

Sprint – III

Model building

Team ID	PNT2022TMID21298
Project Name	Natural Disasters Intensity Analysis and Classification using Artificial Intelligence

Extract zip file

ZIP is an archive file format that supports lossless data compression. By lossless compression, we mean that the compression algorithm allows the original data to be perfectly reconstructed from the compressed data.

```
#extract zip file

!unzip '/content/drive/MyDrive/IBM/dataset.zip'
```

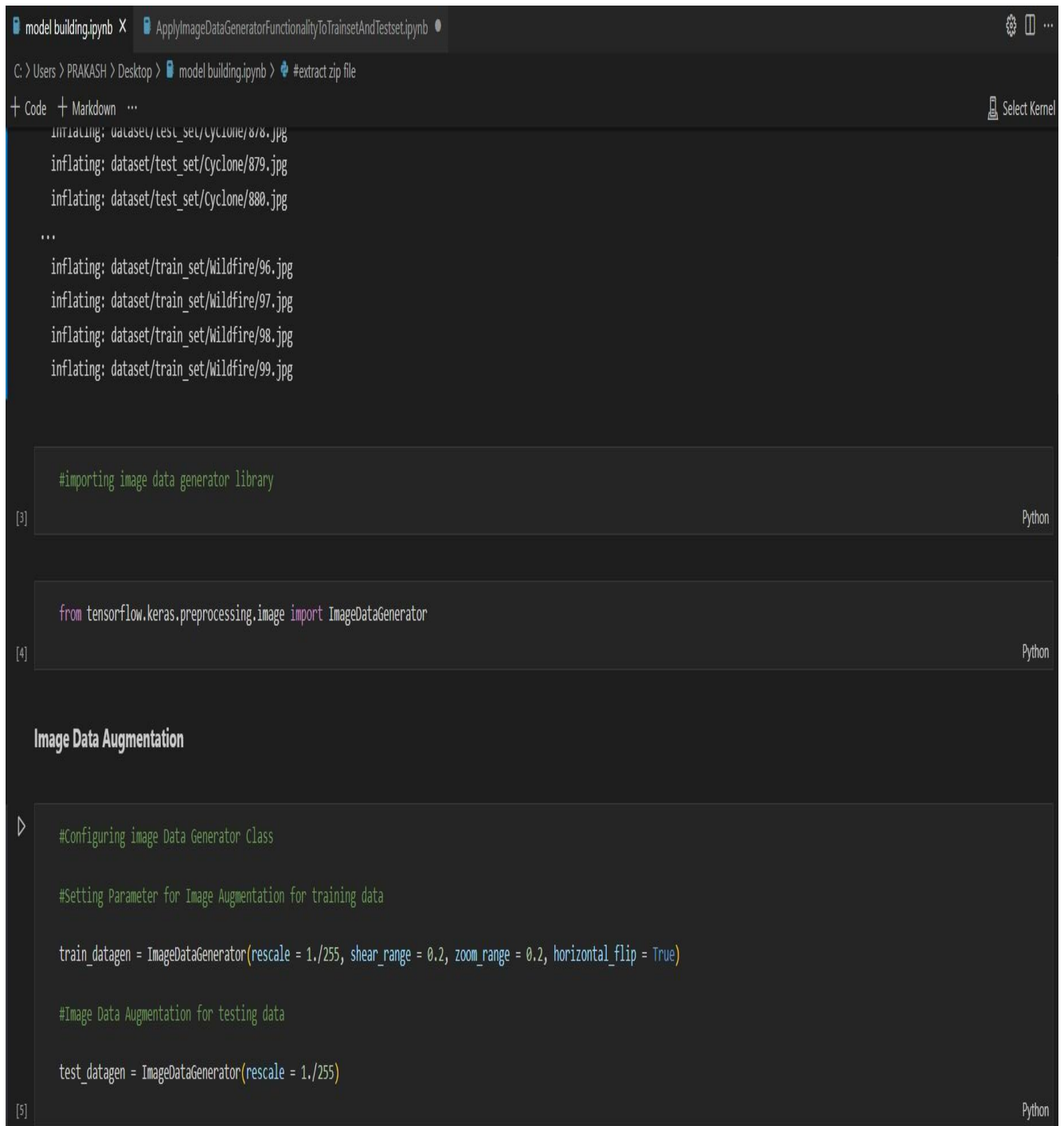
[2] Python

... Output exceeds the [size limit](#). Open the full output data [in a text editor](#)

