1-Cover sheet

Faculty name: Faculty of computer science and Artificial intelligence .

Course name: Selected topics CS-2

team number:43

team members:-

1-Abdulrhman Hussein Saied   ID=202000508

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2-Paper details

Authors name:-

1-Rafflesia Khan

2-Rameswar Debnath

Paper name: "Multi Class Fruit Classification Using Efficient Object Detection and Recognition Techniques".

Publisher name: "Modern Education and Computer Science Press" (MECS Press).

year of publication: 2019

The Dataset used : their own dataset.

The Implementated algorithm : Convolutional Neural Network (CNN).

The result : loss=0.0237&accuracy=0.9783

3-Project Description

The name of the Dataset used: Fruit Classification.

The Link of the Dataset: https://www.kaggle.com/datasets/sshikamaru/fruit-recognition

Total number of images = 22495

The Dimension of Images = 100*100 Pixels

Number of Classes = 33

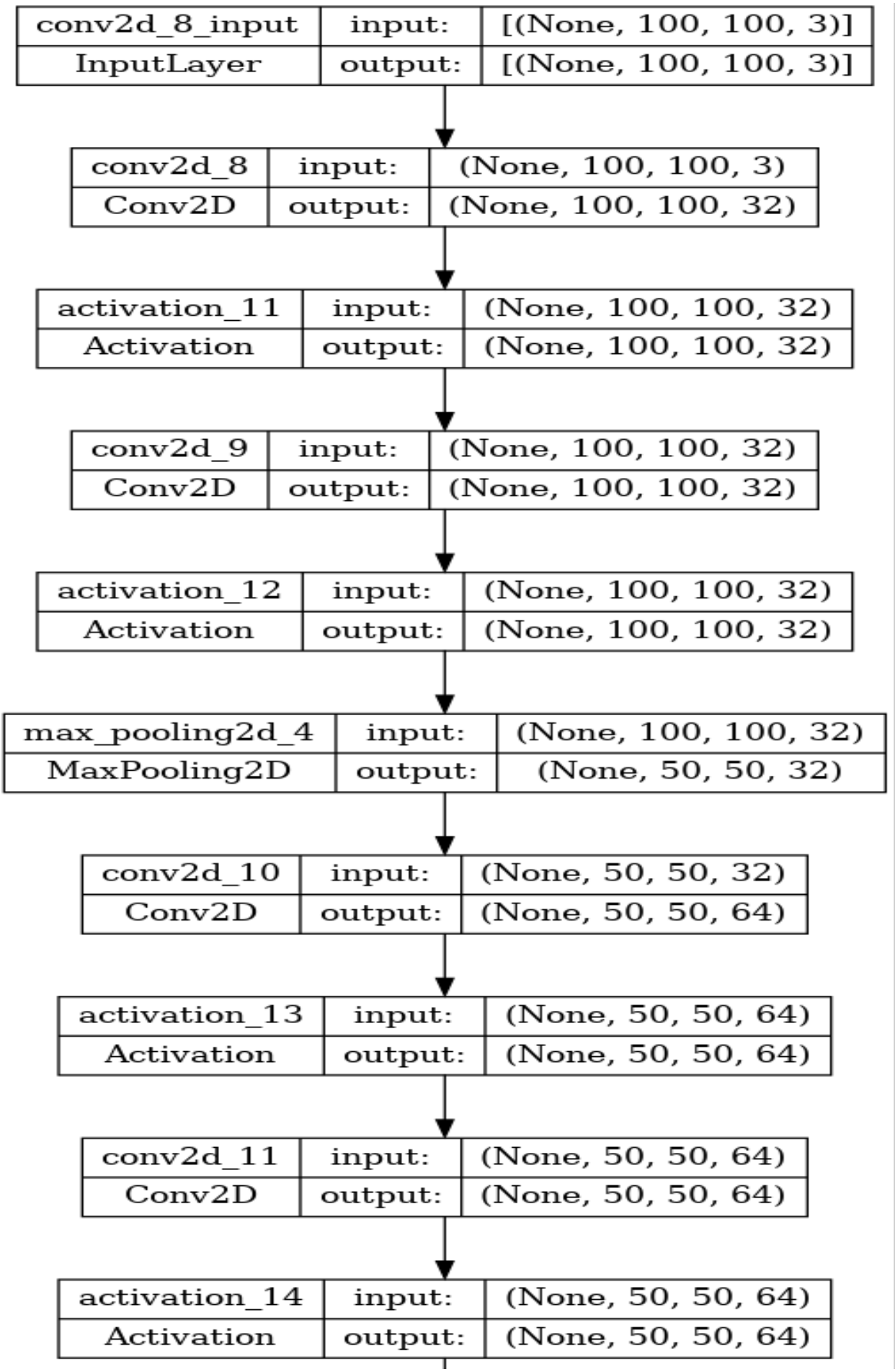
Their Labels :

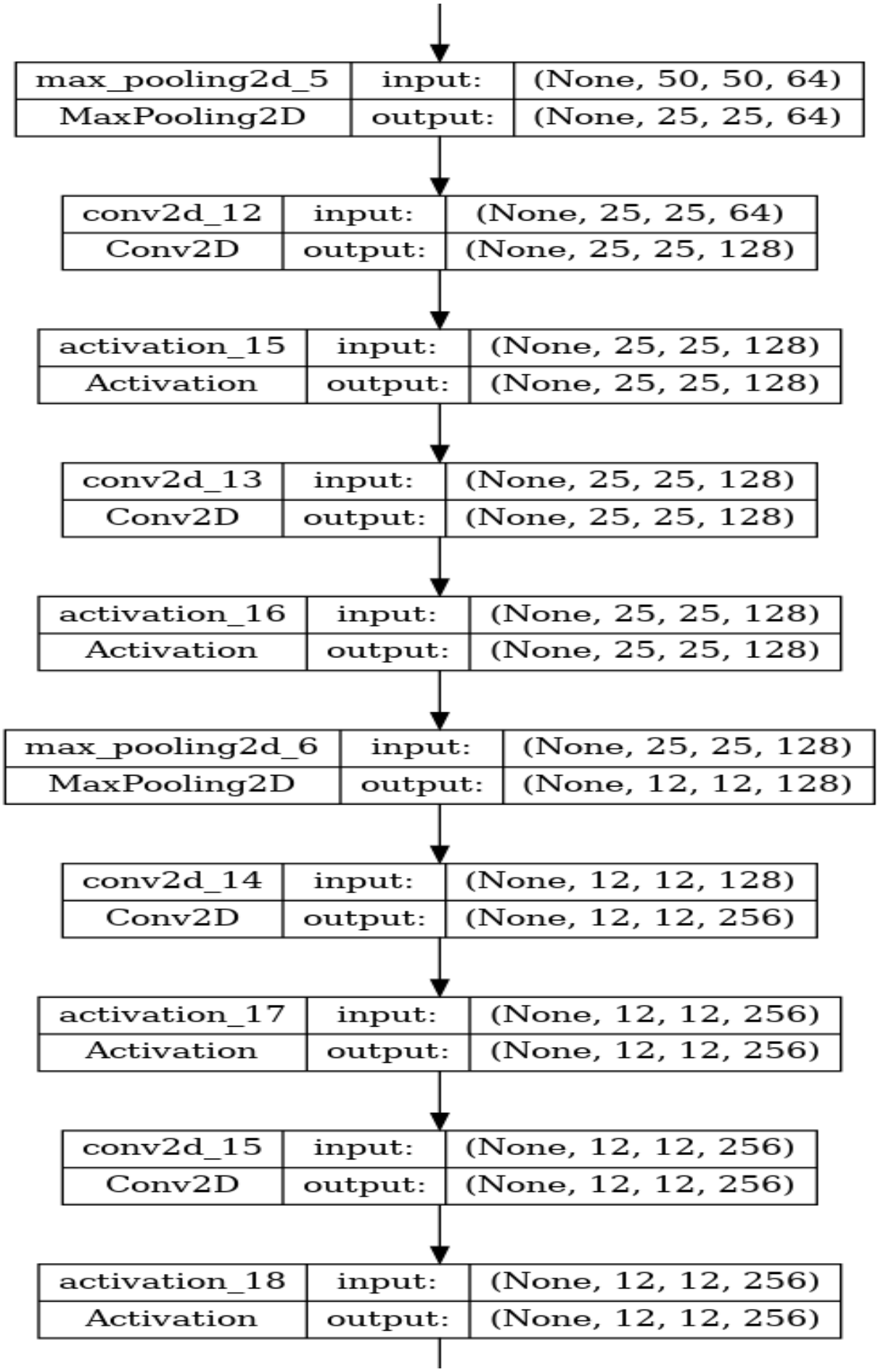
['Apple Braeburn' 'Apple Granny Smith' 'Apricot' 'Avocado' 'Banana'
'Blueberry' 'Cactus fruit' 'Cantaloupe' 'Cherry' 'Clementine' 'Corn'
'Cucumber Ripe' 'Grape Blue' 'Kiwi' 'Lemon' 'Limes' 'Mango' 'Onion White'
'Orange' 'Papaya' 'Passion Fruit' 'Peach' 'Pear' 'Pepper Green'
'Pepper Red' 'Pineapple' 'Plum' 'Pomegranate' 'Potato Red' 'Raspberry'
'Strawberry' 'Tomato' 'Watermelon']

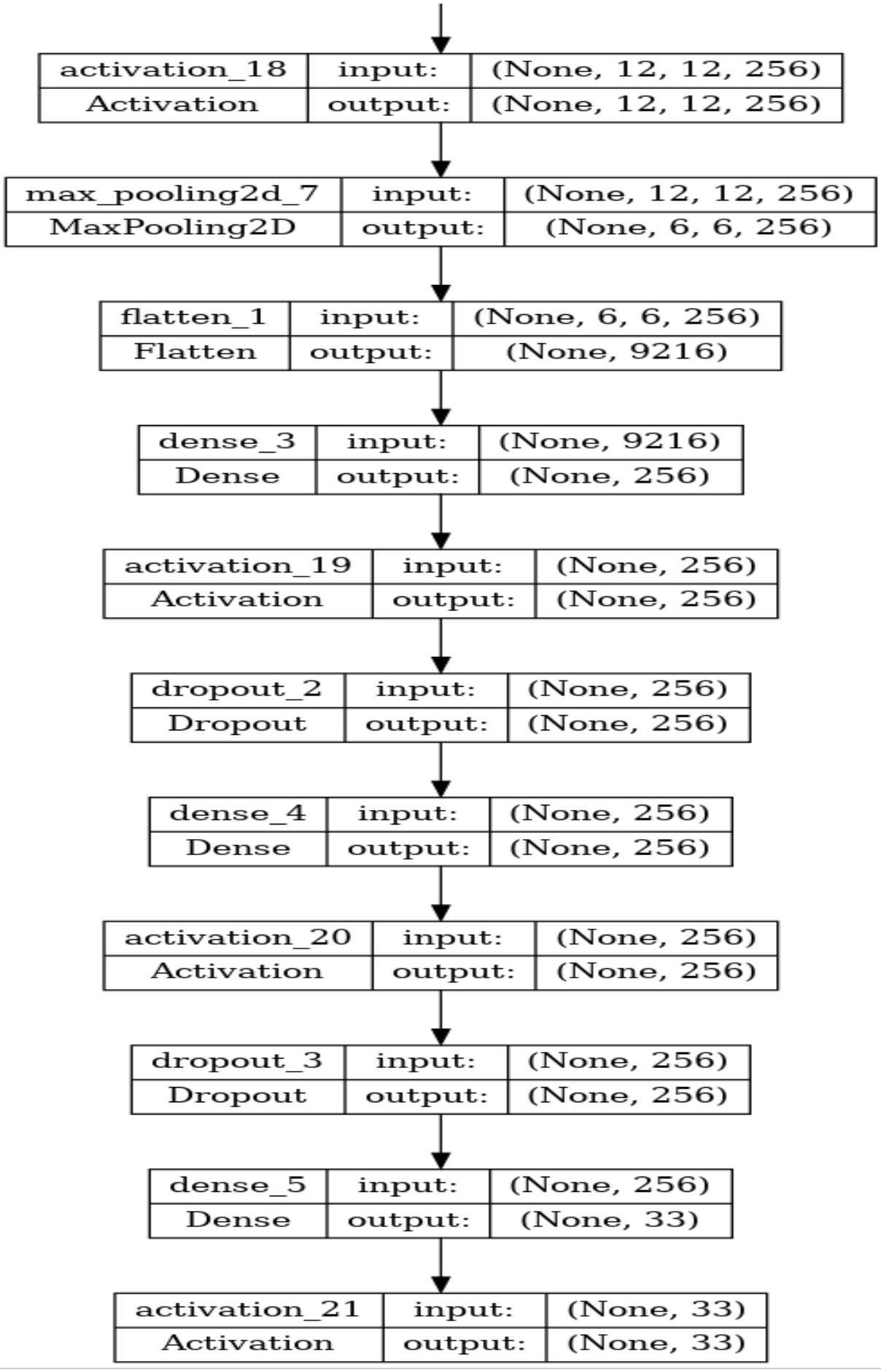
Ratio used for training:64% which have 16854 images

Ratio used for validation:14% which have 3371 images

Ratio used for testing:22% which have 5641 images


conv2d_8_input
InputLayer
input:
output:
[(None, 100, 100, 3)]
[(None, 100, 100, 3)]
conv2d_8
Conv2D
input:
output:
(None, 100, 100, 3)
(None, 100, 100, 32)
activation_11
Activation
input:
output:
(None, 100, 100, 32)
(None, 100, 100, 32)
conv2d_9
Conv2D
input:
output:
(None, 100, 100, 32)
(None, 100, 100, 32)
activation_12
Activation
input:
output:
(None, 100, 100, 32)
(None, 100, 100, 32)
max_pooling2d_4
MaxPooling2D
input:
output:
(None, 100, 100, 32)
(None, 50, 50, 32)
conv2d_10
Conv2D
input:
output:
(None, 50, 50, 32)
(None, 50, 50, 64)
activation_13
Activation
input:
output:
(None, 50, 50, 64)
(None, 50, 50, 64)
conv2d_11
Conv2D
input:
output:
(None, 50, 50, 64)
(None, 50, 50, 64)
activation_14
Activation
input:
output:
(None, 50, 50, 64)
(None, 50, 50, 64)


max_pooling2d_5 | input: | (None, 50, 50, 64)
MaxPooling2D | output: | (None, 25, 25, 64)
conv2d_12 | input: | (None, 25, 25, 64)
Conv2D | output: | (None, 25, 25, 128)
activation_15 | input: | (None, 25, 25, 128)
Activation | output: | (None, 25, 25, 128)
conv2d_13 | input: | (None, 25, 25, 128)
Conv2D | output: | (None, 25, 25, 128)
activation_16 | input: | (None, 25, 25, 128)
Activation | output: | (None, 25, 25, 128)
max_pooling2d_6 | input: | (None, 25, 25, 128)
MaxPooling2D | output: | (None, 12, 12, 128)
conv2d_14 | input: | (None, 12, 12, 128)
Conv2D | output: | (None, 12, 12, 256)
activation_17 | input: | (None, 12, 12, 256)
Activation | output: | (None, 12, 12, 256)
conv2d_15 | input: | (None, 12, 12, 256)
Conv2D | output: | (None, 12, 12, 256)
activation_18 | input: | (None, 12, 12, 256)
Activation | output: | (None, 12, 12, 256)


activation_18 | input: | (None, 12, 12, 256)
Activation | output: | (None, 12, 12, 256)
max_pooling2d_7 | input: | (None, 12, 12, 256)
MaxPooling2D | output: | (None, 6, 6, 256)
flatten_1 | input: | (None, 6, 6, 256)
Flatten | output: | (None, 9216)
dense_3 | input: | (None, 9216)
Dense | output: | (None, 256)
activation_19 | input: | (None, 256)
Activation | output: | (None, 256)
dropout_2 | input: | (None, 256)
Dropout | output: | (None, 256)
dense_4 | input: | (None, 256)
Dense | output: | (None, 256)
activation_20 | input: | (None, 256)
Activation | output: | (None, 256)
dropout_3 | input: | (None, 256)
Dropout | output: | (None, 256)
dense_5 | input: | (None, 256)
Dense | output: | (None, 33)
activation_21 | input: | (None, 33)
Activation | output: | (None, 33)

The hyperparameters used:-

*train_test_split =0.2 for test_size

& its random_state=42

*batch_size=32

*class_mode='categorical'

*epochs=10

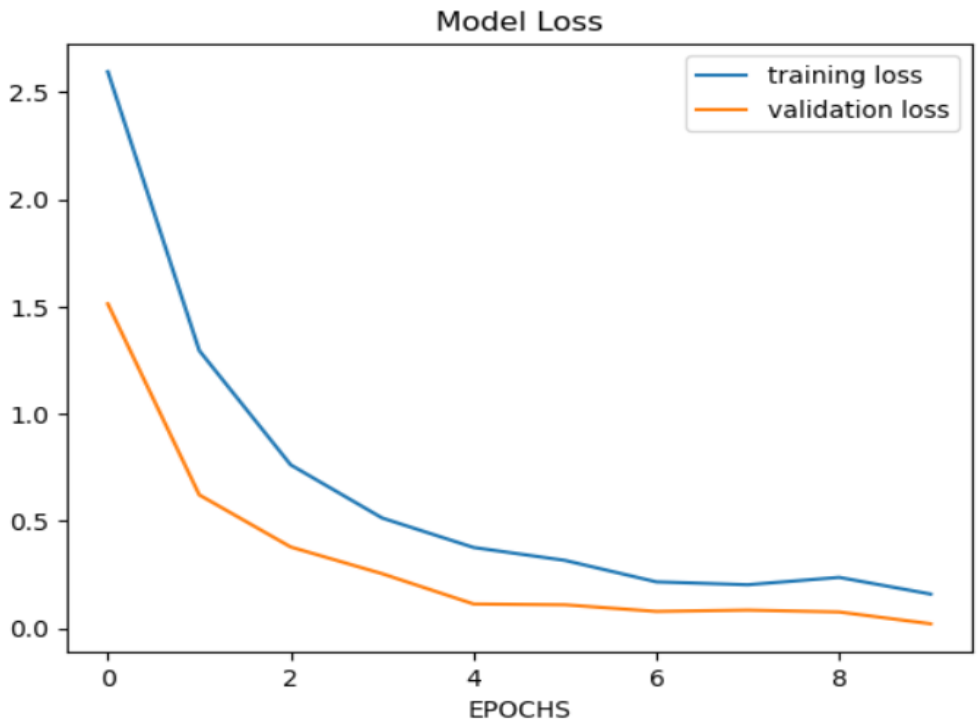
*loss=categorical_crossentropy

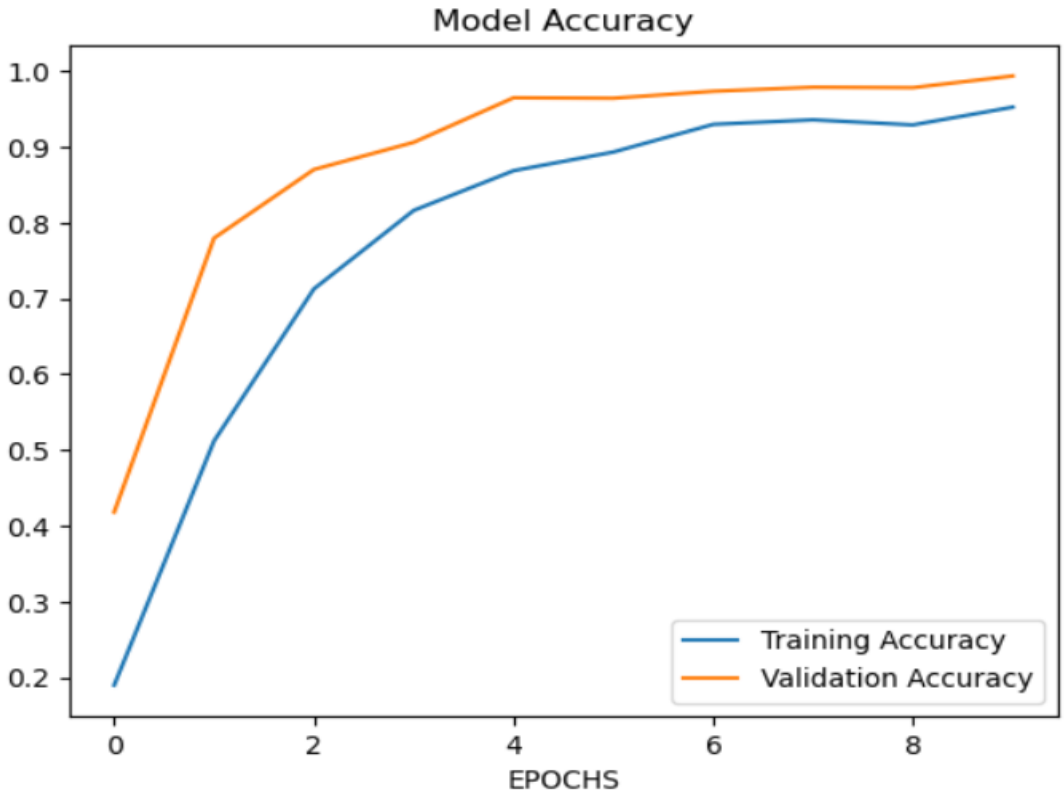
&optimizer=adam

&metrics=accuracy

Model summary

```
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv2d (Conv2D)             (None, 100, 100, 32)      896

 activation (Activation)     (None, 100, 100, 32)      0

 conv2d_1 (Conv2D)           (None, 100, 100, 32)      9248

 activation_1 (Activation)   (None, 100, 100, 32)      0

 max_pooling2d (MaxPooling2D  (None, 50, 50, 32)       0
 )

 conv2d_2 (Conv2D)           (None, 50, 50, 64)        18496

 activation_2 (Activation)   (None, 50, 50, 64)        0

 conv2d_3 (Conv2D)           (None, 50, 50, 64)        36928

 activation_3 (Activation)   (None, 50, 50, 64)        0

 max_pooling2d_1 (MaxPooling  (None, 25, 25, 64)       0
 2D)

 conv2d_4 (Conv2D)           (None, 25, 25, 128)       73856

 activation_4 (Activation)   (None, 25, 25, 128)       0

 conv2d_5 (Conv2D)           (None, 25, 25, 128)       147584

 activation_5 (Activation)   (None, 25, 25, 128)       0

 max_pooling2d_2 (MaxPooling  (None, 12, 12, 128)      0
 2D)

 conv2d_6 (Conv2D)           (None, 12, 12, 256)       295168

 activation_6 (Activation)   (None, 12, 12, 256)       0

 conv2d_7 (Conv2D)           (None, 12, 12, 256)       590080

 activation_7 (Activation)   (None, 12, 12, 256)       0

 max_pooling2d_3 (MaxPooling  (None, 6, 6, 256)        0
 2D)

 flatten (Flatten)           (None, 9216)              0

 dense (Dense)               (None, 256)               2359552

 activation_8 (Activation)   (None, 256)               0

 dropout (Dropout)           (None, 256)               0

 dense_1 (Dense)             (None, 256)               65792

 activation_9 (Activation)   (None, 256)               0

 dropout_1 (Dropout)         (None, 256)               0

 dense_2 (Dense)             (None, 33)                8481

 activation_10 (Activation)  (None, 33)                0

=================================================================
Total params: 3,606,081
Trainable params: 3,606,081
Non-trainable params: 0
_________________________________________________________________
```


Model Loss
training loss
validation loss
2.5
2.0
1.5
1.0
0.5
0.0
0
2
4
6
8
EPOCHS


Model Accuracy
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
Training Accuracy
Validation Accuracy
0
2
4
6
8
EPOCHS

The final test accuracy=99%

And loss= 0.0219