CS564 Foundations of Machine Learning

ASSIGNMENT 4

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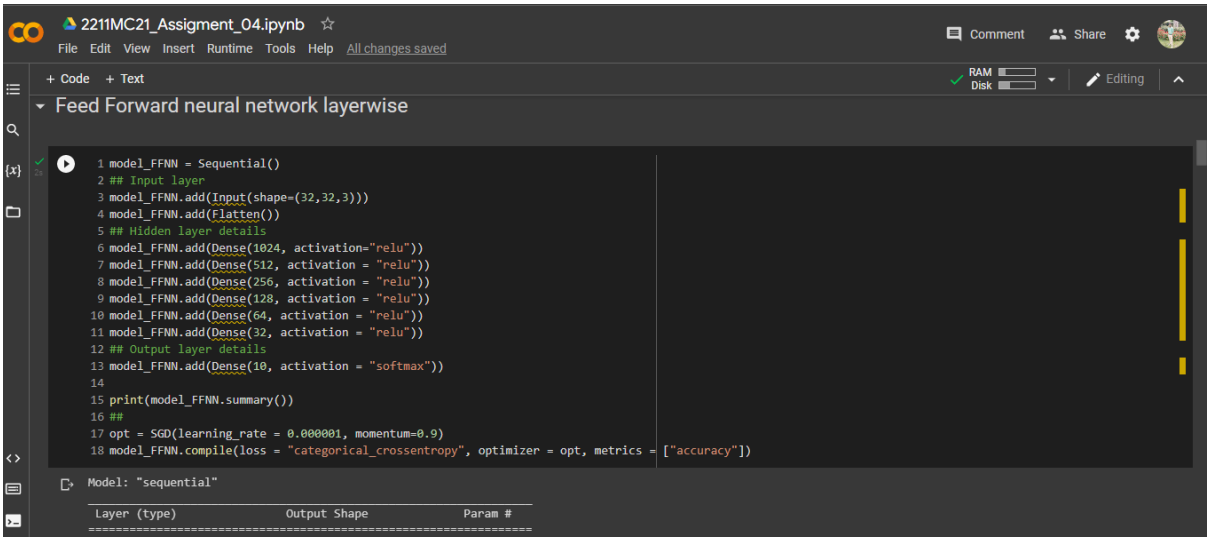
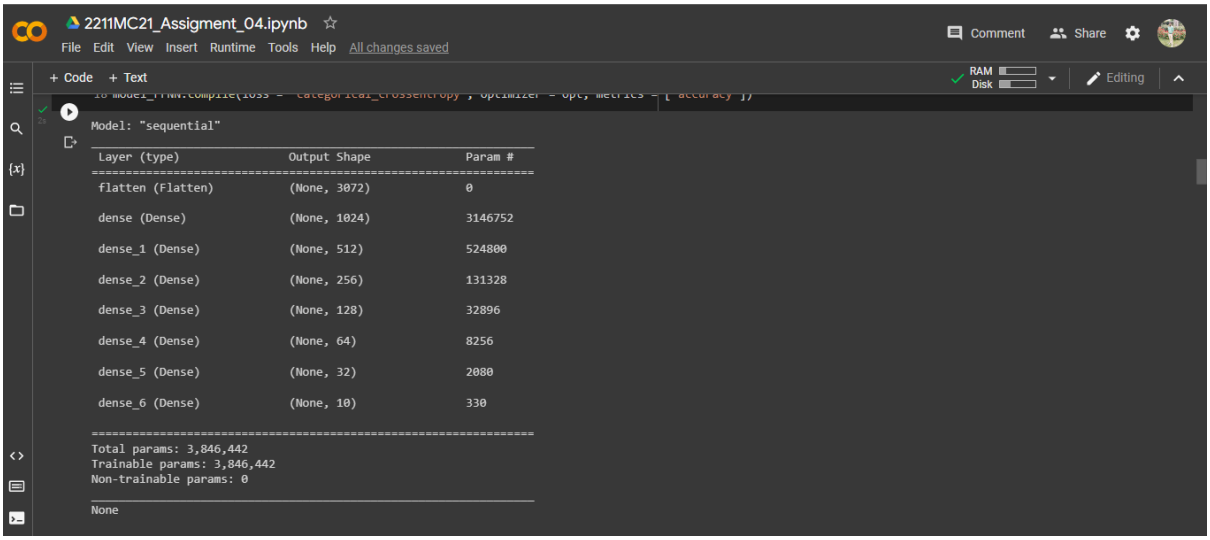
2211MC21

Problem Statement:

- Design and implement a Feed Forward Neural Network (FFNN) and a Recurrent Neural Network (RNN) for the task of image classification on the CIFAR-10 dataset.

