FRUITS CLASSIFICATION

NEURAL NETWORK PROJECT

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Project Overview

- In this project, we collected a diverse dataset of fruit images and employed **neural network** architectures to train our model.
- Our objective was to develop a robust **classifier** capable of distinguishing between various **fruit** types with high accuracy.

Project Scope

Scalability for Diverse Data

CNNs to handle a diverse range of fruit and vegetable images

Optimizing Model Architecture

optimize model parameters, including convolutional layers, pooling layers, and fully connected layers

Performance Evaluation

using standard metrics such as accuracy, precision, recall, and F1-score.

Scalable Web App Deployment

web deployment for easy access and usability, enabling users to interact with the system through a web interface.

Project Pipeline

Data Gathering

Exploratory Data Analysis (EDA)

Data Preprocessing

Model Building

Model Testing and Validation

Model Deployment

Dataset Description

- Our dataset comprises a diverse collection of images representing different classes of **fruits and vegetables.**
- Each **class** includes multiple images captured from various angles, lighting conditions, and white backgrounds, providing a comprehensive representation of the diversity within each category.

Dataset Link

Fruits-360 dataset

A dataset with 90380 images of 131 fruits, vegetables and nuts

k kaggle.com

Dataset Content

- **Train File** - the training folder that contains 131 subfolders for Training and **67400** image will be divided into train and validation
- **Test File** - the testing folder that contains **22688** testing images

An Image from Apple Class

Dataset Description

- Number of images: **90483 images**
- Training set size: **47692 [60%] images**
- Validation set size**: 20243 [20%] images**
- Test set size: **[20%] 22688 images**
- Number of classes: **131 class**
- Most Image size: **100x100 pixels**.

Apple	Banana	Orange	Tomato	Carrot	Broccoli
Grape	Pineapple	Watermelon	Strawberry	Lemon	Mango
Kiwi	Pepper	Potato	Cucamber	Avocado	Pear
Eggplant	Laim	Peach	Plum	Plumkin	Cherry
Radish	Onion	Garlic	Ginger	Cabbage	Cauliflower

Each Category is divided into more detailed categories

Exploratory Data Analysis (EDA)

- Brief overview of the importance of **EDA** in understanding the dataset and informing subsequent modeling decisions

Visualizations

- **Images from classes to show augmentation in data**
- **Distribution of Classes to show balance of data**
- **Random Image from each class in dataset**
- **Image Characteristics**
- **Color Distribution**

Data Preprocessing

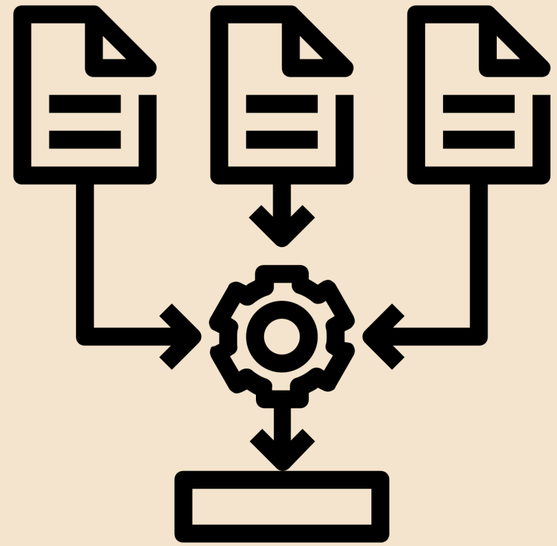
- **Resizing** to the most common size
- **Rescaling** all images to be between 0 and 1
- **Data Augmentation** using many techniques (Flipping, Rotation)
- **Data Shuffling** to ensure best training and testing

Model Building

- Sequential model constructed with Keras.
- Utilizes convolutional layers for feature extraction:

  3 layers with increasing filters (32, 64, 128).
- Dense layers: 2 fully connected layers
- Pooling layers for downsampling and

