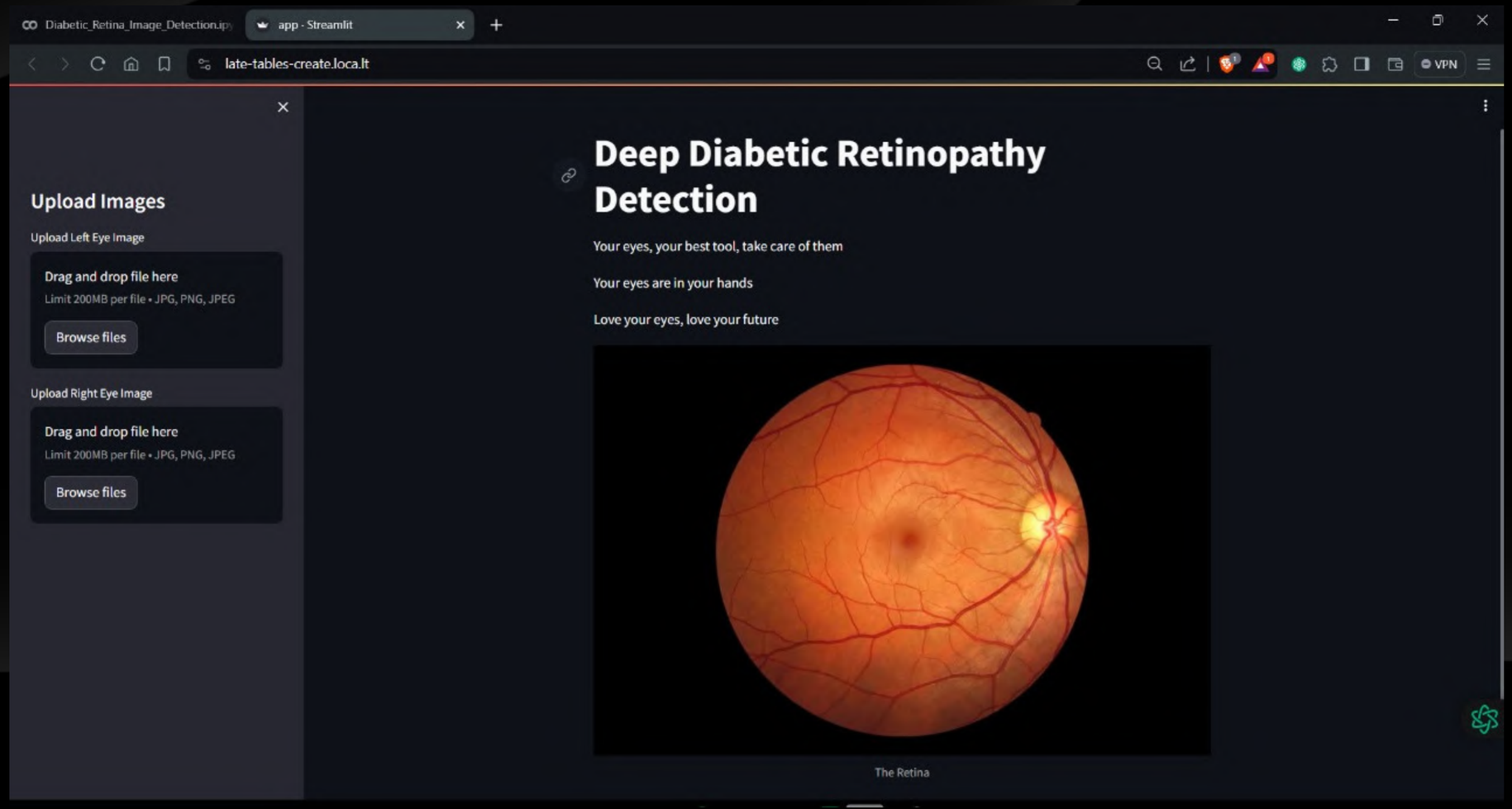
## Operating system

Windows 7 or newer, 64-bit macOS 10.13+, or Linux

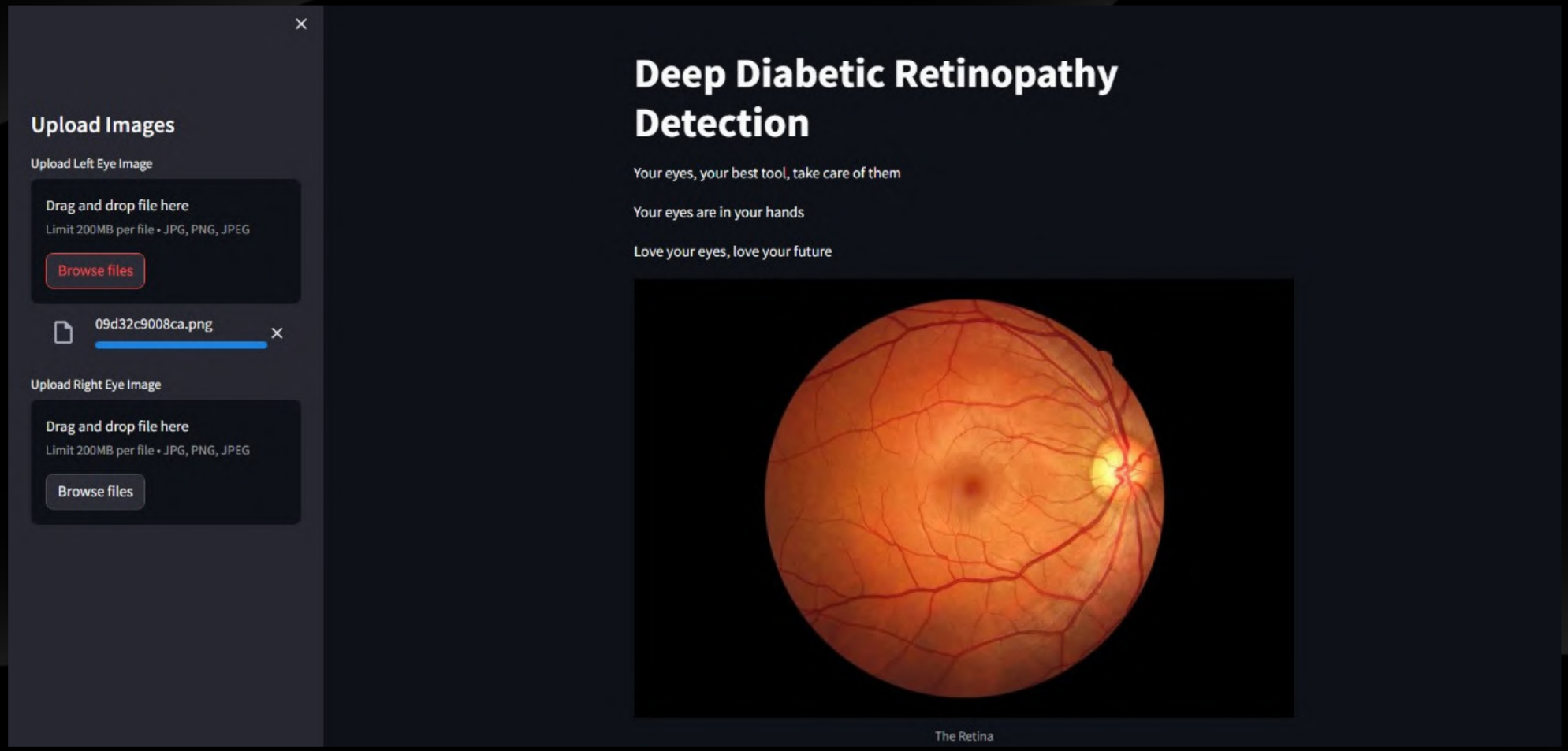
# Visualization Timeline

- Project Planning and Research
- Data Collection and Preprocessing
- Model Development and Training
- Evaluation and Validation
- Presentation and Deployment
- Frontend Development and finishing the project