Archive: /content/drive/MyDrive/IBM/dataset.zip
replace dataset/readme.txt? [y]es, [n]o, [A]ll, [N]one, [r]ename: yes
inflating: dataset/readme.txt
replace dataset/test_set/cyclone/867.jpg? [y]es, [n]o, [A]ll, [N]one, [r]ename: yes
inflating: dataset/test_set/cyclone/867.jpg
replace dataset/test_set/cyclone/868.jpg? [y]es, [n]o, [A]ll, [N]one, [r]ename: yes
inflating: dataset/test_set/cyclone/868.jpg
replace dataset/test_set/cyclone/869.jpg? [y]es, [n]o, [A]ll, [N]one, [r]ename: yes
inflating: dataset/test_set/cyclone/869.jpg
replace dataset/test_set/cyclone/870.jpg? [y]es, [n]o, [A]ll, [N]one, [r]ename: y
inflating: dataset/test_set/cyclone/870.jpg
replace dataset/test_set/cyclone/871.jpg? [y]es, [n]o, [A]ll, [N]one, [r]ename: yes
inflating: dataset/test_set/cyclone/871.jpg
replace dataset/test_set/cyclone/872.jpg? [y]es, [n]o, [A]ll, [N]one, [r]ename: y
inflating: dataset/test_set/cyclone/872.jpg
replace dataset/test_set/cyclone/873.jpg? [y]es, [n]o, [A]ll, [N]one, [r]ename: y
inflating: dataset/test_set/cyclone/873.jpg
replace dataset/test_set/cyclone/874.jpg? [y]es, [n]o, [A]ll, [N]one, [r]ename: ALL yes
inflating: dataset/test_set/cyclone/874.jpg
inflating: dataset/test_set/cyclone/875.jpg
inflating: dataset/test_set/cyclone/876.jpg
inflating: dataset/test_set/cyclone/877.jpg
inflating: dataset/test_set/cyclone/878.jpg
inflating: dataset/test_set/cyclone/879.jpg

Importing image data generator library/Image data Augmentation

Keras Image Data Generator is used for getting the input of the original data and further, it makes the transformation of this data on a random basis and gives the output resultant containing only the data that is newly transformed.