- **Implementation:**
  - ➢ Feed-forward neural network for CIFAR-10 dataset.





2211MC21_Assigment_04.ipynb

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```
1 model_FFNN.fit(X_train, y_cat_train, validation_data = (X_test, y_cat_test), epochs = 50, batch_size = 128)
```

```
Epoch 11/50
391/391 [==============================] - 2s 5ms/step - loss: 2.3128 - accuracy: 0.1034 - val_loss: 2.3196 - val_accuracy: 0.1014
Epoch 12/50
391/391 [==============================] - 2s 5ms/step - loss: 2.3115 - accuracy: 0.1033 - val_loss: 2.3186 - val_accuracy: 0.1013
Epoch 13/50
391/391 [==============================] - 2s 5ms/step - loss: 2.3103 - accuracy: 0.1032 - val_loss: 2.3177 - val_accuracy: 0.1012
Epoch 14/50
391/391 [==============================] - 2s 5ms/step - loss: 2.3094 - accuracy: 0.1034 - val_loss: 2.3170 - val_accuracy: 0.1011
Epoch 15/50
391/391 [==============================] - 2s 5ms/step - loss: 2.3085 - accuracy: 0.1035 - val_loss: 2.3163 - val_accuracy: 0.1009
Epoch 16/50
391/391 [==============================] - 2s 5ms/step - loss: 2.3077 - accuracy: 0.1033 - val_loss: 2.3157 - val_accuracy: 0.1012
Epoch 17/50
391/391 [==============================] - 2s 5ms/step - loss: 2.3070 - accuracy: 0.1034 - val_loss: 2.3152 - val_accuracy: 0.1013
Epoch 18/50
391/391 [==============================] - 2s 5ms/step - loss: 2.3064 - accuracy: 0.1033 - val_loss: 2.3148 - val_accuracy: 0.1016
Epoch 19/50