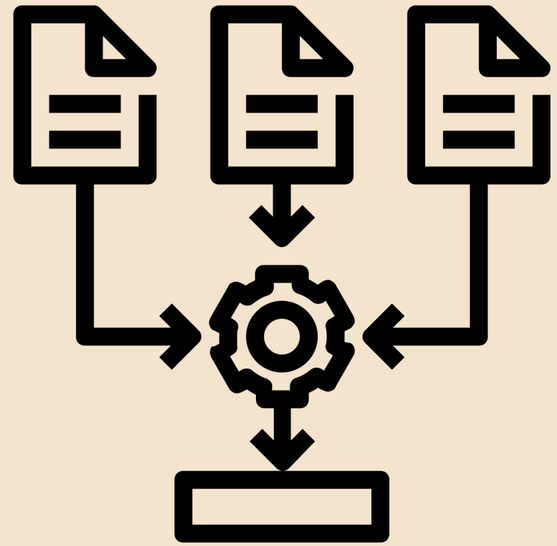
  dimensionality reduction.



Model Building

- **Activation Functions:**

- ReLU activation used throughout convolutional and dense layers.
- Softmax activation in the output layer for multi-class classification.
- **Optimizer:** Default parameters (Adam optimizer).
- **Loss function:** Categorical cross-entropy for multi-class classification.



Training Process

Methodology:

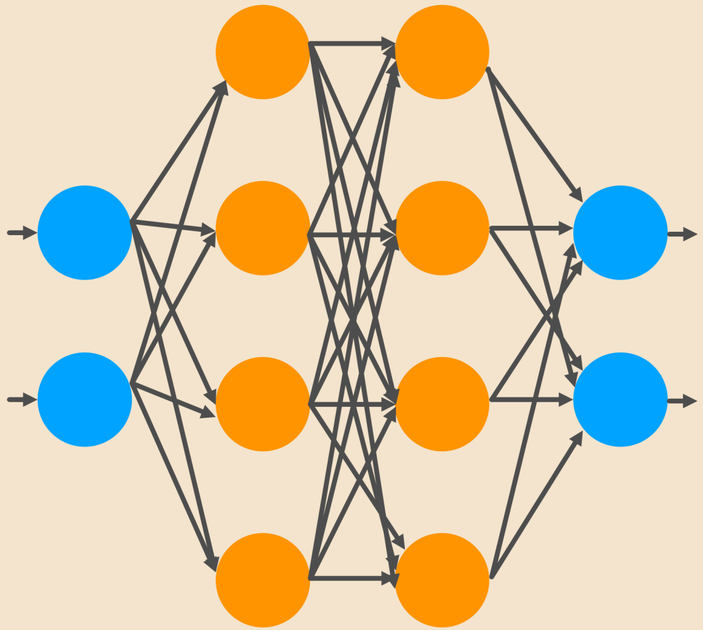
- Neural Network architecture used:

  Convolutional Neural Networks (CNN)

- Optimization Algorithm:

  Mini-Batch Gradient Descent

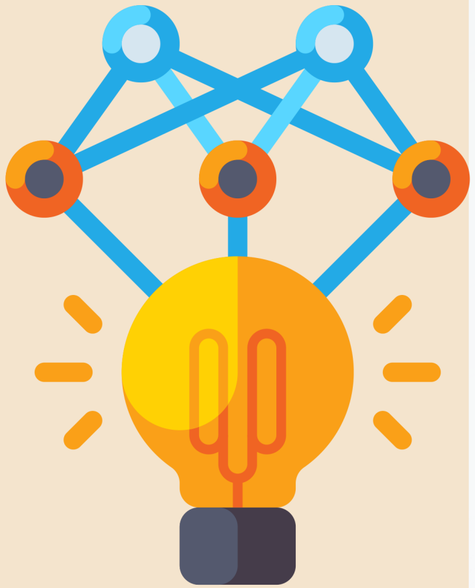
- **Batch Size: 60**
- **Number of Epochs: 30 Epoch**



Training Results

Results:

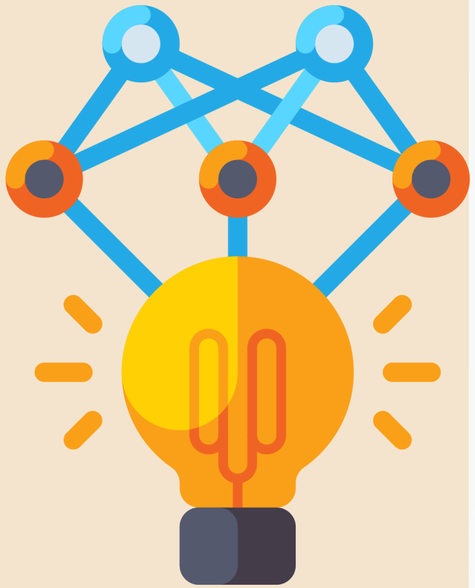
- **Accuracy:** 0.9576
- **Loss:** 0.1100
- **Precision:** 0.9641
- **Recall:** 0.9494



Validation Results

Results:

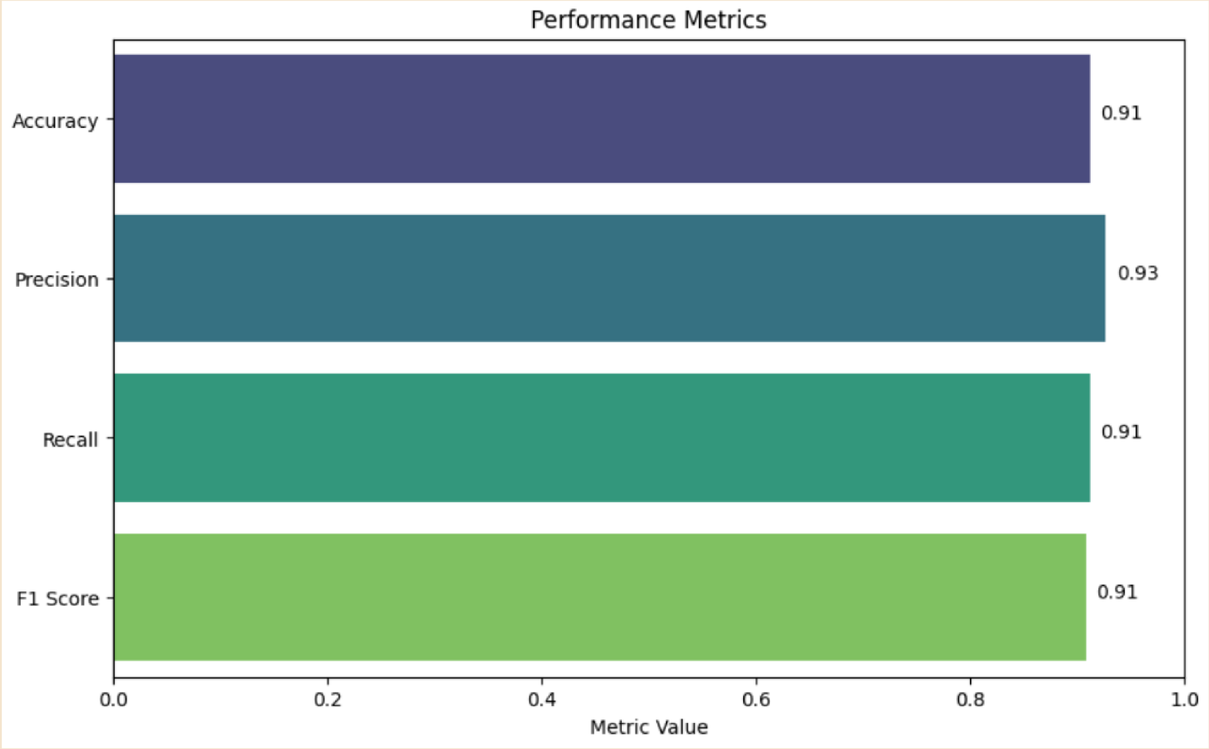
- **Accuracy:** 0.9417
- **Loss:** 0.2009
- **Precision:** 0.9491
- **Recall:** 0.9317



Testing Results

Performance Measures:

- Accuracy: 0.91
- Precision: 0.93
- Recall: 0.91
- F1 Score: 0.91



Model Summary

- True Positives (TP): **100**
- False Positives (FP): **0**
- True Negatives (TN): **115**
- False Negatives (FN): **0**