The screenshot displays a Jupyter Notebook with two tabs: 'model building.ipynb' (active) and 'ApplyImageDataGeneratorFunctionalityToTrainsetAndTestset.ipynb'. The active tab shows a file explorer at the top with the path 'C:\> Users > PRAKASH > Desktop > model building.ipynb' and a file named '#extract.zip file'. Below the explorer, there are tabs for '+ Code' and '+ Markdown'. The code area shows a series of file paths being processed, such as 'dataset/test_set/Cyclone/878.jpg', 'dataset/test_set/Cyclone/879.jpg', 'dataset/test_set/Cyclone/880.jpg', and several files in 'dataset/train_set/Wildfire'. Below this, a code cell [3] contains the comment '#importing image data generator library'. Another code cell [4] contains the import statement 'from tensorflow.keras.preprocessing.image import ImageDataGenerator'. A section header 'Image Data Augmentation' is present. Below it, a code cell [5] contains the configuration for the ImageDataGenerator class, including parameters for training data augmentation (rescale, shear_range, zoom_range, horizontal_flip) and testing data augmentation (rescale).

```
model building.ipynb X ApplyImageDataGeneratorFunctionalityToTrainsetAndTestset.ipynb
C:\> Users > PRAKASH > Desktop > model building.ipynb > #extract.zip file
+ Code + Markdown ...
inflating: dataset/test_set/Cyclone/878.jpg
inflating: dataset/test_set/Cyclone/879.jpg
inflating: dataset/test_set/Cyclone/880.jpg
...
inflating: dataset/train_set/Wildfire/96.jpg
inflating: dataset/train_set/Wildfire/97.jpg
inflating: dataset/train_set/Wildfire/98.jpg
inflating: dataset/train_set/Wildfire/99.jpg

#importing image data generator library
[3] Python

from tensorflow.keras.preprocessing.image import ImageDataGenerator
[4] Python

Image Data Augmentation

#Configuring image Data Generator Class

#Setting Parameter for Image Augmentation for training data

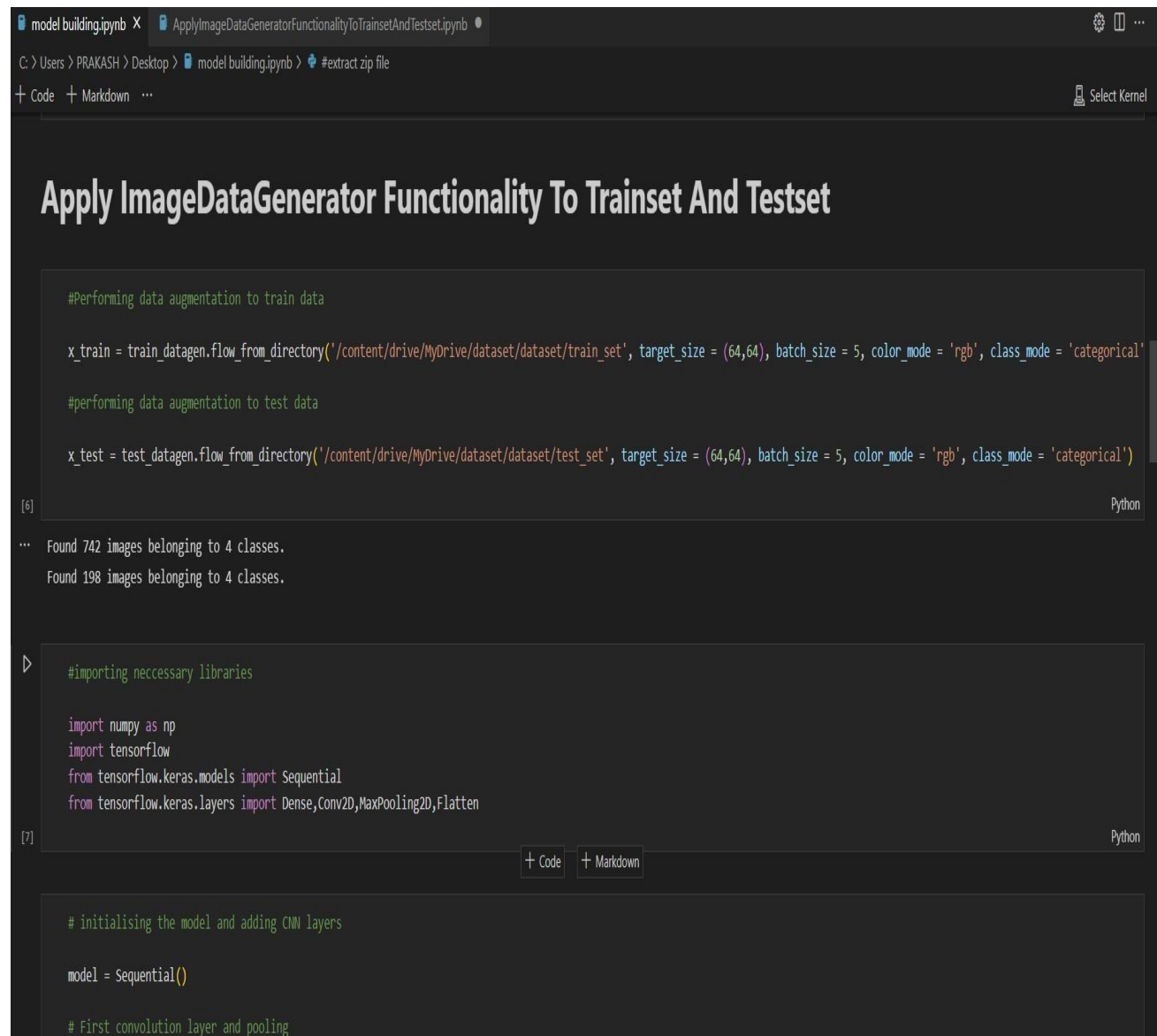
train_datagen = ImageDataGenerator(rescale = 1./255, shear_range = 0.2, zoom_range = 0.2, horizontal_flip = True)

#Image Data Augmentation for testing data

test_datagen = ImageDataGenerator(rescale = 1./255)
[5] Python
```

