My_Own_Model

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1 Grapevine leaves classification, my own model part

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1.1 Environment Initialization

[ ]:

```
#Loading General Tools and Libraries
import os
import random
import shutil
import sklearn
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
import tensorflow as tf
import tensorflow_datasets as tfds
from tensorflow import keras
from keras import layers
plt.style.use('ggplot')
```

1.2 Data Loading

1.2.1 Data Downloading

[ ]:

```
#Loading Dataset
!rm -rf Grapevine_Leaves_Image_Dataset*
!rm -rf Test_Data
!wget https://www.muratkoklu.com/datasets/Grapevine_Leaves_Image_Dataset.zip
!unzip -q Grapevine_Leaves_Image_Dataset.zip
!rm Grapevine_Leaves_Image_Dataset.zip
!ls -lh
```

```
--2022-08-06 06:26:31--
https://www.muratkoklu.com/datasets/Grapevine_Leaves_Image_Dataset.zip
Resolving www.muratkoklu.com (www.muratkoklu.com)… 185.179.25.150
Connecting to www.muratkoklu.com (www.muratkoklu.com)|185.179.25.150|:443…
```

```
connected.
HTTP request sent, awaiting response… 200 OK
Length: 113862245 (109M) [application/zip]
Saving to: ‘Grapevine_Leaves_Image_Dataset.zip’

Grapevine_Leaves_Im 100%[===================>] 108.59M  20.7MB/s    in 6.3s

2022-08-06 06:26:38 (17.4 MB/s) - ‘Grapevine_Leaves_Image_Dataset.zip’ saved
[113862245/113862245]

total 8.0K
drwxr-xr-x 7 root root 4.0K Feb 11 17:53 Grapevine_Leaves_Image_Dataset
drwxr-xr-x 1 root root 4.0K Aug  3 20:21 sample_data
```

1.2.2 Select and Move 20% of Data for OOS (Out Of Sample) Testing

[ ]:

```python
Species = ["Ak", "Ala_Idris", "Buzgulu", "Dimnit", "Nazli"]
OriginalDataPath = "Grapevine_Leaves_Image_Dataset"
TestDataPath = "Test_Data"
os.mkdir(os.path.join(TestDataPath,""))

for folder_name in Species:
  Percentage = 20/100
  Test_location = os.path.join(TestDataPath,folder_name)
  os.mkdir(Test_location)
  Original_location = os.path.join(OriginalDataPath, folder_name)
  AllImages = os.listdir(Original_location)
  Count = int(Percentage * len(AllImages))
  Selecteds = random.sample(AllImages, Count)
  for file in Selecteds:
    shutil.move(os.path.join(Original_location,file), Test_location)
```

1.2.3 Datasets Loading (Train, Validation, and Test)

[ ]:

```python
image_size = (256,256)
batch_size = 32
validation_split = 0.2
seed = 199

train_data = tf.keras.utils.image_dataset_from_directory(
    'Grapevine_Leaves_Image_Dataset',
    class_names = ["Ak", "Ala_Idris", "Buzgulu", "Dimnit", "Nazli"],
    batch_size=batch_size,
    image_size=image_size,
    seed=seed,
    validation_split=validation_split,
    subset="training"
)

validation_data = tf.keras.utils.image_dataset_from_directory(
    'Grapevine_Leaves_Image_Dataset',
    class_names = ["Ak", "Ala_Idris", "Buzgulu", "Dimnit", "Nazli"],
    batch_size=batch_size,
    image_size=image_size,
    seed=seed,
    validation_split=validation_split,
    subset="validation"
)

test_data = tf.keras.utils.image_dataset_from_directory(
    'Test_Data',
    class_names = ["Ak", "Ala_Idris", "Buzgulu", "Dimnit", "Nazli"],
    image_size=image_size,
    batch_size=100,
    shuffle=False)
```

```
Found 400 files belonging to 5 classes.
Using 320 files for training.
Found 400 files belonging to 5 classes.
Using 80 files for validation.
Found 100 files belonging to 5 classes.
```

1.3 Data Augmentation

1.3.1 Color Transformation

[ ]:
```
train_data2 = train_data.map(lambda x, y: (255-x, y))
validation_data2 = validation_data.map(lambda x, y: (255-x, y))
test_data2 = test_data.map(lambda x, y: (255-x, y))
```