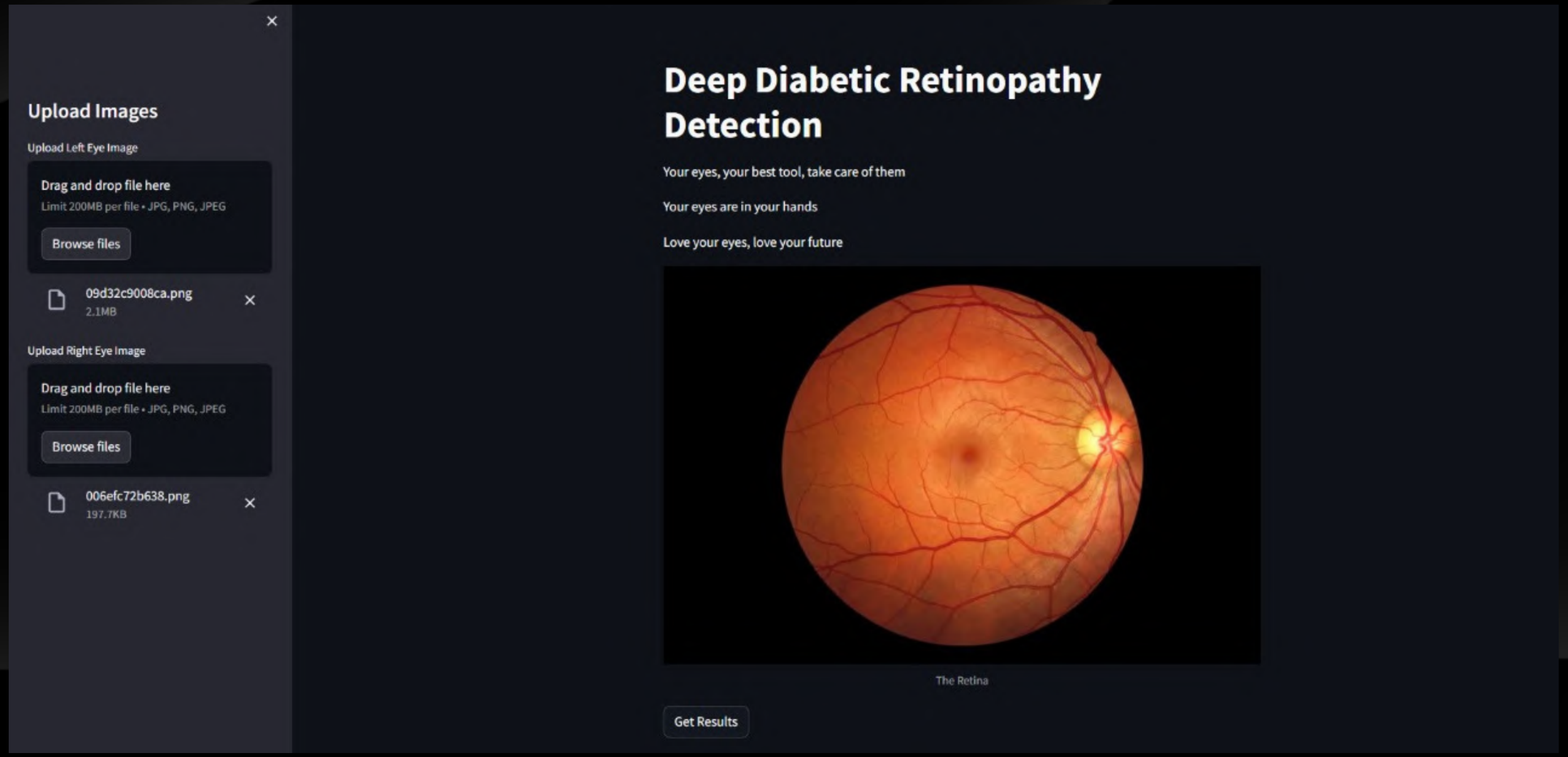
# USER INTERFACE



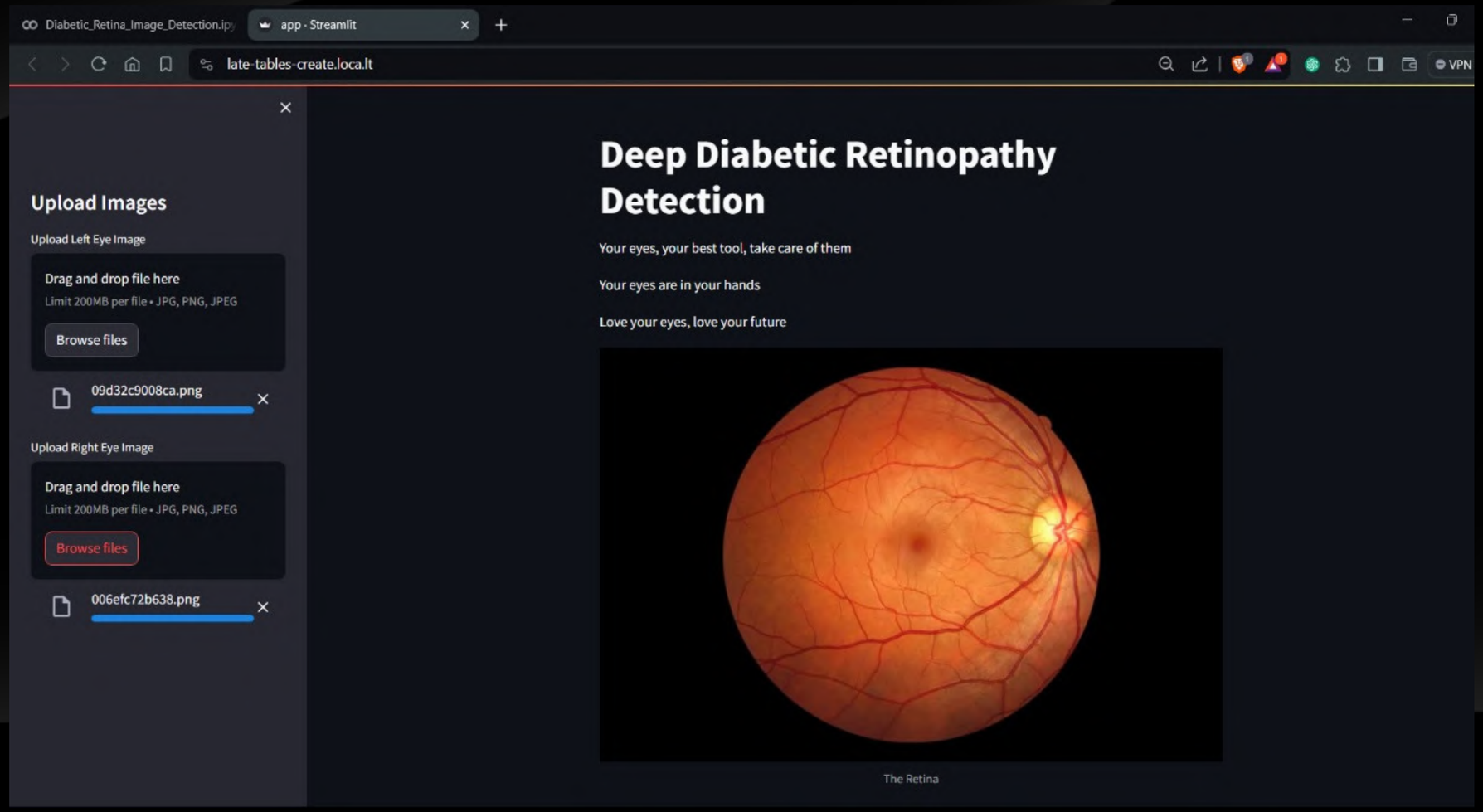
# USER INTERFACE



# USER INTERFACE



# USER INTERFACE



# USER INTERFACE

Get Results

## Results Page

### Left Eye Result: No DR

**Probabilities:**

| | Class | Probability |
|---|---|---|
| 0 | No DR | 0.5774 |
| 1 | Mild | 0.1266 |
| 2 | Moderate | 0.181 |
| 3 | Severe | 0.0289 |
| 4 | Proliferative DR | 0.086 |

## Right Eye Result: Moderate

**Probabilities:**

| | ↑ Class | Probability |
|---|---|---|
| 1 | Mild | 0.1583 |
| 2 | Moderate | 0.3611 |
| 0 | No DR | 0.2161 |
| 4 | Proliferative DR | 0.1708 |
| 3 | Severe | 0.0937 |

Left eye is prone to No Disease.

Highest Probability for Left Eye: 0.5774421095848083

Right eye is prone to Diabetic Retinopathy.

Highest Probability for Right Eye: 0.3610537052154541

Left eye is not prone to any disease, but right eye is prone to Diabetic Retinopathy.

# CONCLUSION

Our project on diabetic retinopathy detection using CNNs offers a comprehensive approach to leveraging deep learning for early diagnosis, emphasizing the potential for improving patient outcomes through efficient and accurate screening methods. By harnessing the power of convolutional neural networks, we aim to contribute to the advancement of medical image analysis, paving the way for more accessible and effective healthcare solutions in the field of diabetic retinopathy management.

# References used


- https://www.nature.com/articles/s41467-021-23458-5
- https://link.springer.com/article/10.1007/s00521-023-08249-x
- https://pubmed.ncbi.nlm.nih.gov/36467440/
- https://colab.research.google.com/drive/1UFA-AvXJUnYakDEA5AQMj0eQReD_QM1ausp=sharing#scrollTo=yIjBpfNZa4YG

# THANK YOU