

# TRAIN MODEL ON IBM

DATE	22 November 2022
TEAM ID	PNT2022TMID14614
PROJECT NAME	AI-powered Nutrition Analyzer for Fitness Enthusiasts

The screenshot displays the IBM Watson Studio web interface. The browser address bar shows the URL: `dataplatform.cloud.ibm.com/analytics/notebooks/v2/9ae3b406-22fc-40b2-a6fd-9070a0ed4932?projectId=d6dcbc93-9f6d-4ea7-9096-05fa308bab26&con...`. The IBM Watson Studio header includes a search bar, a 'Buy' button, and user account information for 'Preethi R's Account' in 'Dallas'. The breadcrumb navigation shows 'Projects / Model Building / Model\_Building'. The notebook interface includes a menu bar (File, Edit, View, Insert, Cell, Kernel, Help) and a toolbar with icons for file operations, running, and formatting. The notebook content is divided into two sections: 'Load The Dataset' and 'Image Preprocessing'. The 'Load The Dataset' section contains three code cells:   
In [1]: `from google.colab import drive  
drive.mount('/content/drive')` with output 'Mounted at /content/drive'.   
In [2]: `Data_trainpath='/content/drive/MyDrive/Dataset/TRAIN_SET'`   
In [3]: `Data_testpath='/content/drive/MyDrive/Dataset/TEST_SET'`   
The 'Image Preprocessing' section includes the text 'Import The ImageDataGenerator Library' and a code cell:   
In [4]: `from keras.preprocessing.image import ImageDataGenerator`   
The bottom status bar shows '27°C Cloudy', system icons, and the time '11:55 PM'.

This screenshot shows a Jupyter notebook in IBM Watson Studio. The notebook is titled 'Model\_Building' and is in the 'Model Building' project. The code in the notebook is as follows:

```
In [6]: test_datagen=ImageDataGenerator(rescale=1./255)

Apply Image DataGenerator Functionality To Trainset And Testset

In [9]: x_train = train_datagen.flow_from_directory(Data_trainpath,target_size=(64,64),batch_size=5,color_mode='rgb',class_mode='sparse')
Found 3492 images belonging to 5 classes.

In [10]: x_test = train_datagen.flow_from_directory(Data_testpath,target_size=(64,64),batch_size=5,color_mode='rgb',class_mode='sparse')
Found 976 images belonging to 5 classes.

In [11]: print(x_train.class_indices)
{'APPLES': 0, 'BANANA': 1, 'ORANGE': 2, 'PINEAPPLE': 3, 'WATERMELON': 4}

In [12]: print(x_test.class_indices)
{'APPLES': 0, 'BANANA': 1, 'ORANGE': 2, 'PINEAPPLE': 3, 'WATERMELON': 4}

In [13]: from collections import Counter as c
```

The notebook interface includes a top bar with the IBM logo, a search bar, and a navigation menu. The bottom status bar shows the temperature as 27°C Cloudy and the time as 11:55 PM.

This screenshot shows a Jupyter notebook in IBM Watson Studio, titled 'Image Preprocessing'. The code in the notebook is as follows:

```
In [4]: from keras.preprocessing.image import ImageDataGenerator

Configure ImageDataGenerator Class

In [5]: train_datagen = ImageDataGenerator(rescale=1./255, shear_range=0.2, zoom_range=0.2, horizontal_flip=True)

In [6]: test_datagen=ImageDataGenerator(rescale=1./255)

Apply Image DataGenerator Functionality To Trainset And Testset

In [9]: x_train = train_datagen.flow_from_directory(Data_trainpath,target_size=(64,64),batch_size=5,color_mode='rgb',class_mode='sparse')
Found 3492 images belonging to 5 classes.
```

The notebook interface is similar to the one in the first screenshot, with a top bar and a bottom status bar showing the temperature as 27°C Cloudy and the time as 11:55 PM.

This screenshot shows a Jupyter notebook in IBM Watson Studio. The browser tabs at the top include IBM, Meet, New Tab, IBM-Project-2425, Service Details, and Model\_Building. The URL is `dataplatfrom.cloud.ibm.com/analytics/notebooks/v2/9ae3b406-22fc-40b2-a6fd-9070a0ed4932?projectid=d6dcbc93-9f6d-4ea7-9096-05fa308bab26&con...`. The notebook interface shows the 'Model\_Building' project. The code in the notebook is as follows:

```
In [6]: test_datagen=ImageDataGenerator(rescale=1./255)

Apply Image DataGenerator Functionality To Trainset And Testset

In [9]: x_train = train_datagen.flow_from_directory(Data_trainpath,target_size=(64,64),batch_size=5,color_mode='rgb',class_mode='sparse')
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{'APPLES': 0, 'BANANA': 1, 'ORANGE': 2, 'PINEAPPLE': 3, 'WATERMELON': 4}

In [13]: from collections import Counter as c
```

The bottom status bar shows the system temperature as 27°C Cloudy and the time as 11:55 PM.

This screenshot shows the same Jupyter notebook in IBM Watson Studio, continuing the model building process. The code in the notebook is as follows:

```
In [15]: model=Sequential()

Adding CNN Layers

First Convolution Layer and pooling

In [16]: 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

In [17]: model.add(Conv2D(32, (3, 3), activation='relu'))
model.add(MaxPooling2D(pool_size=(2, 2)))

Flatten layer

In [18]: model.add(Flatten())
```

The bottom status bar shows the system temperature as 27°C Cloudy and the time as 11:55 PM.

IBM Watson Studio interface showing a Jupyter Notebook titled "Model\_Building". The notebook is running Python 3.9. The code in the notebook is:

```
In [19]: model.add(Dense(units=128, activation='relu'))
model.add(Dense(units=5, activation='softmax'))

In [20]: model.summary()
```

The output of the code is a summary of the model structure:

```
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
```

IBM Watson Studio interface showing the same Jupyter Notebook. The code in the notebook is:

```
Trainable params: 813,733
Non-trainable params: 0

Configure The Learning Process

In [21]: model.compile(optimizer='adam', loss='sparse_categorical_crossentropy', metrics=['accuracy'])

Train The Model

In [22]: model.fit_generator(
generator=x_train, steps_per_epoch = len(x_train),
epochs=15, validation_data=x_test, validation_steps = len(x_test))
```

The output of the code is a summary of the model structure and training progress:

```
Epoch 1/15
699/699 [=====] - 933s 1s/step - loss: 0.7478 - accuracy: 0.7228 - val_loss: 0.6479 - val_accuracy: 0.7643
Epoch 2/15
699/699 [=====] - 43s 61ms/step - loss: 0.5850 - accuracy: 0.7941 - val_loss: 0.6027 - val_accuracy: 0.7961
```

IBM Watson Studio interface showing a Jupyter Notebook with training progress output. The browser tabs include IBM, Meet - osb-sni, New Tab, IBM-Project-2425-1, Service Details - IB, and Model\_Building - IE. The URL is [dataplatform.cloud.ibm.com/analytics/notebooks/v2/9ae3b406-22fc-40b2-a6fd-9070a0ed4932?projectid=d6dcbc93-9f6d-4ea7-9096-05fa308bab26&con...](https://dataplatform.cloud.ibm.com/analytics/notebooks/v2/9ae3b406-22fc-40b2-a6fd-9070a0ed4932?projectid=d6dcbc93-9f6d-4ea7-9096-05fa308bab26&con...). The notebook title is "Model\_Building". The output shows training progress for epochs 2/15 to 13/15, with metrics like loss, accuracy, val\_loss, and val\_accuracy.

```
Epoch 2/15
699/699 [=====] - 43s 61ms/step - loss: 0.5850 - accuracy: 0.7941 - val_loss: 0.6027 - val_accuracy: 0.7961
Epoch 3/15
699/699 [=====] - 41s 58ms/step - loss: 0.5283 - accuracy: 0.8064 - val_loss: 0.6776 - val_accuracy: 0.7664
Epoch 4/15
699/699 [=====] - 39s 56ms/step - loss: 0.4930 - accuracy: 0.8230 - val_loss: 0.5407 - val_accuracy: 0.8043
Epoch 5/15
699/699 [=====] - 41s 58ms/step - loss: 0.4620 - accuracy: 0.8259 - val_loss: 0.5942 - val_accuracy: 0.7736
Epoch 6/15
699/699 [=====] - 41s 58ms/step - loss: 0.4349 - accuracy: 0.8408 - val_loss: 0.6177 - val_accuracy: 0.7715
Epoch 7/15
699/699 [=====] - 39s 55ms/step - loss: 0.4055 - accuracy: 0.8462 - val_loss: 0.5708 - val_accuracy: 0.7971
Epoch 8/15
699/699 [=====] - 43s 61ms/step - loss: 0.3919 - accuracy: 0.8571 - val_loss: 0.4557 - val_accuracy: 0.8504
Epoch 9/15
699/699 [=====] - 44s 63ms/step - loss: 0.3472 - accuracy: 0.8697 - val_loss: 0.5714 - val_accuracy: 0.8309
Epoch 10/15
699/699 [=====] - 44s 63ms/step - loss: 0.3513 - accuracy: 0.8766 - val_loss: 0.5235 - val_accuracy: 0.8391
Epoch 11/15
699/699 [=====] - 43s 62ms/step - loss: 0.2960 - accuracy: 0.8935 - val_loss: 0.4929 - val_accuracy: 0.8494
Epoch 12/15
699/699 [=====] - 46s 65ms/step - loss: 0.2846 - accuracy: 0.8943 - val_loss: 0.5114 - val_accuracy: 0.8258
Epoch 13/15
699/699 [=====] - 39s 56ms/step - loss: 0.2540 - accuracy: 0.9006 - val_loss: 0.5052 - val_accuracy: 0.8494
```

IBM Watson Studio interface showing a Jupyter Notebook with code for saving and testing a model. The browser tabs include IBM, Meet - osb-sni, New Tab, IBM-Project-2425-1, Service Details - IB, and Model\_Building - IE. The URL is [dataplatform.cloud.ibm.com/analytics/notebooks/v2/9ae3b406-22fc-40b2-a6fd-9070a0ed4932?projectid=d6dcbc93-9f6d-4ea7-9096-05fa308bab26&con...](https://dataplatform.cloud.ibm.com/analytics/notebooks/v2/9ae3b406-22fc-40b2-a6fd-9070a0ed4932?projectid=d6dcbc93-9f6d-4ea7-9096-05fa308bab26&con...). The notebook title is "Model\_Building". The code includes saving the model to 'nutrition.h5' and testing it with a new image.

```
Save The Model

In [23]: model.save('nutrition.h5')

Test The Model

In [24]: from tensorflow.keras.models import load_model
         from keras.preprocessing import image
         final_model = load_model("nutrition.h5")

In [25]: from tensorflow.keras.utils import img_to_array

In [26]: img = tensorflow.keras.utils.load_img("/content/drive/MyDrive/Nutrition Image Analysis using CNN and Rapid API/Nutrition Analysis Using Image C
         x = img_to_array(img)
         x = np.expand_dims(x,axis = 0)
         pred = np.argmax(final_model.predict(x),axis=1)
         pred

1/1 [=====] - 0s 101ms/step

Out[26]: array([21])
```

IBM Watson Studio interface showing a Jupyter Notebook session. The notebook is titled "Model\_Building" and is running Python 3.9. The code in the notebook is as follows:


```
In [26]: img = tensorflow.keras.utils.load_img("/content/drive/MyDrive/Nutrition Image Analysis using CNN and Rapid API/Nutrition Analysis Using Image C
x = img_to_array(img)
x = np.expand_dims(x,axis = 0)
pred =np.argmax(final_model.predict(x),axis=1)
pred

1/1 [=====] - 0s 101ms/step

Out[26]: array([2])

In [27]: index=['APPLES', 'BANANA', 'ORANGE', 'PINEAPPLE', 'WATERMELON']
result=index[pred[0]]
result

Out[27]: 'ORANGE'

In [28]: img
Out[28]: 
```

The notebook output shows the prediction of the fruit class (array([2])) and the corresponding fruit name ('ORANGE'). The image of the oranges is displayed below the output.

IBM Watson Studio interface showing a Jupyter Notebook session. The notebook is titled "Model\_Building" and is running Python 3.9. The code in the notebook is as follows:


```
In [29]: img = tensorflow.keras.utils.load_img("/content/drive/MyDrive/Nutrition Image Analysis using CNN and Rapid API/Nutrition Analysis Using Image C
x = img_to_array(img)
x = np.expand_dims(x,axis = 0)
pred =np.argmax(final_model.predict(x),axis=1)
pred

1/1 [=====] - 0s 18ms/step

Out[29]: array([0])

In [30]: result=index[pred[0]]
result

Out[30]: 'APPLES'

In [31]: img
Out[31]: 
```

The notebook output shows the prediction of the fruit class (array([0])) and the corresponding fruit name ('APPLES'). The image of the apple is displayed below the output.