1.3.2 Data Augmentation

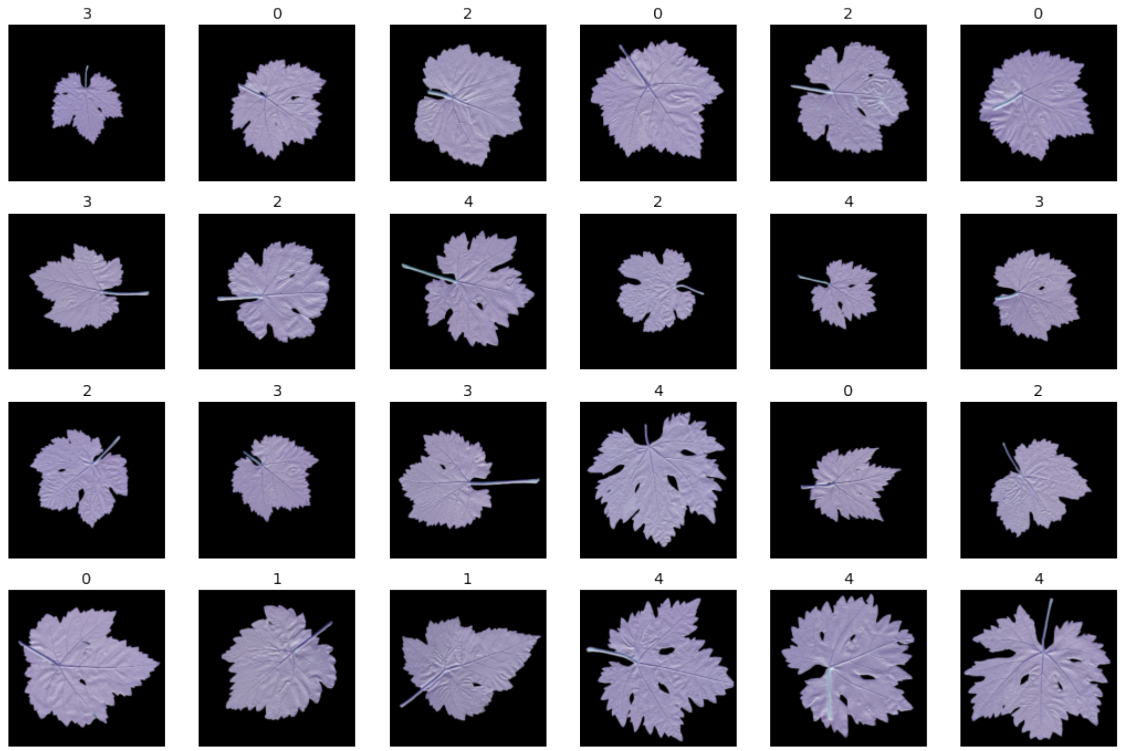
[ ]:
```
data_augmentation = keras.Sequential([
    layers.RandomFlip("horizontal"),
    layers.RandomFlip("vertical"),
    layers.RandomZoom(height_factor=(-0.2,0.2), width_factor=(-0.2,0.
 ↪2),fill_mode='constant', fill_value=0),
    layers.RandomRotation(0.3, fill_mode='constant', fill_value=0)
])

augmented_train_data = train_data2
for i in range(4):
  augmented_train_data = augmented_train_data.concatenate(train_data2.
 ↪map(lambda x, y: (data_augmentation(x, training=True), y)))
```

1.3.3 Showing a random sample

[ ]:

```
plt.figure(figsize=(18, 12))
for images, labels in augmented_train_data.take(1):
    for i in range(24):
        ax = plt.subplot(4, 6, i + 1)
        plt.imshow(images[i].numpy().astype("uint8"))
        plt.title(int(labels[i]))
        plt.axis("off")
```



