Data Preprocessing & ready the datset

```
!pip install tensorflow
```

```
Defaulting to user installation because normal site-packages is not writeable
Requirement already satisfied: tensorflow in c:\users\bariu\appdata\roaming\python\python311\si
Requirement already satisfied: tensorflow-intel==2.14.0 in c:\users\bariu\appdata\roaming\pytho
Requirement already satisfied: absl-py>=1.0.0 in c:\users\bariu\appdata\roaming\python\python31
Requirement already satisfied: astunparse>=1.6.0 in c:\users\bariu\appdata\roaming\python\pytho
Requirement already satisfied: flatbuffers>=23.5.26 in c:\users\bariu\appdata\roaming\python\py
Requirement already satisfied: gast!=0.5.0,!=0.5.1,!=0.5.2,>=0.2.1 in c:\users\bariu\appdata\ro
Requirement already satisfied: google-pasta>=0.1.1 in c:\users\bariu\appdata\roaming\python\pyt
Requirement already satisfied: h5py>=2.9.0 in c:\programdata\anaconda3\lib\site-packages (from
Requirement already satisfied: libclang>=13.0.0 in c:\users\bariu\appdata\roaming\python\python
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Requirement already satisfied: packaging in c:\programdata\anaconda3\lib\site-packages (from te
Requirement already satisfied: protobuf!=4.21.0,!=4.21.1,!=4.21.2,!=4.21.3,!=4.21.4,!=4.21.5,<5
Requirement already satisfied: setuptools in c:\programdata\anaconda3\lib\site-packages (from t
Requirement already satisfied: six>=1.12.0 in c:\programdata\anaconda3\lib\site-packages (from
Requirement already satisfied: termcolor>=1.1.0 in c:\users\bariu\appdata\roaming\python\python
Requirement already satisfied: typing-extensions>=3.6.6 in c:\programdata\anaconda3\lib\site-pa
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Requirement already satisfied: tensorflow-io-gcs-filesystem>=0.23.1 in c:\users\bariu\appdata\r
Requirement already satisfied: grpcio<2.0,>=1.24.3 in c:\users\bariu\appdata\roaming\python\pyt
Requirement already satisfied: tensorboard<2.15,>=2.14 in c:\users\bariu\appdata\roaming\python
Requirement already satisfied: tensorflow-estimator<2.15,>=2.14.0 in c:\users\bariu\appdata\roa
Requirement already satisfied: keras<2.15,>=2.14.0 in c:\users\bariu\appdata\roaming\python\pyt
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Requirement already satisfied: google-auth-oauthlib<1.1,>=0.5 in c:\users\bariu\appdata\roaming
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Requirement already satisfied: requests<3,>=2.21.0 in c:\programdata\anaconda3\lib\site-package
Requirement already satisfied: tensorboard-data-server<0.8.0,>=0.7.0 in c:\users\bariu\appdata\
Requirement already satisfied: werkzeug>=1.0.1 in c:\programdata\anaconda3\lib\site-packages (f
Requirement already satisfied: cachetools<6.0,>=2.0.0 in c:\users\bariu\appdata\roaming\python\
Requirement already satisfied: pyasn1-modules>=0.2.1 in c:\programdata\anaconda3\lib\site-packa
Requirement already satisfied: rsa<5,>=3.1.4 in c:\users\bariu\appdata\roaming\python\python311
Requirement already satisfied: requests-oauthlib>=0.7.0 in c:\users\bariu\appdata\roaming\pytho
Requirement already satisfied: charset-normalizer<4,>=2 in c:\programdata\anaconda3\lib\site-pa
Requirement already satisfied: idna<4,>=2.5 in c:\programdata\anaconda3\lib\site-packages (from
Requirement already satisfied: urllib3<3,>=1.21.1 in c:\programdata\anaconda3\lib\site-packages
Requirement already satisfied: certifi>=2017.4.17 in c:\programdata\anaconda3\lib\site-packages
Requirement already satisfied: MarkupSafe>=2.1.1 in c:\programdata\anaconda3\lib\site-packages
Requirement already satisfied: pyasn1<0.5.0,>=0.4.6 in c:\programdata\anaconda3\lib\site-packag
Requirement already satisfied: oauthlib>=3.0.0 in c:\users\bariu\appdata\roaming\python\python3
```

```python
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import tensorflow as tf

from tensorflow import keras
from tensorflow.keras import layers
```

```python
import os

# Specify the path to your dataset using an absolute path
data_train_path = os.path.abspath("C:\\Users\\bariu\\Python\\Image_Classification\\Fruits_Vegetables\\train")
data_test_path = os.path.abspath("C:\\Users\\bariu\\Python\\Image_Classification\\Fruits_Vegetables\\test")
data_val_path = os.path.abspath("C:\\Users\\bariu\\Python\\Image_Classification\\Fruits_Vegetables\\validation")
```

```python
# data_train_path = 'Python/Image_Classification/Fruits_Vegetables/train'
# data_train_test ='Python/Image_Classification/Fruits_Vegetables/test'
# data_train_val = 'Python/Image_Classification/Fruits_Vegetables/validation'
```

set our images in similar size(fixed width & fixed height

```python
img_width = 180
img_height = 180
```

