

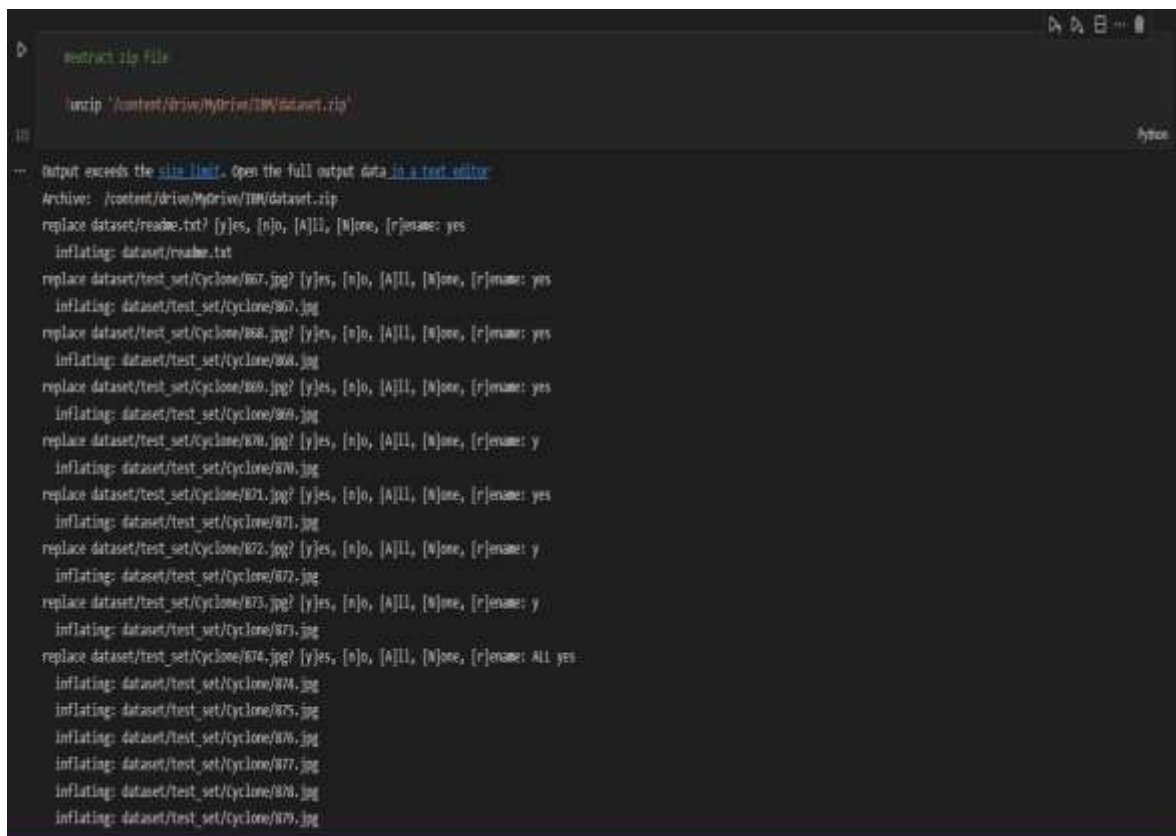
Sprint – III

Model building

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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/TM/dataset.zip'

... Output exceeds the size limit. Open the full output data in a text editor.
Archive: /content/drive/MyDrive/TM/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.

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

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

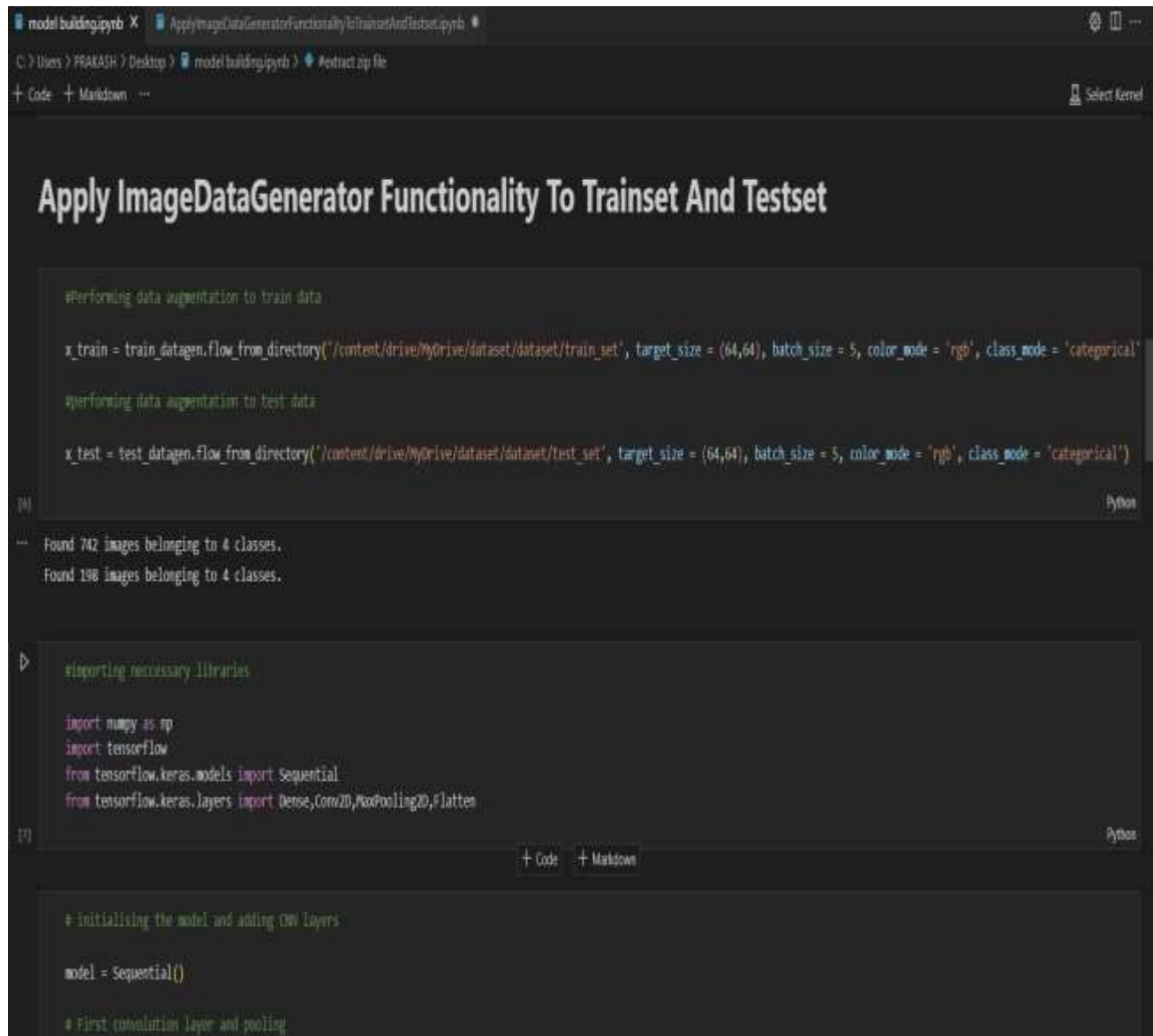
test_datagen = ImageDataGenerator(rescale = 1./255)

[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 interface with two code cells. The first cell, labeled (4), contains Python code for data augmentation using ImageDataGenerator. It defines x_train and x_test generators with parameters for target_size (64,64), batch_size (5), color_mode ('rgb'), and class_mode ('categorical'). The second cell, labeled (7), contains code for importing necessary libraries (numpy, tensorflow, keras) and initializing a Sequential model. The notebook title is 'Apply ImageDataGenerator Functionality To Trainset And Testset'.

```
#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.

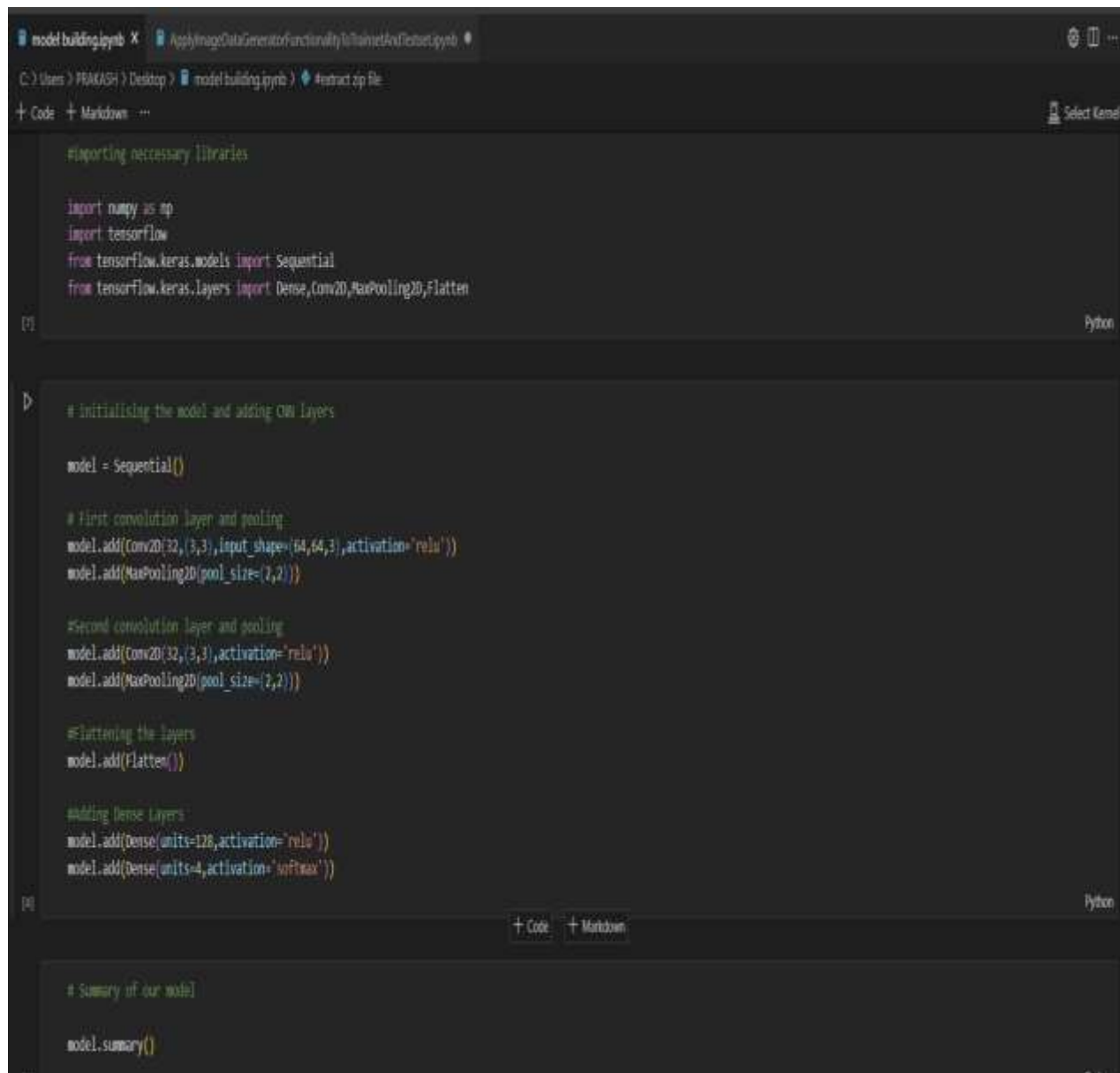
```
#importing necessary libraries
import numpy as np
import tensorflow
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense, Conv2D, MaxPooling2D, Flatten
```

```
# 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.

A screenshot of a Jupyter Notebook interface with a dark theme. The notebook has two tabs: 'model building.ipynb' (active) and 'ApplyImageDataGeneratorFunctionalityToTrainAndTest.ipynb'. The active tab shows Python code for building a Keras model. The code is organized into three cells. The first cell imports necessary libraries: numpy, tensorflow, Sequential, Dense, Conv2D, MaxPooling2D, and Flatten. The second cell initializes the model and adds layers: a Sequential model, followed by two convolutional layers with MaxPooling2D, a Flatten layer, and two dense layers (one with 128 units and one with 4 units for softmax). The third cell shows the model summary. The notebook interface includes a file explorer at the top showing the file path 'C:\Users\PRAKASH\Desktop> model building.ipynb' and a 'Select Kernel' button. The bottom of the notebook shows '+ Code' and '+ Markdown' buttons.

```
# 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
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()
```

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.py X ApplyImageDataGeneratorFunctionalityToTrainsetAndTestset.py X
C:\Users\PRAKASH\Desktop> model_building.py X #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 (MaxPooling (None, 14, 14, 32)         0
2D)

flatten (Flatten)             (None, 6272)                0

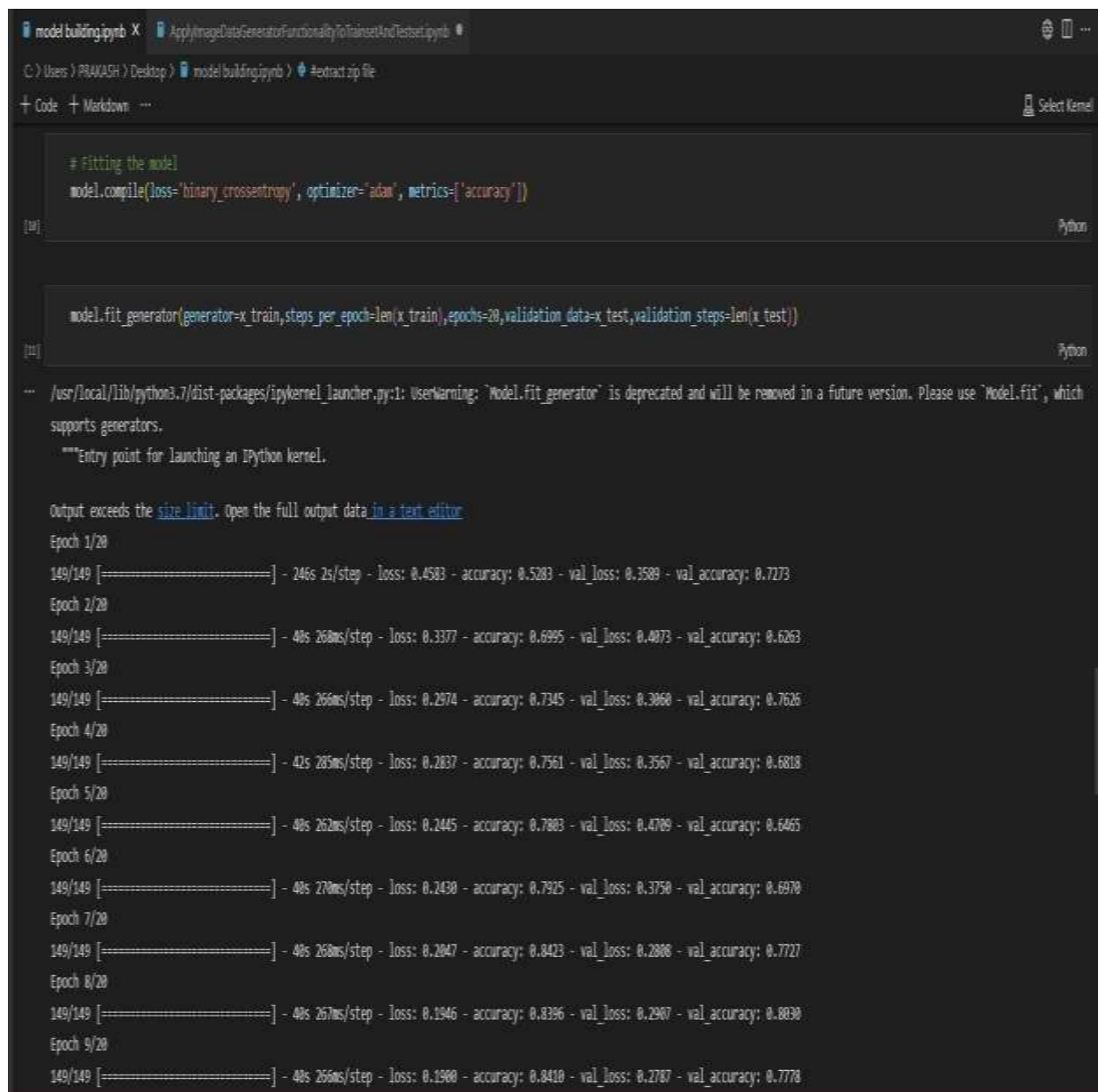
dense (Dense)                 (None, 128)                 802944

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.



The screenshot shows a Jupyter Notebook with two tabs: 'model building.ipynb' and 'Apply Image Data Generator functionality to Trainset and Testset.ipynb'. The active tab is 'model building.ipynb'. The code in the notebook is as follows:

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

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

Below the code, there is a warning message: "UserWarning: 'Model.fit_generator' is deprecated and will be removed in a future version. Please use 'Model.fit', which supports generators." and a message: "Entry point for launching an IPython kernel.".

The output of the notebook shows the training progress for 20 epochs. The output for each epoch is as follows:

```
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: 0.7983 - 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: 0.2806 - 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 Apply ImageDataGenerator Functionality To Train And Test.ipynb
C:\Users\PRAGATI\Desktop> model_building.ipynb > Apply ImageDataGenerator Functionality To Train And Test > model_fit_generator(generator=x_train, steps_per_epoch=len(x_train), epochs=20, validation_data=(x_test, validation_set))
+ Code + Markdown ... Select Kernel

# Save the model

model.save('disaster.h5')
model_json = model.to_json()
with open('content/drive/MyDrive/IR4/model-hw.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
```