

|                               |                       |      |
|-------------------------------|-----------------------|------|
| input_17 (InputLayer)         | [(None, 128, 128, 3)] | 0    |
| conv1_pad (ZeroPadding2D)     | (None, 129, 129, 3)   | 0    |
| conv1 (Conv2D)                | (None, 64, 64, 8)     | 216  |
| conv1_bn (BatchNormalization) | (None, 64, 64, 8)     | 32   |
| conv1_relu (ReLU)             | (None, 64, 64, 8)     | 0    |
| conv_dw_1 (DepthwiseConv2D)   | (None, 64, 64, 8)     | 72   |
| conv_dw_1_bn (BatchNormaliza  | (None, 64, 64, 8)     | 32   |
| conv_dw_1_relu (ReLU)         | (None, 64, 64, 8)     | 0    |
| conv_pw_1 (Conv2D)            | (None, 64, 64, 16)    | 128  |
| conv_pw_1_bn (BatchNormaliza  | (None, 64, 64, 16)    | 64   |
| conv_pw_1_relu (ReLU)         | (None, 64, 64, 16)    | 0    |
| conv_pad_2 (ZeroPadding2D)    | (None, 65, 65, 16)    | 0    |
| conv_dw_2 (DepthwiseConv2D)   | (None, 32, 32, 16)    | 144  |
| conv_dw_2_bn (BatchNormaliza  | (None, 32, 32, 16)    | 64   |
| conv_dw_2_relu (ReLU)         | (None, 32, 32, 16)    | 0    |
| conv_pw_2 (Conv2D)            | (None, 32, 32, 32)    | 512  |
| conv_pw_2_bn (BatchNormaliza  | (None, 32, 32, 32)    | 128  |
| conv_pw_2_relu (ReLU)         | (None, 32, 32, 32)    | 0    |
| conv_dw_3 (DepthwiseConv2D)   | (None, 32, 32, 32)    | 288  |
| conv_dw_3_bn (BatchNormaliza  | (None, 32, 32, 32)    | 128  |
| conv_dw_3_relu (ReLU)         | (None, 32, 32, 32)    | 0    |
| conv_pw_3 (Conv2D)            | (None, 32, 32, 32)    | 1024 |
| conv_pw_3_bn (BatchNormaliza  | (None, 32, 32, 32)    | 128  |
| conv_pw_3_relu (ReLU)         | (None, 32, 32, 32)    | 0    |
| conv_pad_4 (ZeroPadding2D)    | (None, 33, 33, 32)    | 0    |
| conv_dw_4 (DepthwiseConv2D)   | (None, 16, 16, 32)    | 288  |
| conv_dw_4_bn (BatchNormaliza  | (None, 16, 16, 32)    | 128  |
| conv_dw_4_relu (ReLU)         | (None, 16, 16, 32)    | 0    |
| conv_pw_4 (Conv2D)            | (None, 16, 16, 64)    | 2048 |

|                              |                    |       |
|------------------------------|--------------------|-------|
| conv_pw_4_bn (BatchNormaliza | (None, 16, 16, 64) | 256   |
| conv_pw_4_relu (ReLU)        | (None, 16, 16, 64) | 0     |
| conv_dw_5 (DepthwiseConv2D)  | (None, 16, 16, 64) | 576   |
| conv_dw_5_bn (BatchNormaliza | (None, 16, 16, 64) | 256   |
| conv_dw_5_relu (ReLU)        | (None, 16, 16, 64) | 0     |
| conv_pw_5 (Conv2D)           | (None, 16, 16, 64) | 4096  |
| conv_pw_5_bn (BatchNormaliza | (None, 16, 16, 64) | 256   |
| conv_pw_5_relu (ReLU)        | (None, 16, 16, 64) | 0     |
| conv_pad_6 (ZeroPadding2D)   | (None, 17, 17, 64) | 0     |
| conv_dw_6 (DepthwiseConv2D)  | (None, 8, 8, 64)   | 576   |
| conv_dw_6_bn (BatchNormaliza | (None, 8, 8, 64)   | 256   |
| conv_dw_6_relu (ReLU)        | (None, 8, 8, 64)   | 0     |
| conv_pw_6 (Conv2D)           | (None, 8, 8, 128)  | 8192  |
| conv_pw_6_bn (BatchNormaliza | (None, 8, 8, 128)  | 512   |
| conv_pw_6_relu (ReLU)        | (None, 8, 8, 128)  | 0     |
| conv_dw_7 (DepthwiseConv2D)  | (None, 8, 8, 128)  | 1152  |
| conv_dw_7_bn (BatchNormaliza | (None, 8, 8, 128)  | 512   |
| conv_dw_7_relu (ReLU)        | (None, 8, 8, 128)  | 0     |
| conv_pw_7 (Conv2D)           | (None, 8, 8, 128)  | 16384 |
| conv_pw_7_bn (BatchNormaliza | (None, 8, 8, 128)  | 512   |
| conv_pw_7_relu (ReLU)        | (None, 8, 8, 128)  | 0     |
| conv_dw_8 (DepthwiseConv2D)  | (None, 8, 8, 128)  | 1152  |
| conv_dw_8_bn (BatchNormaliza | (None, 8, 8, 128)  | 512   |
| conv_dw_8_relu (ReLU)        | (None, 8, 8, 128)  | 0     |
| conv_pw_8 (Conv2D)           | (None, 8, 8, 128)  | 16384 |
| conv_pw_8_bn (BatchNormaliza | (None, 8, 8, 128)  | 512   |
| conv_pw_8_relu (ReLU)        | (None, 8, 8, 128)  | 0     |
| conv_dw_9 (DepthwiseConv2D)  | (None, 8, 8, 128)  | 1152  |
| conv_dw_9_bn (BatchNormaliza | (None, 8, 8, 128)  | 512   |
| conv_dw_9_relu (ReLU)        | (None, 8, 8, 128)  | 0     |

|                              |                   |       |
|------------------------------|-------------------|-------|
| conv_pw_9 (Conv2D)           | (None, 8, 8, 128) | 16384 |
| conv_pw_9_bn (BatchNormaliza | (None, 8, 8, 128) | 512   |
| conv_pw_9_relu (ReLU)        | (None, 8, 8, 128) | 0     |
| conv_dw_10 (DepthwiseConv2D) | (None, 8, 8, 128) | 1152  |
| conv_dw_10_bn (BatchNormaliz | (None, 8, 8, 128) | 512   |
| conv_dw_10_relu (ReLU)       | (None, 8, 8, 128) | 0     |
| conv_pw_10 (Conv2D)          | (None, 8, 8, 128) | 16384 |
| conv_pw_10_bn (BatchNormaliz | (None, 8, 8, 128) | 512   |
| conv_pw_10_relu (ReLU)       | (None, 8, 8, 128) | 0     |
| conv_dw_11 (DepthwiseConv2D) | (None, 8, 8, 128) | 1152  |
| conv_dw_11_bn (BatchNormaliz | (None, 8, 8, 128) | 512   |
| conv_dw_11_relu (ReLU)       | (None, 8, 8, 128) | 0     |
| conv_pw_11 (Conv2D)          | (None, 8, 8, 128) | 16384 |
| conv_pw_11_bn (BatchNormaliz | (None, 8, 8, 128) | 512   |
| conv_pw_11_relu (ReLU)       | (None, 8, 8, 128) | 0     |
| conv_pad_12 (ZeroPadding2D)  | (None, 9, 9, 128) | 0     |
| conv_dw_12 (DepthwiseConv2D) | (None, 4, 4, 128) | 1152  |
| conv_dw_12_bn (BatchNormaliz | (None, 4, 4, 128) | 512   |
| conv_dw_12_relu (ReLU)       | (None, 4, 4, 128) | 0     |
| conv_pw_12 (Conv2D)          | (None, 4, 4, 256) | 32768 |
| conv_pw_12_bn (BatchNormaliz | (None, 4, 4, 256) | 1024  |
| conv_pw_12_relu (ReLU)       | (None, 4, 4, 256) | 0     |
| conv_dw_13 (DepthwiseConv2D) | (None, 4, 4, 256) | 2304  |
| conv_dw_13_bn (BatchNormaliz | (None, 4, 4, 256) | 1024  |
| conv_dw_13_relu (ReLU)       | (None, 4, 4, 256) | 0     |
| conv_pw_13 (Conv2D)          | (None, 4, 4, 256) | 65536 |
| conv_pw_13_bn (BatchNormaliz | (None, 4, 4, 256) | 1024  |
| conv_pw_13_relu (ReLU)       | (None, 4, 4, 256) | 0     |
| flatten_9 (Flatten)          | (None, 4096)      | 0     |

|                  |             |        |
|------------------|-------------|--------|
| dense_14 (Dense) | (None, 100) | 409700 |
| dense_15 (Dense) | (None, 2)   | 202    |

---

=====  
 Total params: 628,446  
 Trainable params: 622,974  
 Non-trainable params: 5,472

---

Traceback (most recent call last):

```

File "<ipython-input-42-45012fd0b85e>", line 1, in <module>
    runfile('C:/Data/SGN-41007 PR and ML/exercises/Ex5/EX5_Testing.py', wdir='C:/Data/
SGN-41007 PR and ML/exercises/Ex5')

File "C:\Program Files\Anaconda\lib\site-packages\spyder_kernels\customize
\spydercustomize.py", line 827, in runfile
    execfile(filename, namespace)

File "C:\Program Files\Anaconda\lib\site-packages\spyder_kernels\customize
\spydercustomize.py", line 110, in execfile
    exec(compile(f.read(), filename, 'exec'), namespace)

File "C:/Data/SGN-41007 PR and ML/exercises/Ex5/EX5_Testing.py", line 84, in <module>
    validation_data=(x_test, y_test))

File "C:\Program Files\Anaconda\lib\site-packages\tensorflow_core\python\keras\engine
\training.py", line 728, in fit
    use_multiprocessing=use_multiprocessing)

File "C:\Program Files\Anaconda\lib\site-packages\tensorflow_core\python\keras\engine
\training_v2.py", line 224, in fit
    distribution_strategy=strategy)

File "C:\Program Files\Anaconda\lib\site-packages\tensorflow_core\python\keras\engine
\training_v2.py", line 547, in _process_training_inputs
    use_multiprocessing=use_multiprocessing)

File "C:\Program Files\Anaconda\lib\site-packages\tensorflow_core\python\keras\engine
\training_v2.py", line 594, in _process_inputs
    steps=steps)

File "C:\Program Files\Anaconda\lib\site-packages\tensorflow_core\python\keras\engine
\training.py", line 2538, in _standardize_user_data
    y, self._feed_loss_fns, feed_output_shapes)

File "C:\Program Files\Anaconda\lib\site-packages\tensorflow_core\python\keras\engine
\training_utils.py", line 743, in check_loss_and_target_compatibility
    ' while using as loss `'+ loss_name + '`.'

ValueError: A target array with shape (60000, 10) was passed for an output of shape (None,
2) while using as loss `categorical_crossentropy`. This loss expects targets to have the
same shape as the output.

```

In [43]:

```

In [43]:          'C:/Data/SGN-41007 PR and ML/exercises/Ex5/EX5_Testing.py'      ='C:/Data/
SGN-41007 PR and ML/exercises/Ex5'
x_train shape: (60000, 128, 128, 3)

```

60000 train samples  
10000 test samples  
Model: "model\_16"

| Layer (type)                  | Output Shape          | Param # |
|-------------------------------|-----------------------|---------|
| input_18 (InputLayer)         | [(None, 128, 128, 3)] | 0       |
| conv1_pad (ZeroPadding2D)     | (None, 129, 129, 3)   | 0       |
| conv1 (Conv2D)                | (None, 64, 64, 8)     | 216     |
| conv1_bn (BatchNormalization) | (None, 64, 64, 8)     | 32      |
| conv1_relu (ReLU)             | (None, 64, 64, 8)     | 0       |
| conv_dw_1 (DepthwiseConv2D)   | (None, 64, 64, 8)     | 72      |
| conv_dw_1_bn (BatchNormaliza  | (None, 64, 64, 8)     | 32      |
| conv_dw_1_relu (ReLU)         | (None, 64, 64, 8)     | 0       |
| conv_pw_1 (Conv2D)            | (None, 64, 64, 16)    | 128     |
| conv_pw_1_bn (BatchNormaliza  | (None, 64, 64, 16)    | 64      |
| conv_pw_1_relu (ReLU)         | (None, 64, 64, 16)    | 0       |
| conv_pad_2 (ZeroPadding2D)    | (None, 65, 65, 16)    | 0       |
| conv_dw_2 (DepthwiseConv2D)   | (None, 32, 32, 16)    | 144     |
| conv_dw_2_bn (BatchNormaliza  | (None, 32, 32, 16)    | 64      |
| conv_dw_2_relu (ReLU)         | (None, 32, 32, 16)    | 0       |
| conv_pw_2 (Conv2D)            | (None, 32, 32, 32)    | 512     |
| conv_pw_2_bn (BatchNormaliza  | (None, 32, 32, 32)    | 128     |
| conv_pw_2_relu (ReLU)         | (None, 32, 32, 32)    | 0       |
| conv_dw_3 (DepthwiseConv2D)   | (None, 32, 32, 32)    | 288     |
| conv_dw_3_bn (BatchNormaliza  | (None, 32, 32, 32)    | 128     |
| conv_dw_3_relu (ReLU)         | (None, 32, 32, 32)    | 0       |
| conv_pw_3 (Conv2D)            | (None, 32, 32, 32)    | 1024    |
| conv_pw_3_bn (BatchNormaliza  | (None, 32, 32, 32)    | 128     |
| conv_pw_3_relu (ReLU)         | (None, 32, 32, 32)    | 0       |
| conv_pad_4 (ZeroPadding2D)    | (None, 33, 33, 32)    | 0       |
| conv_dw_4 (DepthwiseConv2D)   | (None, 16, 16, 32)    | 288     |
| conv_dw_4_bn (BatchNormaliza  | (None, 16, 16, 32)    | 128     |

|                              |                    |       |
|------------------------------|--------------------|-------|
| conv_dw_4_relu (ReLU)        | (None, 16, 16, 32) | 0     |
| conv_pw_4 (Conv2D)           | (None, 16, 16, 64) | 2048  |
| conv_pw_4_bn (BatchNormaliza | (None, 16, 16, 64) | 256   |
| conv_pw_4_relu (ReLU)        | (None, 16, 16, 64) | 0     |
| conv_dw_5 (DepthwiseConv2D)  | (None, 16, 16, 64) | 576   |
| conv_dw_5_bn (BatchNormaliza | (None, 16, 16, 64) | 256   |
| conv_dw_5_relu (ReLU)        | (None, 16, 16, 64) | 0     |
| conv_pw_5 (Conv2D)           | (None, 16, 16, 64) | 4096  |
| conv_pw_5_bn (BatchNormaliza | (None, 16, 16, 64) | 256   |
| conv_pw_5_relu (ReLU)        | (None, 16, 16, 64) | 0     |
| conv_pad_6 (ZeroPadding2D)   | (None, 17, 17, 64) | 0     |
| conv_dw_6 (DepthwiseConv2D)  | (None, 8, 8, 64)   | 576   |
| conv_dw_6_bn (BatchNormaliza | (None, 8, 8, 64)   | 256   |
| conv_dw_6_relu (ReLU)        | (None, 8, 8, 64)   | 0     |
| conv_pw_6 (Conv2D)           | (None, 8, 8, 128)  | 8192  |
| conv_pw_6_bn (BatchNormaliza | (None, 8, 8, 128)  | 512   |
| conv_pw_6_relu (ReLU)        | (None, 8, 8, 128)  | 0     |
| conv_dw_7 (DepthwiseConv2D)  | (None, 8, 8, 128)  | 1152  |
| conv_dw_7_bn (BatchNormaliza | (None, 8, 8, 128)  | 512   |
| conv_dw_7_relu (ReLU)        | (None, 8, 8, 128)  | 0     |
| conv_pw_7 (Conv2D)           | (None, 8, 8, 128)  | 16384 |
| conv_pw_7_bn (BatchNormaliza | (None, 8, 8, 128)  | 512   |
| conv_pw_7_relu (ReLU)        | (None, 8, 8, 128)  | 0     |
| conv_dw_8 (DepthwiseConv2D)  | (None, 8, 8, 128)  | 1152  |
| conv_dw_8_bn (BatchNormaliza | (None, 8, 8, 128)  | 512   |
| conv_dw_8_relu (ReLU)        | (None, 8, 8, 128)  | 0     |
| conv_pw_8 (Conv2D)           | (None, 8, 8, 128)  | 16384 |
| conv_pw_8_bn (BatchNormaliza | (None, 8, 8, 128)  | 512   |
| conv_pw_8_relu (ReLU)        | (None, 8, 8, 128)  | 0     |

|                              |                   |       |
|------------------------------|-------------------|-------|
| conv_dw_9 (DepthwiseConv2D)  | (None, 8, 8, 128) | 1152  |
| conv_dw_9_bn (BatchNormaliza | (None, 8, 8, 128) | 512   |
| conv_dw_9_relu (ReLU)        | (None, 8, 8, 128) | 0     |
| conv_pw_9 (Conv2D)           | (None, 8, 8, 128) | 16384 |
| conv_pw_9_bn (BatchNormaliza | (None, 8, 8, 128) | 512   |
| conv_pw_9_relu (ReLU)        | (None, 8, 8, 128) | 0     |
| conv_dw_10 (DepthwiseConv2D) | (None, 8, 8, 128) | 1152  |
| conv_dw_10_bn (BatchNormaliz | (None, 8, 8, 128) | 512   |
| conv_dw_10_relu (ReLU)       | (None, 8, 8, 128) | 0     |
| conv_pw_10 (Conv2D)          | (None, 8, 8, 128) | 16384 |
| conv_pw_10_bn (BatchNormaliz | (None, 8, 8, 128) | 512   |
| conv_pw_10_relu (ReLU)       | (None, 8, 8, 128) | 0     |
| conv_dw_11 (DepthwiseConv2D) | (None, 8, 8, 128) | 1152  |
| conv_dw_11_bn (BatchNormaliz | (None, 8, 8, 128) | 512   |
| conv_dw_11_relu (ReLU)       | (None, 8, 8, 128) | 0     |
| conv_pw_11 (Conv2D)          | (None, 8, 8, 128) | 16384 |
| conv_pw_11_bn (BatchNormaliz | (None, 8, 8, 128) | 512   |
| conv_pw_11_relu (ReLU)       | (None, 8, 8, 128) | 0     |
| conv_pad_12 (ZeroPadding2D)  | (None, 9, 9, 128) | 0     |
| conv_dw_12 (DepthwiseConv2D) | (None, 4, 4, 128) | 1152  |
| conv_dw_12_bn (BatchNormaliz | (None, 4, 4, 128) | 512   |
| conv_dw_12_relu (ReLU)       | (None, 4, 4, 128) | 0     |
| conv_pw_12 (Conv2D)          | (None, 4, 4, 256) | 32768 |
| conv_pw_12_bn (BatchNormaliz | (None, 4, 4, 256) | 1024  |
| conv_pw_12_relu (ReLU)       | (None, 4, 4, 256) | 0     |
| conv_dw_13 (DepthwiseConv2D) | (None, 4, 4, 256) | 2304  |
| conv_dw_13_bn (BatchNormaliz | (None, 4, 4, 256) | 1024  |
| conv_dw_13_relu (ReLU)       | (None, 4, 4, 256) | 0     |
| conv_pw_13 (Conv2D)          | (None, 4, 4, 256) | 65536 |
| conv_pw_13_bn (BatchNormaliz | (None, 4, 4, 256) | 1024  |

|                             |                   |        |
|-----------------------------|-------------------|--------|
| conv_pw_13_relu (ReLU)      | (None, 4, 4, 256) | 0      |
| flatten_10 (Flatten)        | (None, 4096)      | 0      |
| dense_16 (Dense)            | (None, 100)       | 409700 |
| dense_17 (Dense)            | (None, 2)         | 202    |
| =====                       |                   |        |
| Total params: 628,446       |                   |        |
| Trainable params: 622,974   |                   |        |
| Non-trainable params: 5,472 |                   |        |

Traceback (most recent call last):

```
File "<ipython-input-43-45012fd0b85e>", line 1, in <module>
    runfile('C:/Data/SGN-41007 PR and ML/exercises/Ex5/EX5_Testing.py', wdir='C:/Data/
SGN-41007 PR and ML/exercises/Ex5')
```

```
File "C:\Program Files\Anaconda\lib\site-packages\spyder_kernels\customize
\spydercustomize.py", line 827, in runfile
    execfile(filename, namespace)
```

```
File "C:\Program Files\Anaconda\lib\site-packages\spyder_kernels\customize
\spydercustomize.py", line 110, in execfile
    exec(compile(f.read(), filename, 'exec'), namespace)
```

```
File "C:/Data/SGN-41007 PR and ML/exercises/Ex5/EX5_Testing.py", line 86, in <module>
    validation_data=(x_test, y_test))
```

```
File "C:\Program Files\Anaconda\lib\site-packages\tensorflow_core\python\keras\engine
\training.py", line 728, in fit
    use_multiprocessing=use_multiprocessing)
```

```
File "C:\Program Files\Anaconda\lib\site-packages\tensorflow_core\python\keras\engine
\training_v2.py", line 224, in fit
    distribution_strategy=strategy)
```

```
File "C:\Program Files\Anaconda\lib\site-packages\tensorflow_core\python\keras\engine
\training_v2.py", line 547, in _process_training_inputs
    use_multiprocessing=use_multiprocessing)
```

```
File "C:\Program Files\Anaconda\lib\site-packages\tensorflow_core\python\keras\engine
\training_v2.py", line 594, in _process_inputs
    steps=steps)
```

```
File "C:\Program Files\Anaconda\lib\site-packages\tensorflow_core\python\keras\engine
\training.py", line 2538, in _standardize_user_data
    y, self._feed_loss_fns, feed_output_shapes)
```

```
File "C:\Program Files\Anaconda\lib\site-packages\tensorflow_core\python\keras\engine
\training_utils.py", line 743, in check_loss_and_target_compatibility
    ' while using as loss ``' + loss_name + ``. '
```

**ValueError:** A target array with shape (60000, 10) was passed for an output of shape (None, 2) while using as loss `categorical\_crossentropy`. This loss expects targets to have the same shape as the output.



In [44]:

In [44]: 'C:/Data/SGN-41007 PR and ML/exercises/Ex5/EX5\_Testing.py' = 'C:/Data/SGN-41007 PR and ML/exercises/Ex5'

x\_train shape: (60000, 128, 128, 3)

60000 train samples

10000 test samples

Model: "sequential"

| Layer (type)                | Output Shape      | Param # |
|-----------------------------|-------------------|---------|
| mobilenet_0.25_128 (Model)  | (None, 4, 4, 256) | 218544  |
| flatten_12 (Flatten)        | (None, 4096)      | 0       |
| dense_20 (Dense)            | (None, 100)       | 409700  |
| dense_21 (Dense)            | (None, 10)        | 1010    |
| Total params: 629,254       |                   |         |
| Trainable params: 623,782   |                   |         |
| Non-trainable params: 5,472 |                   |         |

Train on 60000 samples, validate on 10000 samples

Epoch 1/12

60000/60000 [=====] - 121s 2ms/sample - loss: 8.3231 - accuracy: 0.0833 - val\_loss: 7.6408 - val\_accuracy: 0.0936

Epoch 2/12

60000/60000 [=====] - 108s 2ms/sample - loss: 7.0356 - accuracy: 0.1109 - val\_loss: 6.5630 - val\_accuracy: 0.1217

Epoch 3/12

60000/60000 [=====] - 110s 2ms/sample - loss: 6.2034 - accuracy: 0.1394 - val\_loss: 5.8496 - val\_accuracy: 0.1532

Epoch 4/12

60000/60000 [=====] - 112s 2ms/sample - loss: 5.6084 - accuracy: 0.1739 - val\_loss: 5.3744 - val\_accuracy: 0.1895

Epoch 5/12

60000/60000 [=====] - 113s 2ms/sample - loss: 5.2473 - accuracy: 0.2047 - val\_loss: 5.0543 - val\_accuracy: 0.2246

Epoch 6/12

60000/60000 [=====] - 117s 2ms/sample - loss: 4.9268 - accuracy: 0.2494 - val\_loss: 4.7846 - val\_accuracy: 0.2704

Epoch 7/12

60000/60000 [=====] - 114s 2ms/sample - loss: 4.6978 - accuracy: 0.2874 - val\_loss: 4.5395 - val\_accuracy: 0.3180

Epoch 8/12

60000/60000 [=====] - 140s 2ms/sample - loss: 4.4243 - accuracy: 0.3322 - val\_loss: 4.1825 - val\_accuracy: 0.3556

Epoch 9/12

60000/60000 [=====] - 130s 2ms/sample - loss: 3.9212 - accuracy: 0.3711 - val\_loss: 3.6324 - val\_accuracy: 0.4007

Epoch 10/12

60000/60000 [=====] - 121s 2ms/sample - loss: 3.4688 - accuracy: 0.4154 - val\_loss: 3.2966 - val\_accuracy: 0.4523

Epoch 11/12

60000/60000 [=====] - 124s 2ms/sample - loss: 3.2014 - accuracy: 0.4742 - val\_loss: 3.1139 - val\_accuracy: 0.5058

Epoch 12/12

60000/60000 [=====] - 118s 2ms/sample - loss: 3.0619 - accuracy:

```
0.5183 - val_loss: 2.9787 - val_accuracy: 0.5539  
Test loss: 2.978718588256836  
Test accuracy: 0.5539
```

```
In [45]:
```