391/391 [==============================] - 2s 5ms/step - loss: 2.3058 - accuracy: 0.1033 - val_loss: 2.3144 - val_accuracy: 0.1012
Epoch 20/50
391/391 [==============================] - 2s 5ms/step - loss: 2.3053 - accuracy: 0.1032 - val_loss: 2.3140 - val_accuracy: 0.1012
Epoch 21/50
391/391 [==============================] - 2s 5ms/step - loss: 2.3048 - accuracy: 0.1034 - val_loss: 2.3137 - val_accuracy: 0.1013
Epoch 22/50
391/391 [==============================] - 2s 5ms/step - loss: 2.3044 - accuracy: 0.1035 - val_loss: 2.3134 - val_accuracy: 0.1011
Epoch 23/50
391/391 [==============================] - 2s 5ms/step - loss: 2.3040 - accuracy: 0.1036 - val_loss: 2.3131 - val_accuracy: 0.1013
```

2211MC21_Assigment_04.ipynb

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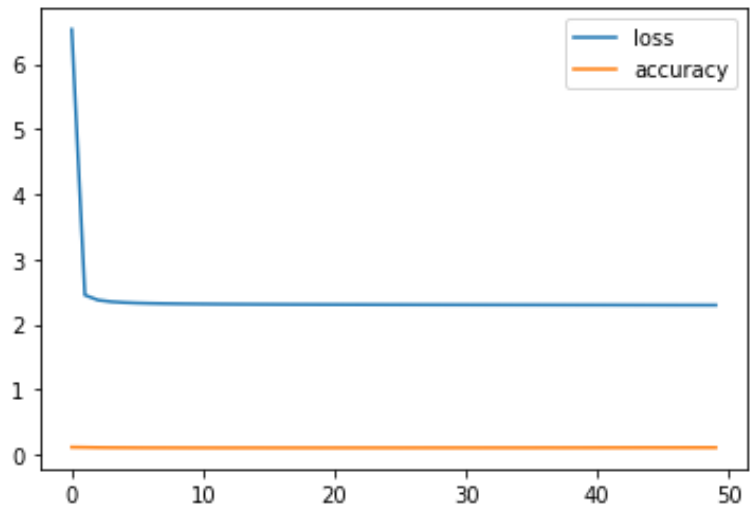
```
<keras.callbacks.History at 0x7fabb4466bd0>
```

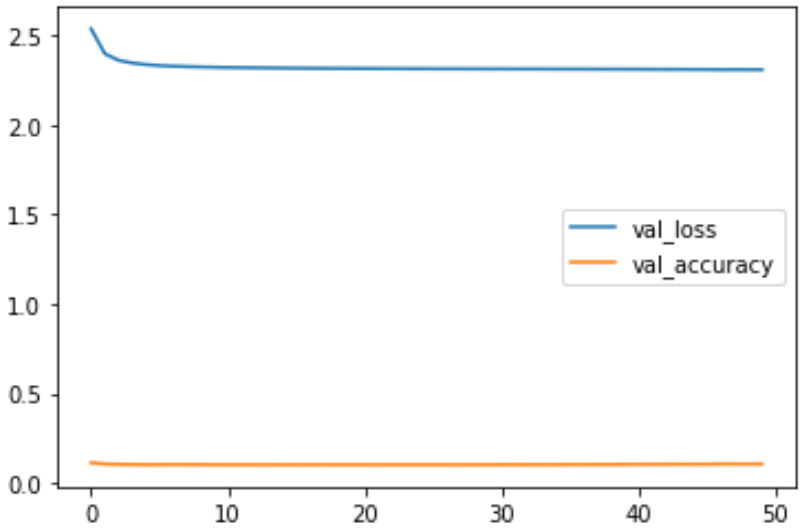
```
1 metrics_FFNN = pd.DataFrame(model_FFNN.history.history)
2 metrics_FFNN
```

	loss	accuracy	val_loss	val_accuracy
0	6.532239	0.11330	2.535487	0.1121
1	2.450019	0.11094	2.396581	0.1054
2	2.373081	0.10790	2.359746	0.1040
3	2.347943	0.10644	2.344705	0.1030
4	2.335569	0.10568	2.335771	0.1016
5	2.327861	0.10480	2.330216	0.1023
6	2.322760	0.10426	2.326642	0.1024
7	2.319282	0.10416	2.324337	0.1024
8	2.316667	0.10390	2.322378	0.1022
9	2.314572	0.10354	2.320843	0.1017
10	2.312843	0.10338	2.319582	0.1014

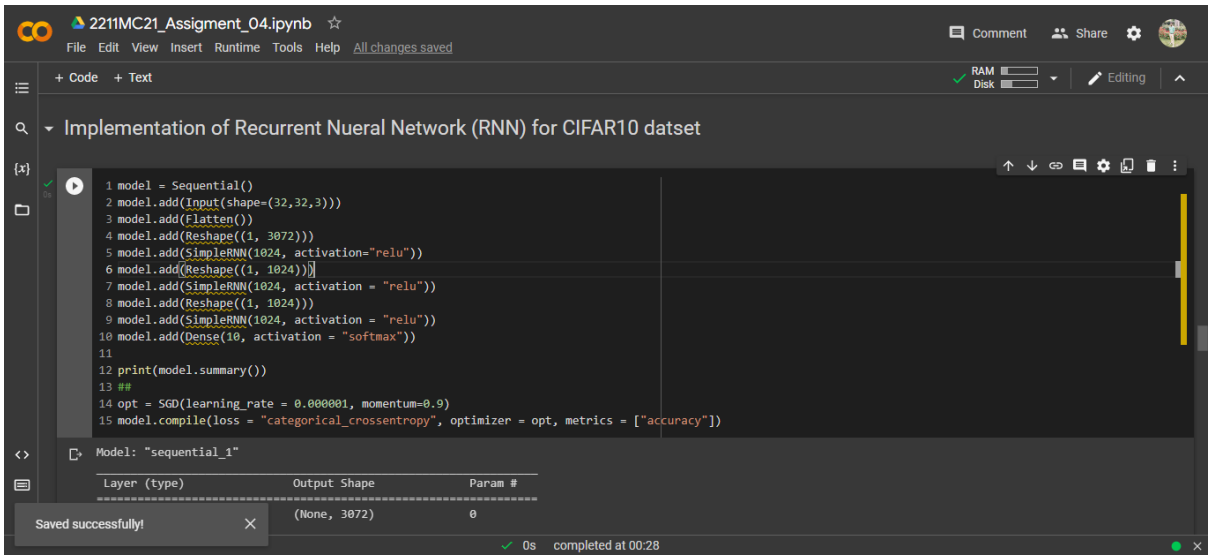
- Plot shows the Loss vs Accuracy for Feed forward Neural network (FFNN).