The tf.keras.utils.image_dataset_from_directory function is a convenient way to load image data from a directory structure and convert it into a TensorFlow dataset, which can be used for training machine learning models. This function handles various aspects such as reading images, resizing, shuffling, and batching, making it suitable for image classification tasks.

```python
data_train = tf.keras.utils.image_dataset_from_directory(
    data_train_path,
    shuffle=True,
    image_size=(img_width, img_height),
    batch_size=32,
    validation_split=False)
```

```
Found 3115 files belonging to 36 classes.
```

Show class_Name by this function and keep that function in a variable for later use

```python
data_cat=data_train.class_names
```

```python
data_cat
```

```
['apple',
 'banana',
 'beetroot',
 'bell pepper',
 'cabbage',
 'capsicum',
 'carrot',
 'cauliflower',
 'chilli pepper',
 'corn',
 'cucumber',
 'eggplant',
 'garlic',
 'ginger',
 'grapes',
 'jalepeno',
 'kiwi',
 'lemon',
 'lettuce',
 'mango',
 'onion',
 'orange',
 'paprika',
 'pear',
 'peas',
 'pineapple',
 'pomegranate',
 'potato',
 'raddish',
 'soy beans',
 'spinach',
 'sweetcorn',
 'sweetpotato',
 'tomato',
 'turnip',
 'watermelon']
```

```python
data_val = tf.keras.utils.image_dataset_from_directory(data_val_path,
                                                       image_size=(img_height, img_width),
                                                       batch_size=32,
                                                       shuffle=False,
                                                       validation_split=False)
```

```
Found 351 files belonging to 36 classes.
```

```python
data_test = tf.keras.utils.image_dataset_from_directory(data_test_path,
                                                        image_size=(img_height, img_width),
                                                        shuffle=False,
                                                        batch_size=32,
                                                        validation_split=False)
```

```
Found 359 files belonging to 36 classes.
```

Let's print some images from training dataset

```python
plt.figure(figsize=(10,10))
for image, labels in data_train.take(1):
    for i in range(9):
        plt.subplot(3,3,i+1)
        plt.imshow(image[i].numpy().astype('uint8'))
        plt.title(data_cat[labels[i]])
        plt.axis('off')
```

model creation

create layers within model

```python
from tensorflow.keras.models import Sequential
```

```python
data_train
```

```
<_PrefetchDataset element_spec=(TensorSpec(shape=(None, 180, 180, 3), dtype=tf.float32, name=No
```

```python
model = Sequential([
    layers.Rescaling(1./255),
    layers.Conv2D(16,3, padding='same', activation='relu'),
    layers.MaxPooling2D(),
    layers.Conv2D(32,3,padding='same',activation='relu'),
    layers.MaxPooling2D(),
    layers.Conv2D(64,3,padding='same',activation='relu'),
    layers.MaxPooling2D(),
    layers.Flatten(),
    layers.Dropout(0.2),
    layers.Dense(128),
    layers.Dense(len(data_cat))

])
```

already model has been created now model compiling

```python
model.compile(optimizer='adam',loss=tf.keras.losses.SparseCategoricalCrossentropy(from_logits=True),metrics=['ac
```

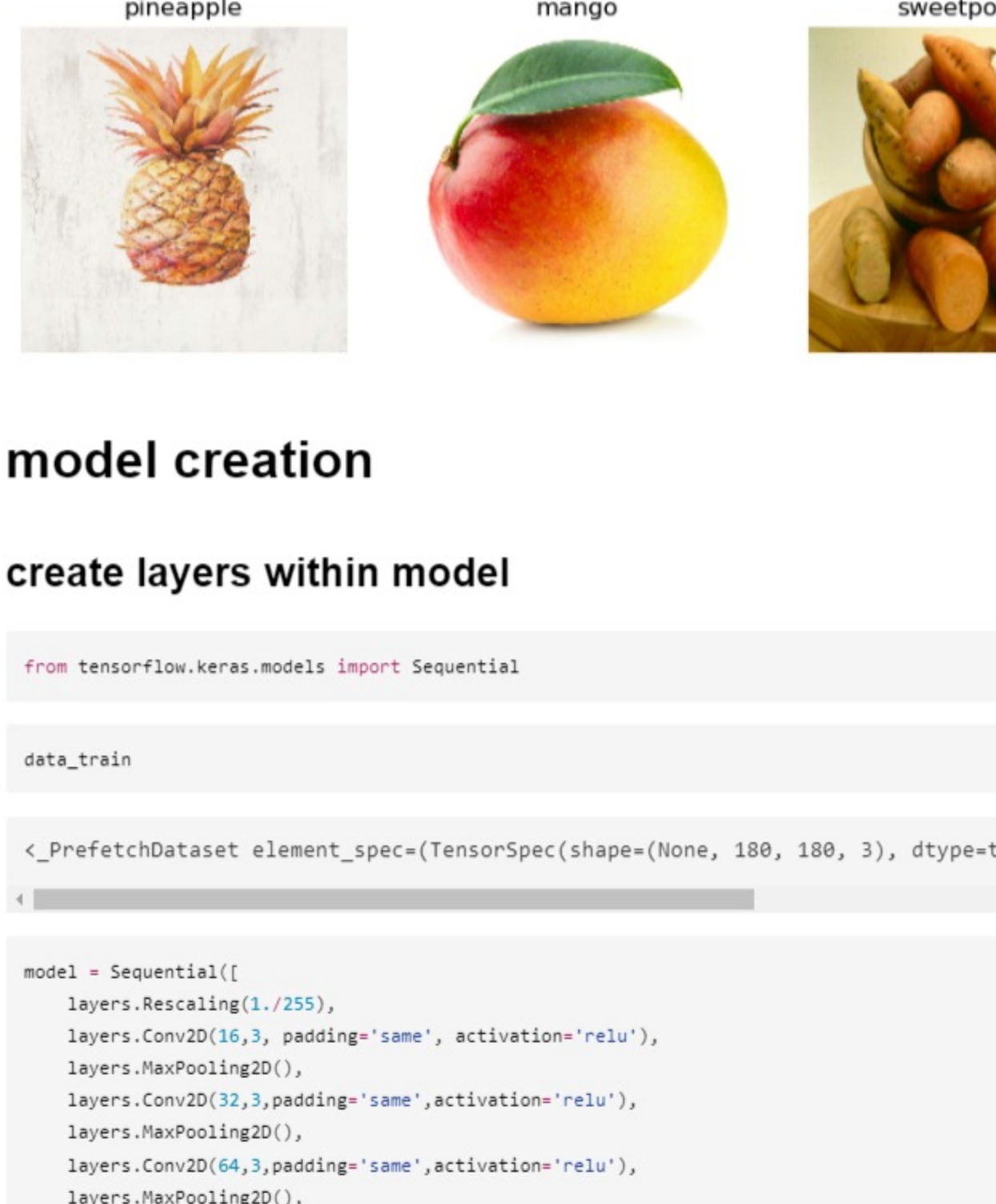
```python
epochs_size = 25
history = model.fit(data_train, validation_data=data_val, epochs=epochs_size)
```

```
Epoch 1/25
98/98 [==============================] - 116s 1s/step - loss: 3.2249 - accuracy: 0.1230 - val_l
Epoch 2/25
98/98 [==============================] - 95s 888ms/step - loss: 2.3506 - accuracy: 0.3316 - val_
Epoch 3/25
98/98 [==============================] - 75s 728ms/step - loss: 1.8370 - accuracy: 0.4700 - val_
Epoch 4/25
98/98 [==============================] - 84s 818ms/step - loss: 1.2253 - accuracy: 0.6523 - val_
Epoch 5/25
98/98 [==============================] - 88s 853ms/step - loss: 0.6061 - accuracy: 0.8289 - val_
Epoch 6/25
98/98 [==============================] - 97s 957ms/step - loss: 0.3303 - accuracy: 0.9101 - val_
Epoch 7/25
98/98 [==============================] - 119s 1s/step - loss: 0.2175 - accuracy: 0.9435 - val_l
Epoch 8/25
98/98 [==============================] - 122s 1s/step - loss: 0.1681 - accuracy: 0.9647 - val_l
Epoch 9/25
98/98 [==============================] - 121s 1s/step - loss: 0.1103 - accuracy: 0.9775 - val_l
Epoch 10/25
98/98 [==============================] - 84s 819ms/step - loss: 0.1144 - accuracy: 0.9807 - val_
Epoch 11/25
98/98 [==============================] - 97s 954ms/step - loss: 0.0773 - accuracy: 0.9865 - val_
Epoch 12/25
98/98 [==============================] - 107s 1s/step - loss: 0.0911 - accuracy: 0.9856 - val_l
Epoch 13/25
98/98 [==============================] - 104s 1s/step - loss: 0.0673 - accuracy: 0.9872 - val_l
Epoch 14/25
98/98 [==============================] - 102s 996ms/step - loss: 0.0728 - accuracy: 0.9852 - va
Epoch 15/25
98/98 [==============================] - 102s 992ms/step - loss: 0.0569 - accuracy: 0.9878 - va
Epoch 16/25
98/98 [==============================] - 102s 996ms/step - loss: 0.0522 - accuracy: 0.9888 - va
Epoch 17/25
98/98 [==============================] - 102s 987ms/step - loss: 0.0564 - accuracy: 0.9894 - va
Epoch 18/25
98/98 [==============================] - 102s 1000ms/step - loss: 0.0544 - accuracy: 0.9891 - v
Epoch 19/25
98/98 [==============================] - 104s 1s/step - loss: 0.0518 - accuracy: 0.9884 - val_l
Epoch 20/25
98/98 [==============================] - 106s 1s/step - loss: 0.0403 - accuracy: 0.9897 - val_l
Epoch 21/25
98/98 [==============================] - 101s 984ms/step - loss: 0.0512 - accuracy: 0.9888 - va
Epoch 22/25
98/98 [==============================] - 102s 994ms/step - loss: 0.0455 - accuracy: 0.9878 - va
Epoch 23/25
98/98 [==============================] - 103s 998ms/step - loss: 0.0379 - accuracy: 0.9891 - va
Epoch 24/25
98/98 [==============================] - 103s 998ms/step - loss: 0.0418 - accuracy: 0.9891 - va
Epoch 25/25
98/98 [==============================] - 103s 1s/step - loss: 0.0371 - accuracy: 0.9900 - val_l
```

```python
epochs_size = 25
epochs_range = range(epochs_size)
plt.figure(figsize=(8,8))
plt.subplot(1,2,1)
plt.plot(epochs_range,history.history['accuracy'], label='Training Accuracy')
plt.plot(epochs_range,history.history['val_accuracy'], label='Validation Accuracy')
plt.title('Accuracy')

plt.subplot(1,2,2)
plt.plot(epochs_range,history.history['loss'], label='Training Loss')
plt.plot(epochs_range,history.history['val_loss'], label='Validation Loss')
plt.title('Loss')
```

```
Text(0.5, 1.0, 'Loss')
```



Now let's print the summary of the model

```python
model.summary()
```

```
Model: "sequential_1"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 rescaling_1 (Rescaling)     (None, 180, 180, 3)       0

 conv2d_3 (Conv2D)           (None, 180, 180, 16)      448

 max_pooling2d_3 (MaxPoolin  (None, 90, 90, 16)        0
 g2D)

 conv2d_4 (Conv2D)           (None, 90, 90, 32)        4640

 max_pooling2d_4 (MaxPoolin  (None, 45, 45, 32)        0
 g2D)

 conv2d_5 (Conv2D)           (None, 45, 45, 64)        18496

 max_pooling2d_5 (MaxPoolin  (None, 22, 22, 64)        0
 g2D)

 flatten_1 (Flatten)         (None, 30976)             0

 dropout_1 (Dropout)         (None, 30976)             0

 dense_2 (Dense)             (None, 128)               3965056

 dense_3 (Dense)             (None, 36)                4644

=================================================================
Total params: 3993284 (15.23 MB)
Trainable params: 3993284 (15.23 MB)
Non-trainable params: 0 (0.00 Byte)
_________________________________________________________________
```

Predictiong Value from model

```python
image = "C:\\Users\\bariu\\Python\\Image_Classification\\apple.jpg"
image = tf.keras.utils.load_img(image,target_size= (img_height,img_width))
img_arr = tf.keras.utils.array_to_img(image)
img_bat = tf.expand_dims(img_arr,0)
```

```python
predict = model.predict(img_bat)
```

```
1/1 [==============================] - 0s 26ms/step
```

```python
score = tf.nn.softmax(predict)
```

```python
print('Veg/Fruit in image is {} with accuracy of {:0.2f}' .format(data_cat[np.argmax(score)],np.max(score)*100))
```

```
Veg/Fruit in image is apple with accuracy of 99.99
```

```python
model.save('Image_classify.keras')
```