Apply Image Data Generator Functionality to train set and test set

You probably encountered a situation where you try to load a dataset but there is not enough memory in your machine. As the field of machine learning progresses, this problem becomes more and more common. Today this is already one of the challenges in the field of vision where large datasets of images and video files are processed



The screenshot shows a Jupyter Notebook with two code cells. The first cell, labeled [6], contains code for data augmentation using ImageDataGenerator. The second cell, labeled [7], contains code for importing necessary libraries and initializing a model.

```
#Performing data augmentation to train data

x_train = train_datagen.flow_from_directory('/content/drive/MyDrive/dataset/dataset/train_set', target_size = (64,64), batch_size = 5, color_mode = 'rgb', class_mode = 'categorical')

#performing data augmentation to test data

x_test = test_datagen.flow_from_directory('/content/drive/MyDrive/dataset/dataset/test_set', target_size = (64,64), batch_size = 5, color_mode = 'rgb', class_mode = 'categorical')
```

Found 742 images belonging to 4 classes.
Found 198 images belonging to 4 classes.

```
#importing necessary libraries

import numpy as np
import tensorflow
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense, Conv2D, MaxPooling2D, Flatten
```

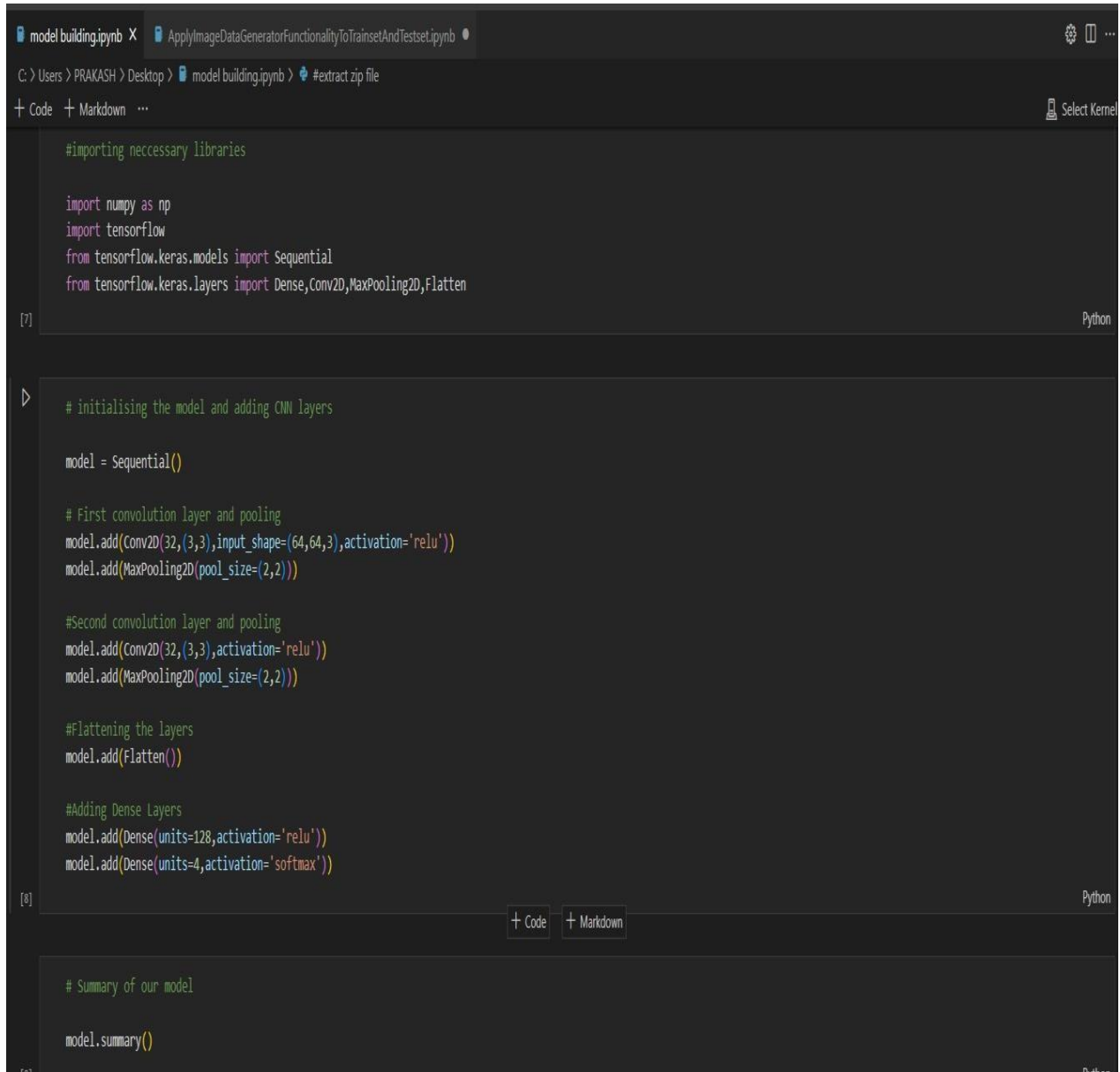
```
# initialising the model and adding CNN layers

model = Sequential()

# First convolution layer and pooling
```

Importing necessary libraries/Initializing the model and adding CNN layers

TensorFlow is a popular deep learning framework. In this tutorial, you will learn the basics of this Python library and understand how to implement these deep, feed-forward artificial neural networks with it.



The screenshot shows a Jupyter Notebook with two tabs: 'model building.ipynb' (active) and 'Apply Image Data Generator Functionality To Trainset And Testset.ipynb'. The active tab displays the following code:

```
#importing neccessary libraries

import numpy as np
import tensorflow
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense,Conv2D,MaxPooling2D,Flatten

# initialising the model and adding CNN layers

model = Sequential()

# First convolution layer and pooling
model.add(Conv2D(32,(3,3),input_shape=(64,64,3),activation='relu'))
model.add(MaxPooling2D(pool_size=(2,2)))

#Second convolution layer and pooling
model.add(Conv2D(32,(3,3),activation='relu'))
model.add(MaxPooling2D(pool_size=(2,2)))

#Flattening the layers
model.add(Flatten())

#Adding Dense Layers
model.add(Dense(units=128,activation='relu'))
model.add(Dense(units=4,activation='softmax'))

# Summary of our model

model.summary()
```

The interface includes a file explorer on the left showing the path 'C:\> Users > PRAKASH > Desktop > model building.ipynb' and a toolbar with '+ Code', '+ Markdown', and 'Select Kernel' buttons. The code is executed in two cells, with the first cell showing '[1]' and the second cell showing '[8]'.

Summary of our model

The model summary gives us a fine visualization of our model and the aim is to provide complete information that is not provided by the print statement.

```
model building.ipynb X ApplyImageDataGeneratorFunctionalityToTrainsetAndTestset.ipynb
C:\Users\> PRAKASH > Desktop > model building.ipynb > #extract zip file
+ Code + Markdown ... Select Kernel
```

```
# Summary of our model

model.summary()
```

```
[9] Python
```