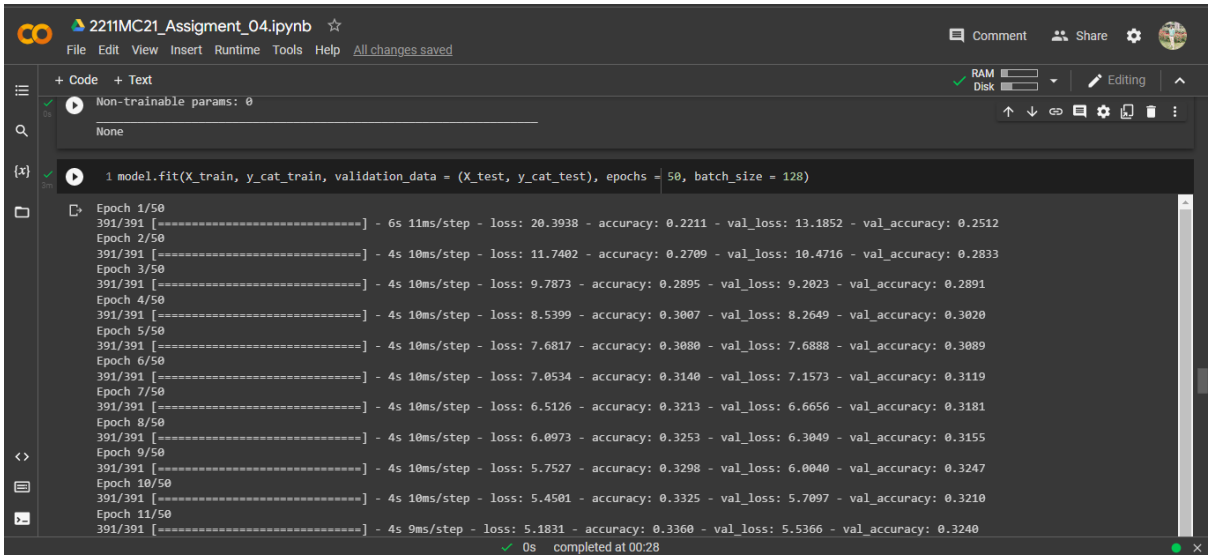


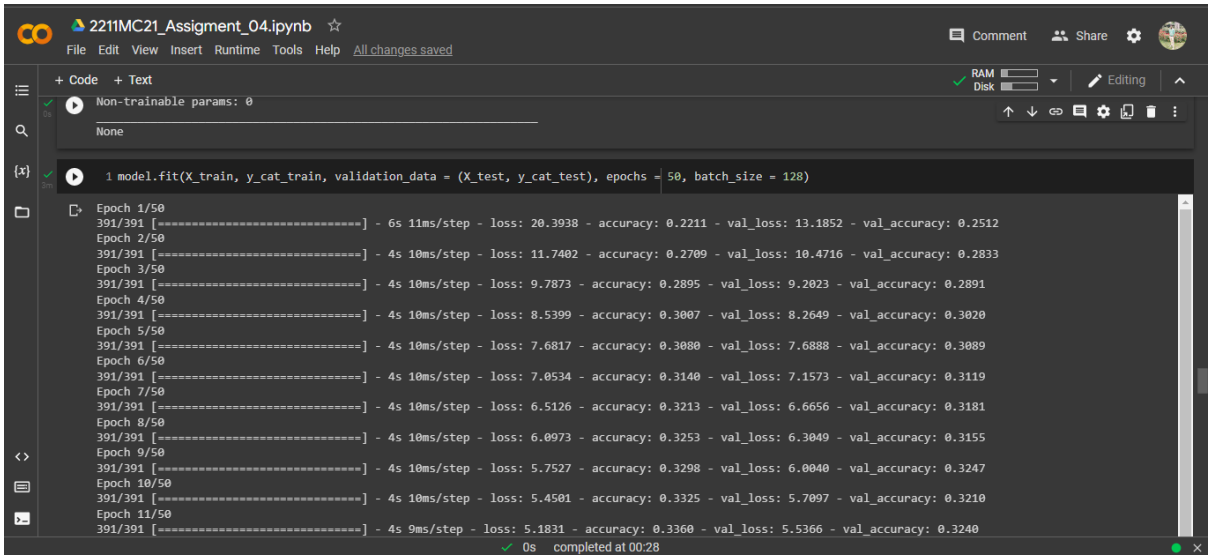
- Plot shows the val_loss vs val_accuracy for Feed forward Neural network (FFNN).



