NEURAL NETWORK DEEP LEARNING

ICP 5

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GitHub:

Repository URL for the source code: https://github.com/axk82380/NNPL/tree/main/ICP_5

Video Link:

https://drive.google.com/file/d/154p_aIZzDS_3K_YWfWhtehL7Ssg6c7fH/view?usp=sharing

Output:

```
[ ]  sgd = SGD(learning_rate=0.01, momentum=0.9, decay=1e-6)
     model.compile(loss='categorical_crossentropy', optimizer=sgd, metrics=['accuracy'])
     print(model.summary())
```

```
/usr/local/lib/python3.10/dist-packages/keras/src/optimizers/base_optimizer.py:33: UserWarning: Argument `decay` is no longer
  warnings.warn(
Model: "sequential_1"
```

Layer (type)	Output Shape	Param #
conv2d (Conv2D)	(None, 32, 32, 32)	896
dropout (Dropout)	(None, 32, 32, 32)	0
conv2d_1 (Conv2D)	(None, 32, 32, 32)	9,248
max_pooling2d (MaxPooling2D)	(None, 16, 16, 32)	0
flatten (Flatten)	(None, 8192)	0
dense (Dense)	(None, 512)	4,194,816
dropout_1 (Dropout)	(None, 512)	0
dense_1 (Dense)	(None, 10)	5,130

```
Total params: 4,210,090 (16.06 MB)
Trainable params: 4,210,090 (16.06 MB)
Non-trainable params: 0 (0.00 B)
None
```

```
[ ] epochs = 5
    batch_size = 32
    model.fit(X_train, y_train, validation_data=(X_test, y_test), epochs=epochs, batch_size=batch_size)
```

```
Epoch 1/5
1563/1563 ━━━━━━━━━━━━━━━━━━━━ 16s 7ms/step - accuracy: 0.2960 - loss: 1.9382 - val_accuracy: 0.4212 - val_loss: 1.6107
Epoch 2/5
1563/1563 ━━━━━━━━━━━━━━━━━━━━ 6s 4ms/step - accuracy: 0.4703 - loss: 1.4611 - val_accuracy: 0.5444 - val_loss: 1.2595
Epoch 3/5
1563/1563 ━━━━━━━━━━━━━━━━━━━━ 10s 4ms/step - accuracy: 0.5485 - loss: 1.2613 - val_accuracy: 0.5737 - val_loss: 1.1901
Epoch 4/5
1563/1563 ━━━━━━━━━━━━━━━━━━━━ 6s 4ms/step - accuracy: 0.6093 - loss: 1.0997 - val_accuracy: 0.5973 - val_loss: 1.1197
Epoch 5/5
1563/1563 ━━━━━━━━━━━━━━━━━━━━ 7s 4ms/step - accuracy: 0.6545 - loss: 0.9746 - val_accuracy: 0.6289 - val_loss: 1.0521
<keras.src.callbacks.history.History at 0x7d94bfb10a00>
```

```
] scores = model.evaluate(X_test, y_test, verbose=0)
  print("Accuracy: %.2f%%" % (scores[1]*100))
```

```
Accuracy: 62.89%
```

[8]

Model: "sequential_3"

Layer (type)	Output Shape	Param #
conv2d_18 (Conv2D)	(None, 32, 32, 32)	896
dropout_18 (Dropout)	(None, 32, 32, 32)	0
conv2d_19 (Conv2D)	(None, 32, 32, 32)	9,248
max_pooling2d_9 (MaxPooling2D)	(None, 16, 16, 32)	0
conv2d_20 (Conv2D)	(None, 16, 16, 64)	18,496
dropout_19 (Dropout)	(None, 16, 16, 64)	0
conv2d_21 (Conv2D)	(None, 16, 16, 64)	36,928
max_pooling2d_10 (MaxPooling2D)	(None, 8, 8, 64)	0
conv2d_22 (Conv2D)	(None, 8, 8, 128)	73,856
dropout_20 (Dropout)	(None, 8, 8, 128)	0
conv2d_23 (Conv2D)	(None, 8, 8, 128)	147,584
max_pooling2d_11 (MaxPooling2D)	(None, 4, 4, 128)	0
flatten_3 (Flatten)	(None, 2048)	0
dropout_21 (Dropout)	(None, 2048)	0
dense_9 (Dense)	(None, 1024)	2,098,176
dropout_22 (Dropout)	(None, 1024)	0

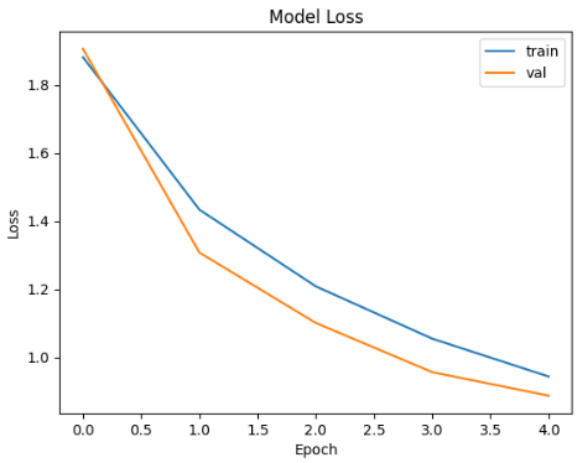
[8]

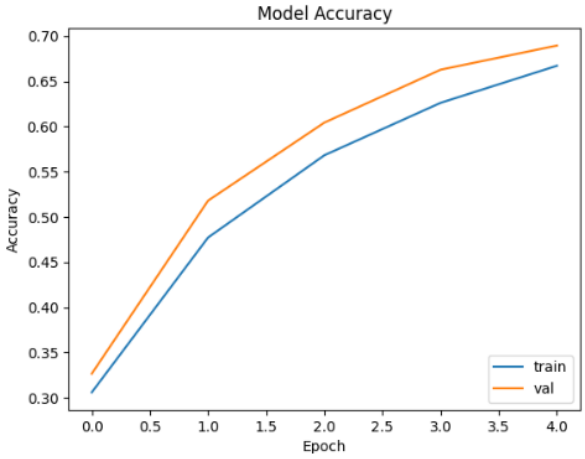
flatten_3 (Flatten)	(None, 2048)	0
dropout_21 (Dropout)	(None, 2048)	0
dense_9 (Dense)	(None, 1024)	2,098,176
dropout_22 (Dropout)	(None, 1024)	0
dense_10 (Dense)	(None, 512)	524,800
dropout_23 (Dropout)	(None, 512)	0
dense_11 (Dense)	(None, 10)	5,130

Total params: 2,915,114 (11.12 MB)
Trainable params: 2,915,114 (11.12 MB)
Non-trainable params: 0 (0.00 B)
None
Epoch 1/5
1563/1563 ━━━━━━━━━━━━━━━━━━━━ **23s** 10ms/step - accuracy: 0.2243 - loss: 2.0757 - val_accuracy: 0.3266 - val_loss: 1.9049
Epoch 2/5
1563/1563 ━━━━━━━━━━━━━━━━━━━━ **10s** 7ms/step - accuracy: 0.4546 - loss: 1.4943 - val_accuracy: 0.5180 - val_loss: 1.3072
Epoch 3/5
1563/1563 ━━━━━━━━━━━━━━━━━━━━ **21s** 7ms/step - accuracy: 0.5512 - loss: 1.2456 - val_accuracy: 0.6043 - val_loss: 1.1006
Epoch 4/5
1563/1563 ━━━━━━━━━━━━━━━━━━━━ **10s** 6ms/step - accuracy: 0.6202 - loss: 1.0719 - val_accuracy: 0.6628 - val_loss: 0.9562
Epoch 5/5
1563/1563 ━━━━━━━━━━━━━━━━━━━━ **10s** 7ms/step - accuracy: 0.6639 - loss: 0.9532 - val_accuracy: 0.6895 - val_loss: 0.8870
Accuracy: 68.95%

```
# Print the predicted and actual labels for the first 4 images
print("Predicted labels:", predicted_labels)
print("Actual labels:   ", actual_labels)
```

```
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 324ms/step
Predicted labels: [3 8 8 0]
Actual labels:    [3 8 8 0]
```


Model Loss
train
val
Loss
Epoch
1.8
1.6
1.4
1.2
1.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0


Model Accuracy
Accuracy
Epoch
train
val
0.70
0.65
0.60
0.55
0.50
0.45
0.40
0.35
0.30
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0