Model: "sequential"

Layer (type)	Output Shape	Param #
conv2d (Conv2D)	(None, 98, 98, 32)	896
max_pooling2d (MaxPooling2D)	(None, 49, 49, 32)	0
conv2d_1 (Conv2D)	(None, 47, 47, 64)	18,496
max_pooling2d_1 (MaxPooling2D)	(None, 23, 23, 64)	0
conv2d_2 (Conv2D)	(None, 21, 21, 128)	73,856
max_pooling2d_2 (MaxPooling2D)	(None, 10, 10, 128)	0
flatten (Flatten)	(None, 12800)	0
dense (Dense)	(None, 512)	6,554,112
dropout (Dropout)	(None, 512)	0
dense_1 (Dense)	(None, 131)	67,203

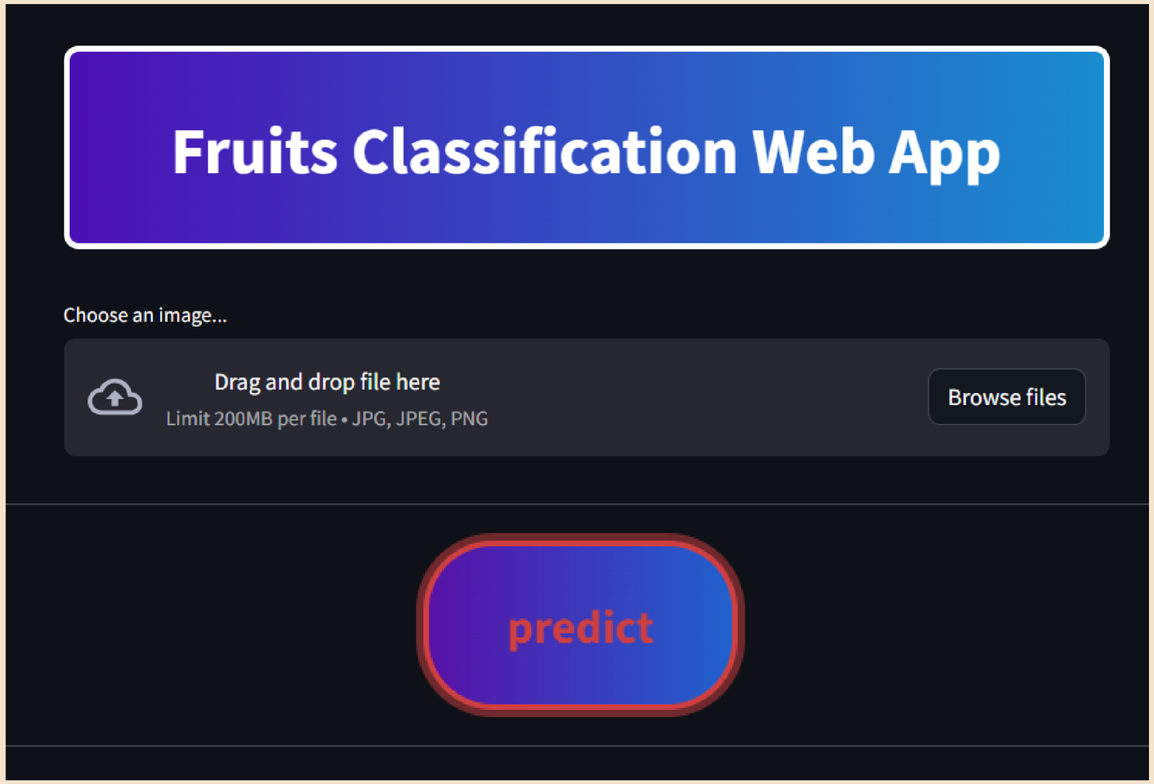
Total params: 20,143,691 (76.84 MB)
Trainable params: 6,714,563 (25.61 MB)
Non-trainable params: 0 (0.00 B)
Optimizer params: 13,429,128 (51.23 MB)

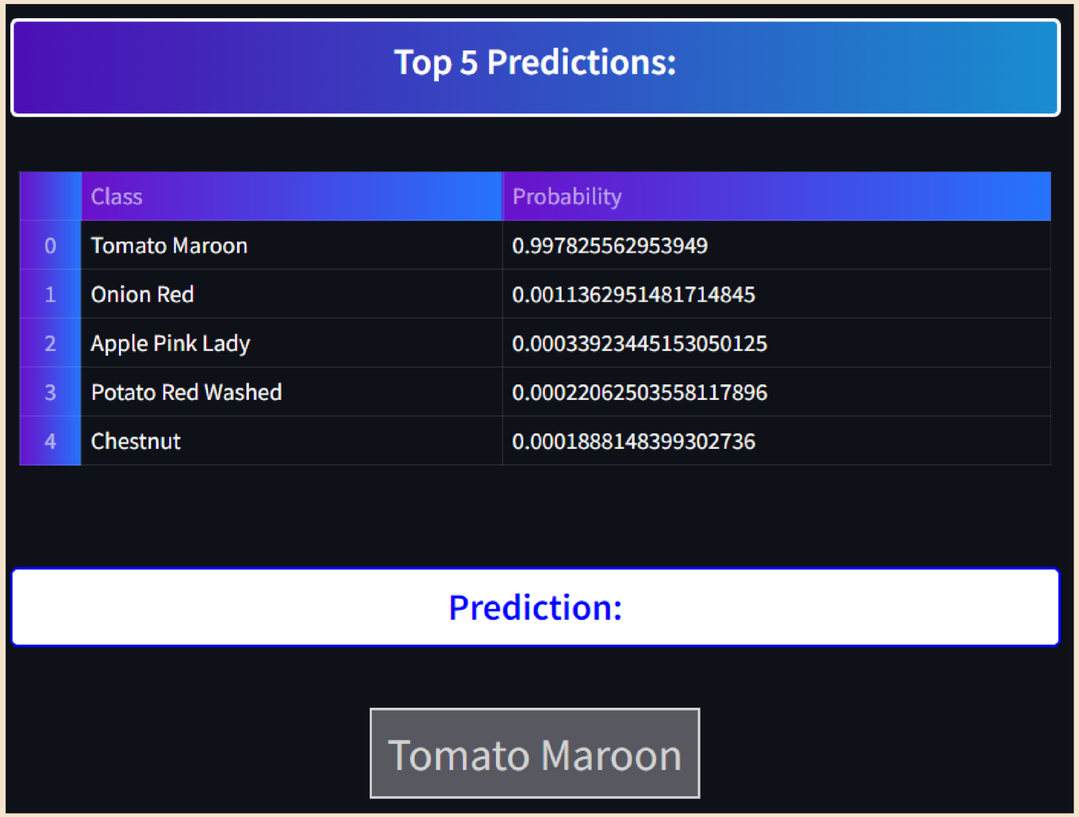
Deployment

Streamlit

- **Streamlit** as an open-source framework for building web applications with **Python** and known with its **simplicity and ease of use** for creating interactive and data-driven applications and ML Models.

Deployment


Fruits Classification Web App
Choose an image...
Drag and drop file here
Limit 200MB per file • JPG, JPEG, PNG
Browse files
predict


Top 5 Predictions:
Class
Probability
0 Tomato Maroon 0.997825562953949
1 Onion Red 0.0011362951481714845
2 Apple Pink Lady 0.00033923445153050125
3 Potato Red Washed 0.00022062503558117896
4 Chestnut 0.0001888148399302736
Prediction:
Tomato Maroon

Conclusion

Project Objectives Achieved

- The fruit and vegetable classification project successfully achieved its objectives of **developing a neural network-based classification system.**

Impact and Significance:

- The project holds significant implications for various industries, including **agriculture, food processing, and healthcare**, by automating the classification process and improving efficiency.

Acknowledgments

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Acknowledgments

Team Members

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Thank You!

الْحَمْدُ لِلَّهِ الَّذِي هَدَانَا لِهَذَا وَمَا كُنَّا لِنَهْتَدِيَ لَوْلا أَنْ هَدَانَا اللَّهُ