1.4 My own Convolutional neural network Model

1.4.1 Model Architecture Define

[ ]:

```
MyOwnModel = keras.models.Sequential([
    layers.RandomRotation(0.1, fill_mode='constant', fill_value=0,␣
 ↪input_shape=image_size + (3,)),
    layers.RandomFlip("horizontal"),
    layers.RandomFlip("vertical"),
    layers.Conv2D(16, (3, 3), activation='relu'),
    layers.MaxPooling2D(2, 2),
    layers.Conv2D(32, (3, 3), activation='relu'),
    layers.MaxPooling2D(2, 2),
    layers.Conv2D(64, (3, 3), activation='relu'),
    layers.MaxPooling2D(2, 2),
    layers.Conv2D(128, (3, 3), activation='relu'),
    layers.MaxPooling2D(2, 2),
    layers.Conv2D(256, (3, 3), activation='relu'),
    layers.MaxPooling2D(2,2),
    layers.Conv2D(512, (3, 3), activation='relu'),
    layers.MaxPooling2D(2,2),
    layers.Flatten(),
    layers.Dense(1024, activation='relu'),
    layers.Dense(512, activation='relu'),
    layers.Dense(256, activation='relu'),
    layers.Dense(128, activation='relu'),
    layers.Dense(5, activation='softmax')
])
MyOwnModel.summary()
```

```
Model: "sequential_1"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 random_rotation_1 (RandomRo  (None, 256, 256, 3)      0
 tation)

 random_flip_2 (RandomFlip)  (None, 256, 256, 3)       0

 random_flip_3 (RandomFlip)  (None, 256, 256, 3)       0

 conv2d (Conv2D)             (None, 254, 254, 16)      448

 max_pooling2d (MaxPooling2D  (None, 127, 127, 16)     0
 )

 conv2d_1 (Conv2D)           (None, 125, 125, 32)      4640

 max_pooling2d_1 (MaxPooling  (None, 62, 62, 32)       0
 2D)

 conv2d_2 (Conv2D)           (None, 60, 60, 64)        18496

 max_pooling2d_2 (MaxPooling  (None, 30, 30, 64)       0
 2D)

 conv2d_3 (Conv2D)           (None, 28, 28, 128)       73856

 max_pooling2d_3 (MaxPooling  (None, 14, 14, 128)      0
 2D)

 conv2d_4 (Conv2D)           (None, 12, 12, 256)       295168
 max_pooling2d_4 (MaxPooling  (None, 6, 6, 256)        0
 2D)

 conv2d_5 (Conv2D)           (None, 4, 4, 512)         1180160

 max_pooling2d_5 (MaxPooling  (None, 2, 2, 512)        0
 2D)

 flatten (Flatten)           (None, 2048)              0

 dense (Dense)               (None, 1024)              2098176

 dense_1 (Dense)             (None, 512)               524800

 dense_2 (Dense)             (None, 256)               131328

 dense_3 (Dense)             (None, 128)               32896

 dense_4 (Dense)             (None, 5)                 645

=================================================================
Total params: 4,360,613
Trainable params: 4,360,613
Non-trainable params: 0
_________________________________________________________________
```

1.4.2 Model Creation and Training

[ ]:

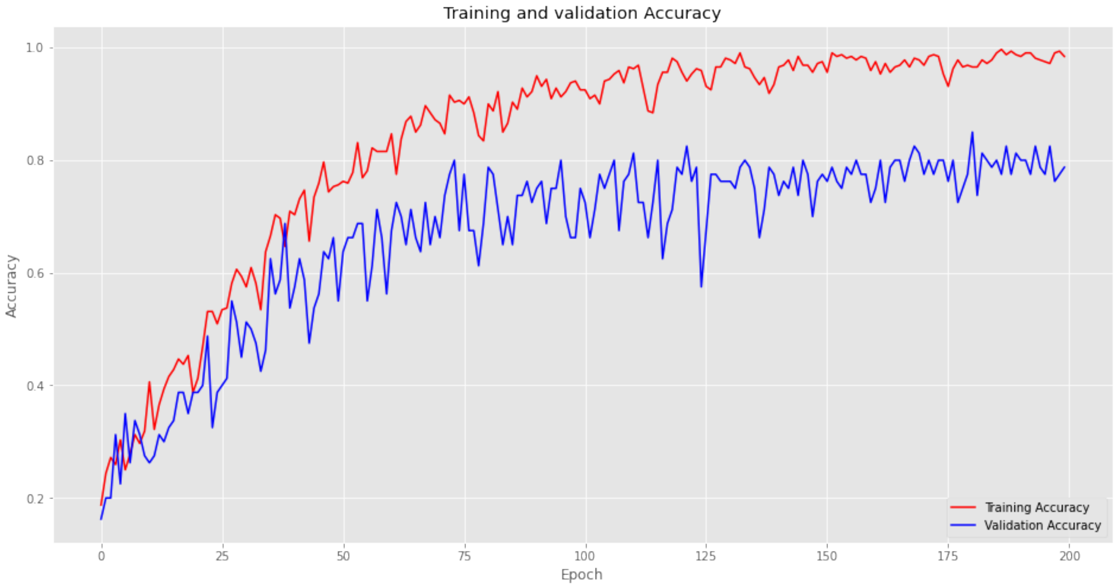
```
MyOwnModel.compile(
    optimizer=keras.optimizers.Adam(2*1e-4),
    loss=tf.keras.losses.SparseCategoricalCrossentropy(),
    metrics=["accuracy"],
)
epochs = 200
history_myown = MyOwnModel.fit(
    train_data2, epochs=epochs,
    validation_data=validation_data2)
MyOwnModel.save('MyOwnModel.h5')
```

1.4.3 Accuracy Curve

[ ]:

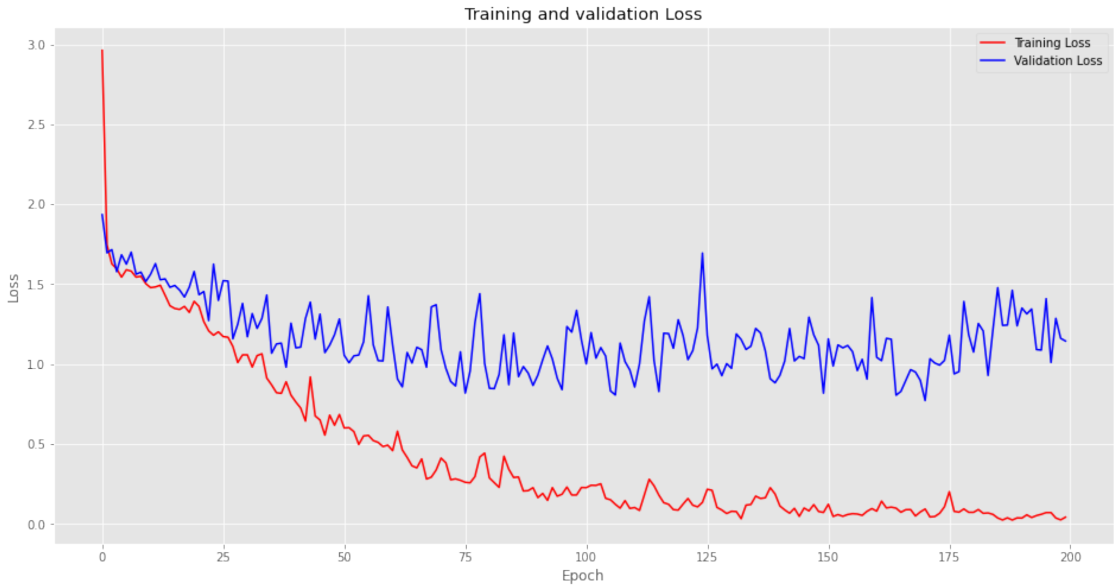
```
MyOwnModel_acc=history_myown.history['accuracy']
MyOwnModel_val_acc=history_myown.history['val_accuracy']
MyOwnModel_loss=history_myown.history['loss']
MyOwnModel_val_loss=history_myown.history['val_loss']
epochs=range(len(MyOwnModel_acc))
```

```
fig = plt.figure(figsize=(16,8))
plt.plot(epochs, MyOwnModel_acc, 'r', label="Training Accuracy")
plt.plot(epochs, MyOwnModel_val_acc, 'b', label="Validation Accuracy")
plt.xlabel('Epoch')
plt.ylabel('Accuracy')
plt.title('Training and validation Accuracy')
plt.legend(loc='lower right')
plt.show()
```



1.4.4 Loss Curve

[ ]:
```
fig2 = plt.figure(figsize=(16,8))
plt.plot(epochs, MyOwnModel_loss, 'r', label="Training Loss")
plt.plot(epochs, MyOwnModel_val_loss, 'b', label="Validation Loss")
plt.legend(loc='upper right')
plt.xlabel('Epoch')
plt.ylabel('Loss')
plt.title('Training and validation Loss')
plt.show()
```



1.4.5 Model Performance Evaluation on Test Data

[ ]:
```
from sklearn.metrics import␣
  ↪accuracy_score,classification_report,confusion_matrix
result = MyOwnModel.predict(test_data2)
y_test = np.concatenate([y for x, y in test_data2], axis=0)
MyOwnModel_y_predict = np.array([i.argmax() for i in result])

MyOwnModel_cm = confusion_matrix(y_test, MyOwnModel_y_predict)
MyOwnModel_ac = accuracy_score(y_test,MyOwnModel_y_predict)

print("confusion matrix on test data :\n",MyOwnModel_cm)
print("accuracy score on test data:\n",MyOwnModel_ac)

print(classification_report(y_test, MyOwnModel_y_predict))
```

```
confusion matrix on test data :
 [[14  3  0  3  0]
 [ 2 15  0  2  1]
 [ 1  1 14  3  1]
 [ 0  2  0 17  1]
 [ 0  0  0  0 20]]
accuracy score on test data:
 0.8
              precision    recall  f1-score   support

           0       0.82      0.70      0.76        20
           1       0.71      0.75      0.73        20
           2       1.00      0.70      0.82        20
           3       0.68      0.85      0.76        20
           4       0.87      1.00      0.93        20

    accuracy                           0.80       100
   macro avg       0.82      0.80      0.80       100
weighted avg       0.82      0.80      0.80       100
```

[ ]: