Date Fruit Image Classification

Presented by:

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Introduction

- Our project showcases ML's power in accurately identifying date fruit type by using CNN

Problem description

- **Main task:** Designing and implementing a machine learning image classification system for date fruits.

- **Applications:**
- **Agricultural:** Optimize farming practices accuracy (sorting crops , reduce wastage).
- **Food Market:** Ensures that only high-quality date fruits meeting specific standards reach the market.
- **Economic Growth:** Boost market competitiveness and economic growth in date-producing regions.
- **Educational Outreach:** Utilize date fruit classification to educate consumers about the diverse types of dates.

Dataset

- The dataset includes images of various types of dates commonly found in Saudi Arabia, with 9 classes of the fruit as shown in the table.
- Dataset counts: 1658 images
  - Train Counts: 1156 image:

Ajwa	Galaxy	Mejdool	Meneifi	NabtatAli	Rutab	Shaishe	Sokari	Sugaey
122	133	94	162	123	102	119	184	117

  - Test Counts: 502 images:

Ajwa	Galaxy	Mejdool	Meneifi	NabtatAli	Rutab	Shaishe	Sokari	Sugaey
53	57	41	70	54	44	52	80	51

Samples of the dataset

Ajwa

Galaxy

Mejdool

Meneifi

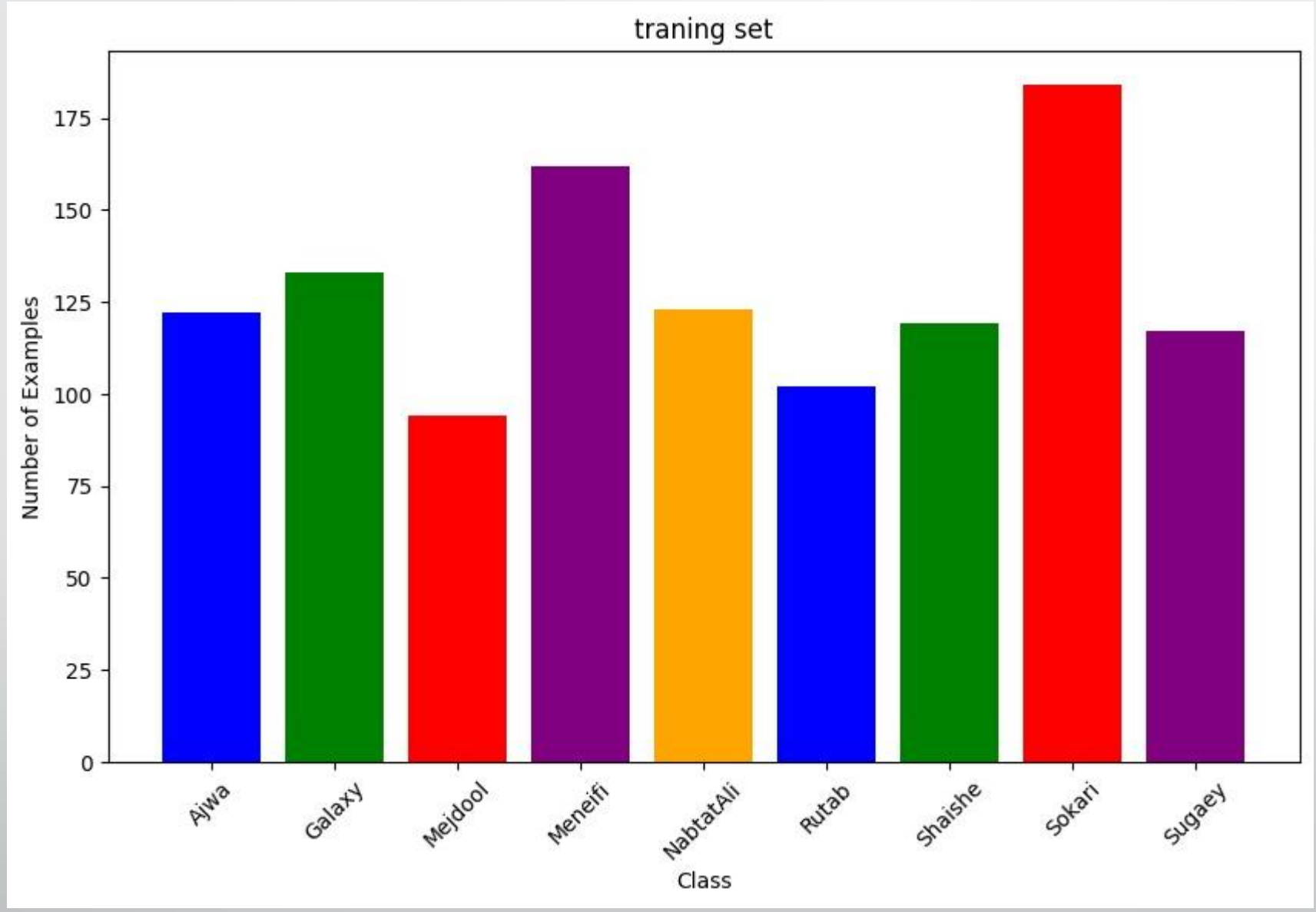
NabtatAli

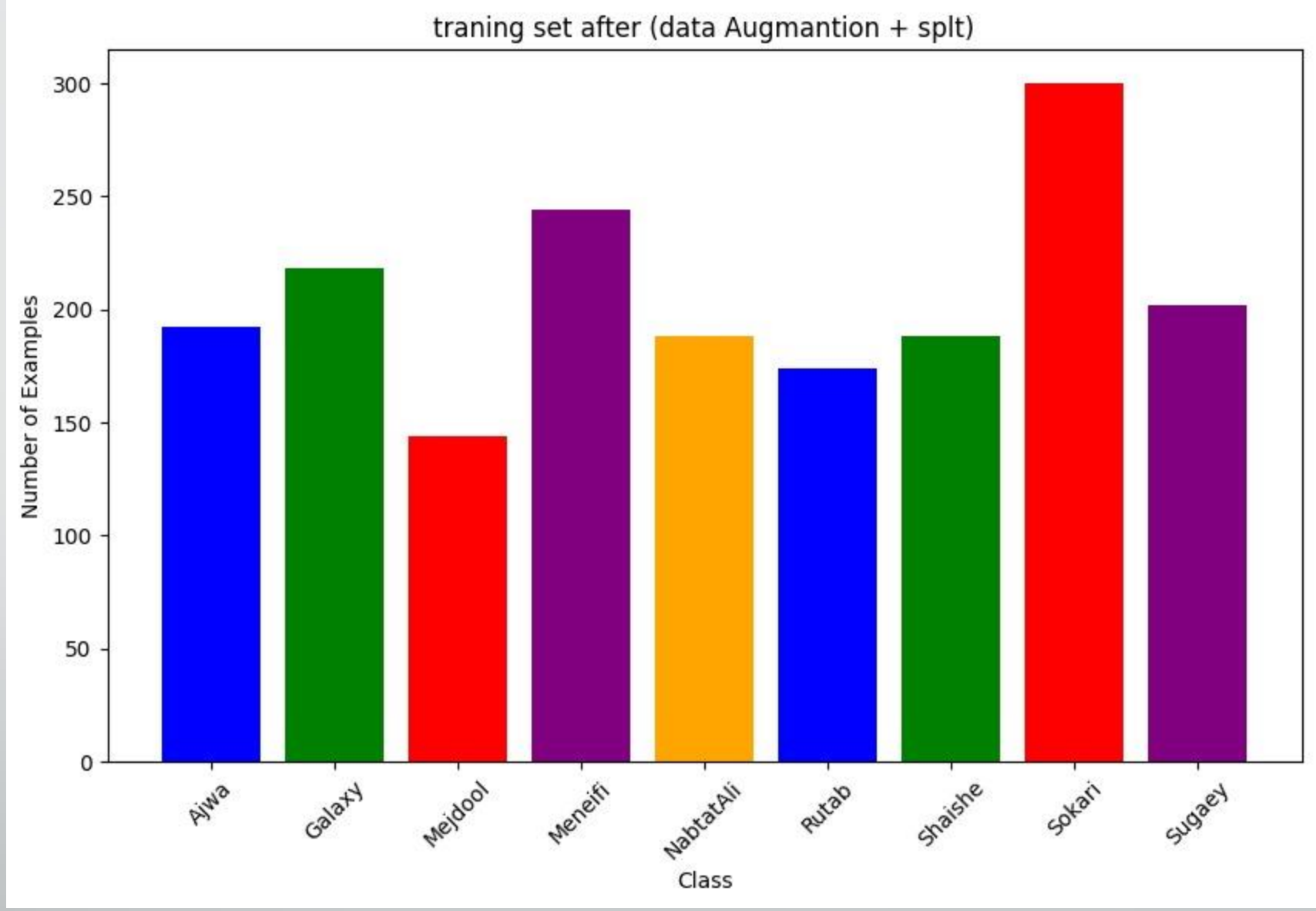
Rutab

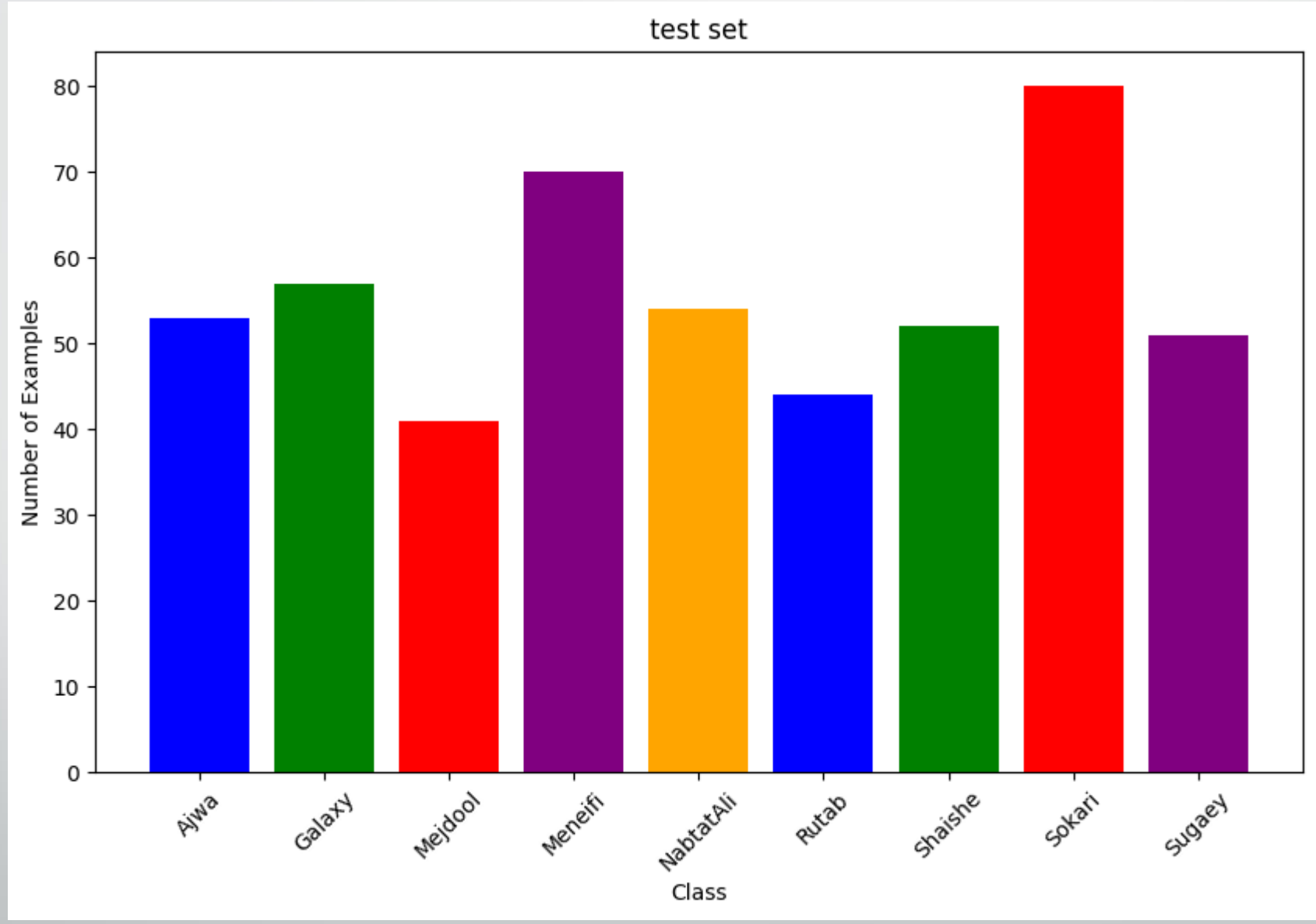
Shaishe

Sokari

Sugaey


traning set
Number of Examples
0
25
50
75
100
125
150
175
Ajwa
Galaxy
Mejdool
Meneifi
NabtatAli
Rutab
Shaishe
Sokari
Sugaey
Class


traning set after (data Augmantion + splt)
Number of Examples
0
50
100
150
200
250
300
Ajwa
Galaxy
Mejdool
Meneifi
NabtatAli
Rutab
Shaishe
Sokari
Sugaey
Class


test set
Number of Examples
0
10
20
30
40
50
60
70
80
Ajwa
Galaxy
Mejdool
Meneifi
NabtatAli
Rutab
Shaishe
Sokari
Sugaey
Class

Methodology

- Pre-trained Model: Utilized a pre-trained Convolutional Neural Network (CNN) architecture which is MobileNet V2.
- Fine-tuning: Adapted the pre-trained model to date fruit classification by fine-tuning certain layers on our dataset.
- Custom Classification Layer: Added a final classification layer to the network for identifying date fruit classes.
- Data Preprocessing: Rescaled and resized images to a standard format of (224, 224, 3) pixels.
- Data Augmentation: Applied random flip, rotation, zoom, and translation to increase dataset diversity and improve model generalization.

optimizer and its hyperparameters

Adam: is a smart optimizer for training neural networks. It adjusts how fast the model learns from the data, helping it find the best solution quickly.

Hyperparameter:

Learning Rate: Default value of 0.001

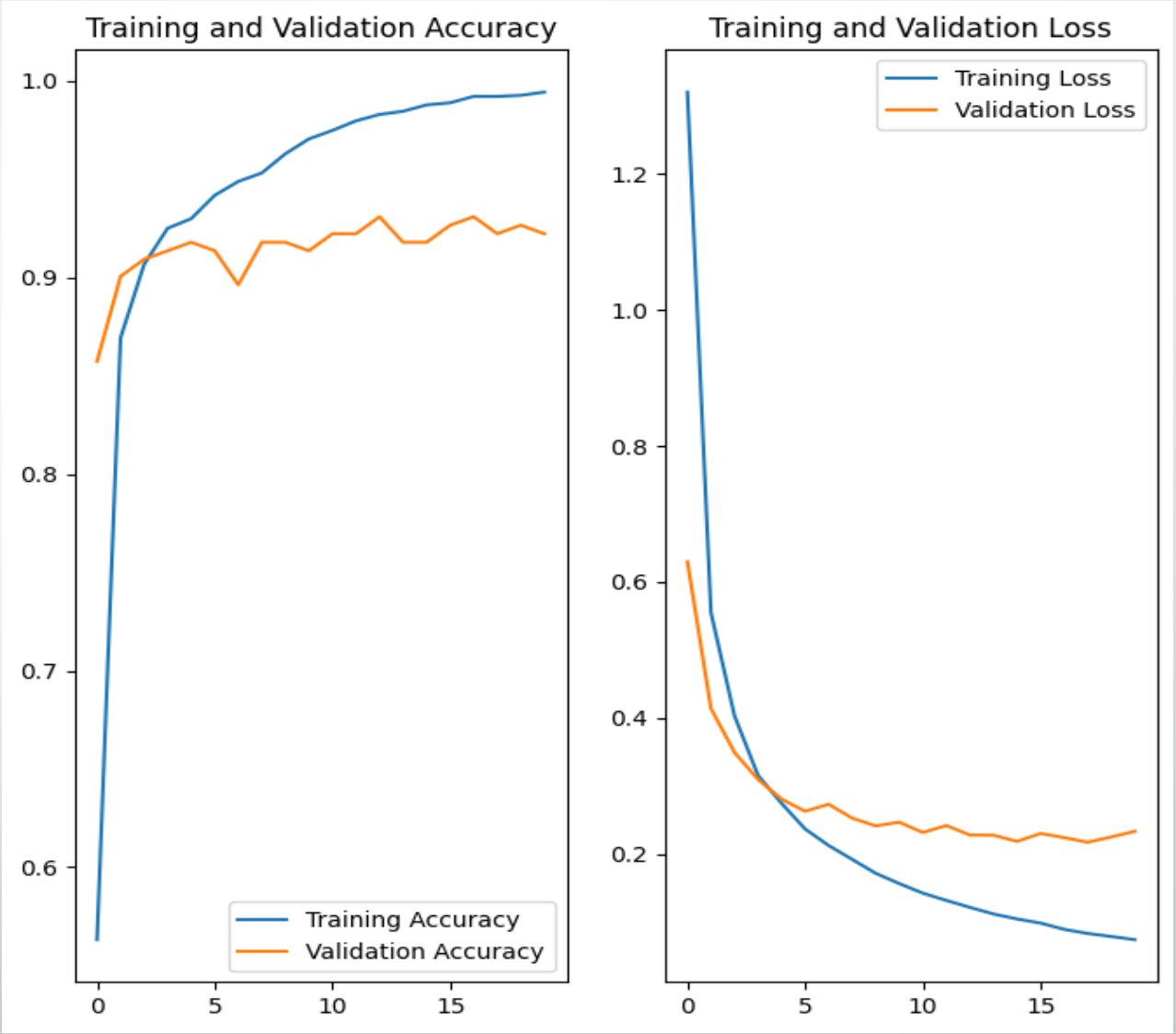
Beta Parameters (β1 and β2): default values are 0.9 and 0.99,respectively

Epsilon: set to 1e-7 by default.

The loss function: sparse categorical cross entropy

Epouch and the performance durning training

Epouch = 20



Evaluation:

Performance:
Accuracy: 0.94
f1-score: 0,94

Time to train: 27 min

Time to predict: 0.2349684s

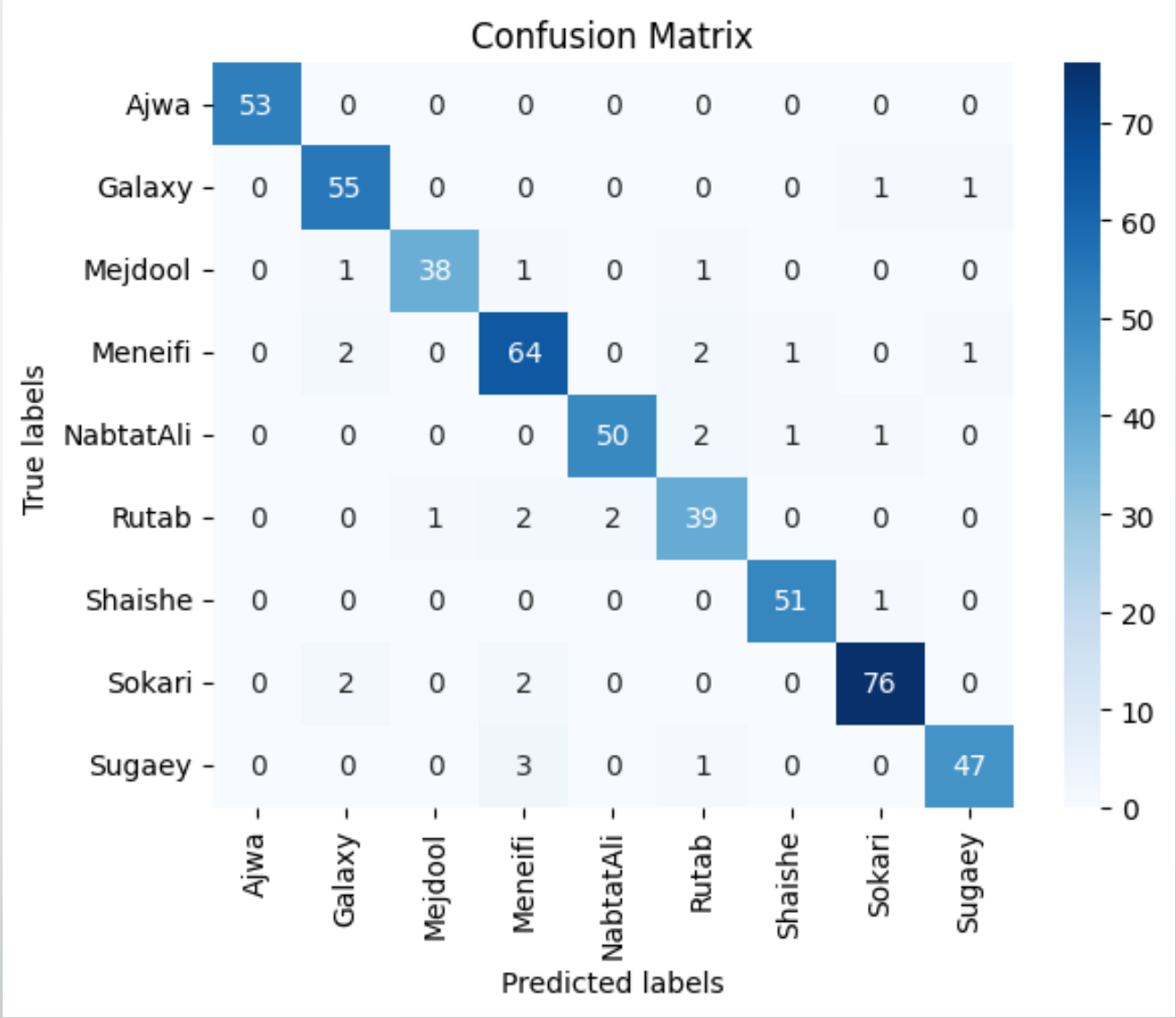
Performance

Classfication Report:

	precision	recall	f1-score	support
Ajwa	1.00	1.00	1.00	53
Galaxy	0.92	0.96	0.94	57
Mejdool	0.97	0.93	0.95	41
Meneifi	0.89	0.91	0.90	70
NabtatAli	0.96	0.93	0.94	54
Rutab	0.87	0.89	0.88	44
Shaishe	0.96	0.98	0.97	52
Sokari	0.96	0.95	0.96	80
Sugaey	0.96	0.92	0.94	51
accuracy			0.94	502
macro avg	0.94	0.94	0.94	502
weighted avg	0.94	0.94	0.94	502

Performance:

Confusion matrix :



Challenges and Learnings:

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Learning :

- How to use tenserflow
- how to build a neural network
- How to load the images in tenserflow and use it
- How to apply the transfer learning

Conclusion:

Summirization of the project :

1. data preprocessing by applying both data Augmentation and rescaling
2. Build the model using pre-trained model (mobilenet_v2)
3. We used different matrices to evaluate the performance of our model (F1-score, Accuracy)

Conclusion:

Future improvement:

1- **Preprocessing Enhancements:** Explore additional preprocessing techniques to further improve the quality and diversity of the dataset.

2- **Neural Network Architecture Improvements:** Investigate alternative neural network architectures to find the most suitable model for the task

Thank you

Any Questions?