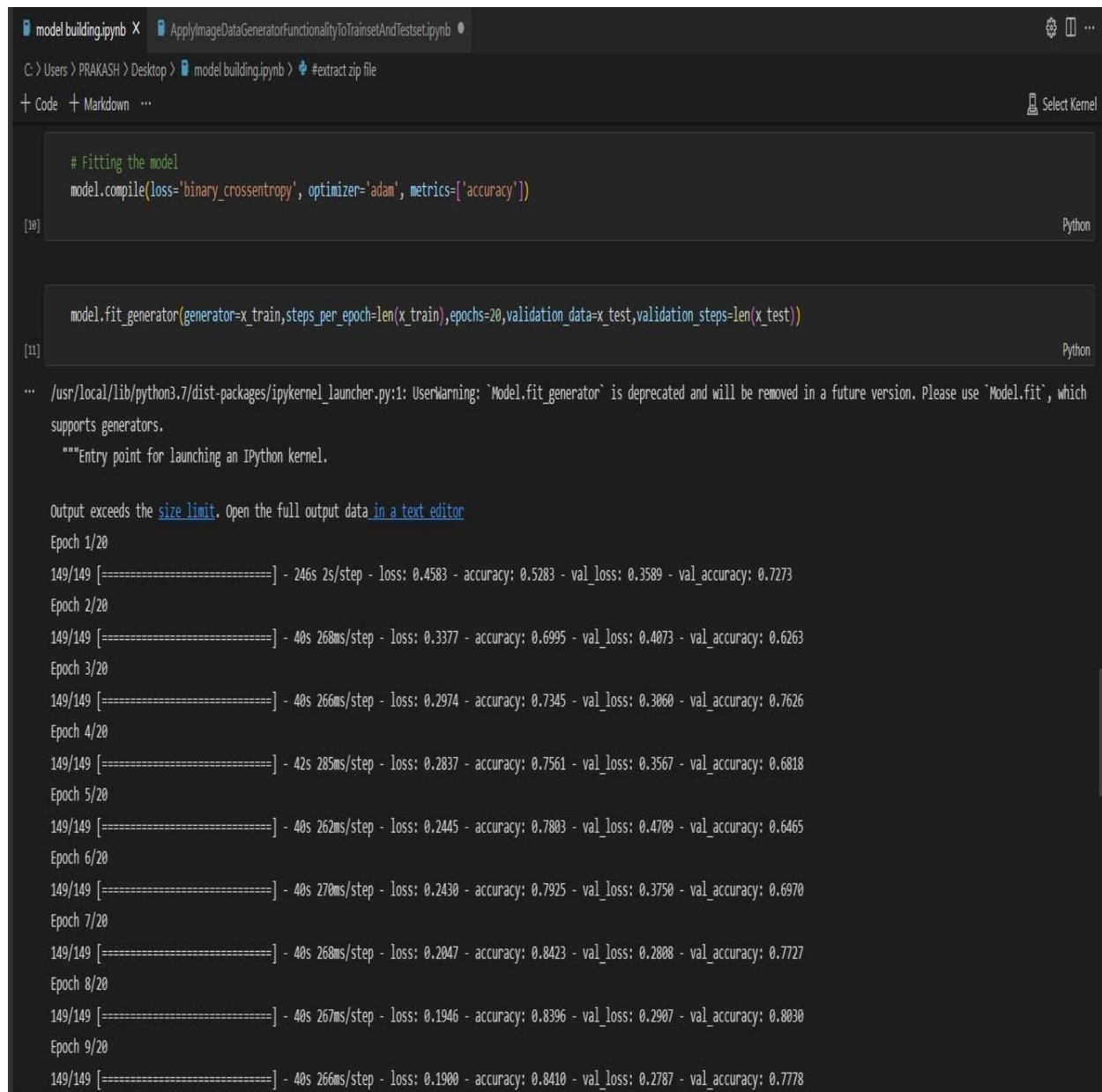
```
... Model: "sequential"
```

Layer (type)	Output Shape	Param #
conv2d (Conv2D)	(None, 62, 62, 32)	896
max_pooling2d (MaxPooling2D)	(None, 31, 31, 32)	0
conv2d_1 (Conv2D)	(None, 29, 29, 32)	9248
max_pooling2d_1 (MaxPooling2D)	(None, 14, 14, 32)	0
flatten (Flatten)	(None, 6272)	0
dense (Dense)	(None, 128)	802944
dense_1 (Dense)	(None, 4)	516

```
=====
Total params: 813,604
Trainable params: 813,604
Non-trainable params: 0
=====
```

Fitting the model

We'll define the Keras sequential model and add a one-dimensional convolutional layer. Input shape becomes as it is confirmed above We'll add Dense, MaxPooling1D, and Flatten layers into the model. The output layer contains the number of output classes and 'SoftMax' activation.



```
# Fitting the model
model.compile(loss='binary_crossentropy', optimizer='adam', metrics=['accuracy'])

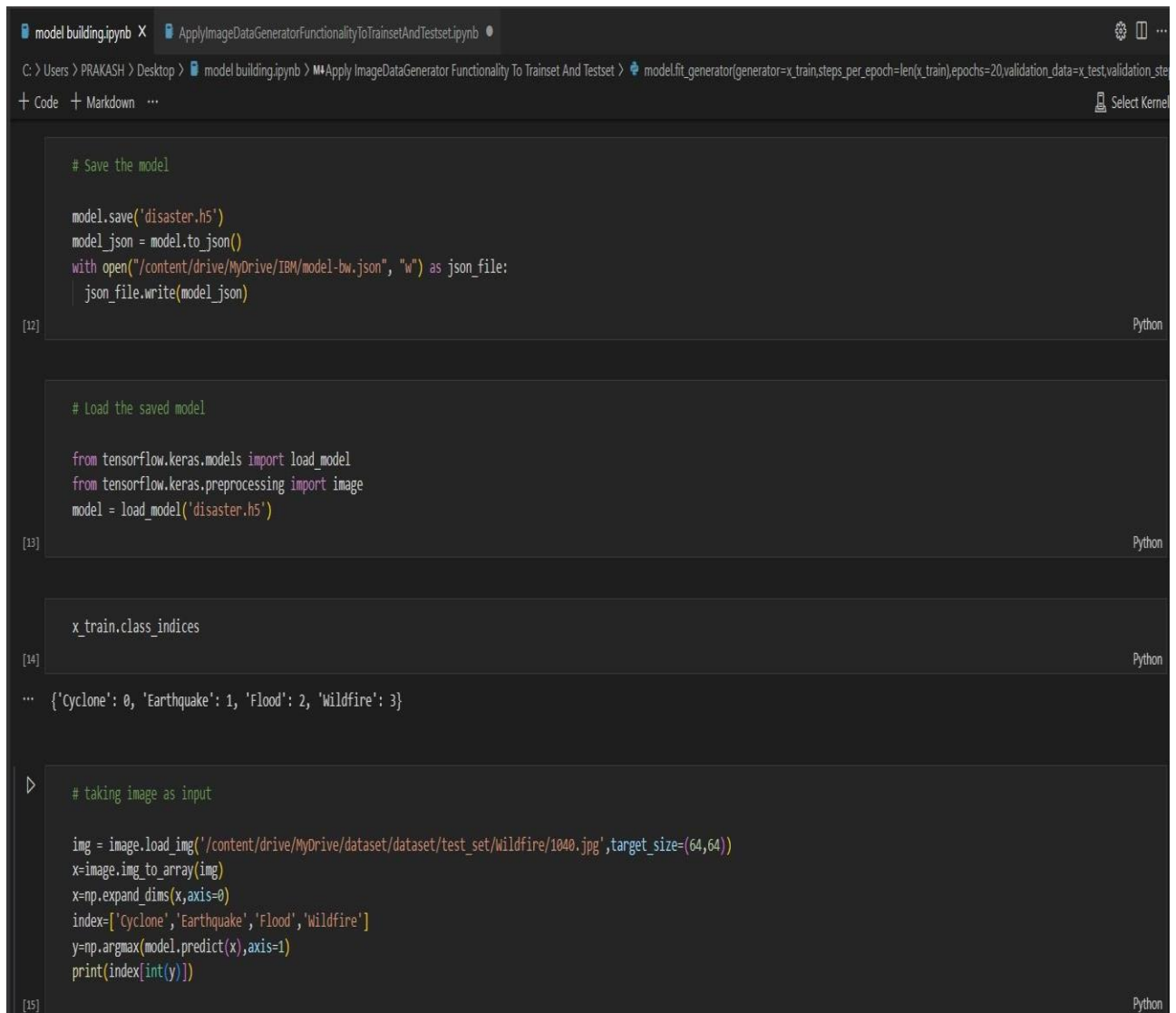
model.fit_generator(generator=x_train, steps_per_epoch=len(x_train), epochs=20, validation_data=x_test, validation_steps=len(x_test))
```

```
... /usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:1: UserWarning: `Model.fit_generator` is deprecated and will be removed in a future version. Please use `Model.fit`, which supports generators.
    """Entry point for launching an IPython kernel.

Output exceeds the size limit. Open the full output data in a text editor
Epoch 1/20
149/149 [=====] - 246s 2s/step - loss: 0.4583 - accuracy: 0.5283 - val_loss: 0.3589 - val_accuracy: 0.7273
Epoch 2/20
149/149 [=====] - 40s 268ms/step - loss: 0.3377 - accuracy: 0.6995 - val_loss: 0.4073 - val_accuracy: 0.6263
Epoch 3/20
149/149 [=====] - 40s 266ms/step - loss: 0.2974 - accuracy: 0.7345 - val_loss: 0.3060 - val_accuracy: 0.7626
Epoch 4/20
149/149 [=====] - 42s 285ms/step - loss: 0.2837 - accuracy: 0.7561 - val_loss: 0.3567 - val_accuracy: 0.6818
Epoch 5/20
149/149 [=====] - 40s 262ms/step - loss: 0.2445 - accuracy: 0.7803 - val_loss: 0.4709 - val_accuracy: 0.6465
Epoch 6/20
149/149 [=====] - 40s 270ms/step - loss: 0.2430 - accuracy: 0.7925 - val_loss: 0.3750 - val_accuracy: 0.6970
Epoch 7/20
149/149 [=====] - 40s 268ms/step - loss: 0.2047 - accuracy: 0.8423 - val_loss: 0.2808 - val_accuracy: 0.7727
Epoch 8/20
149/149 [=====] - 40s 267ms/step - loss: 0.1946 - accuracy: 0.8396 - val_loss: 0.2907 - val_accuracy: 0.8030
Epoch 9/20
149/149 [=====] - 40s 266ms/step - loss: 0.1900 - accuracy: 0.8410 - val_loss: 0.2787 - val_accuracy: 0.7778
```

Save the model/Load the saved model/Taking image as input

The Saved Model format is another way to serialize models. Models saved in this format can be restored using and are compatible with TensorFlow Serving. The Saved Model goes into detail about how to serve/inspect the Saved Model. The section below illustrates the steps to save and restore the model.



```
model building.ipynb x ApplyImageDataGeneratorFunctionalityToTrainsetAndTestset.ipynb
C:\Users\> PRAKASH > Desktop > model building.ipynb > Apply ImageDataGenerator Functionality To Trainset And Testset > model_fit_generator(generator=x_train,steps_per_epoch=len(x_train),epochs=20,validation_data=x_test,validation_steps=10)
+ Code + Markdown ... Select Kernel

# Save the model

model.save('disaster.h5')
model_json = model.to_json()
with open("/content/drive/MyDrive/IBM/model-bw.json", "w") as json_file:
    json_file.write(model_json)

[12] Python

# Load the saved model

from tensorflow.keras.models import load_model
from tensorflow.keras.preprocessing import image
model = load_model('disaster.h5')

[13] Python

x_train.class_indices

[14] Python

... {'Cyclone': 0, 'Earthquake': 1, 'Flood': 2, 'Wildfire': 3}

# taking image as input

img = image.load_img('/content/drive/MyDrive/dataset/dataset/test_set/wildfire/1040.jpg',target_size=(64,64))
x=image.img_to_array(img)
x=np.expand_dims(x,axis=0)
index=['Cyclone','Earthquake','Flood','Wildfire']
y=np.argmax(model.predict(x),axis=1)
print(index[int(y)])

[15] Python
```