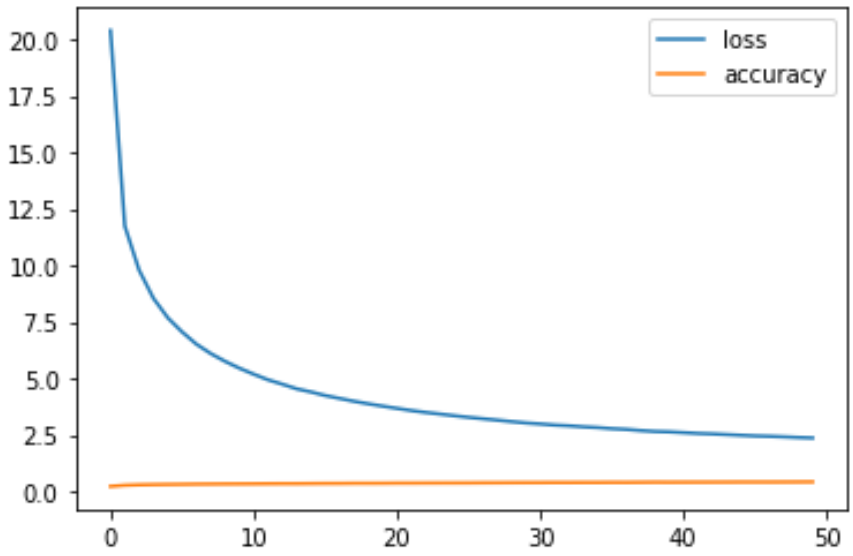
- Recurrent Neural Network (RNN) for CIFAR 10 dataset.



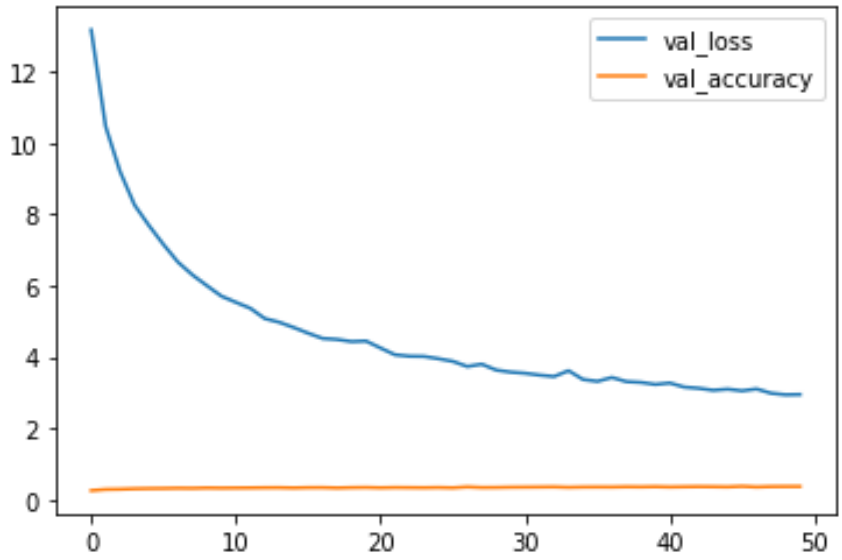




- Plot shows the Loss vs Accuracy for Feed forward Neural network (FFNN).



- Plot shows the val_loss vs val_accuracy for Feed forward Neural network (FFNN).



Inference from Results:

- For the Feed forward neural Network (FFNN), training the model for 50 epoch produces very less accuracy and slightly high error for the CIFAR 10 dataset.

- While for the Recurrent Neural Network (RNN), Loss Vs accuracy plot shows sufficiently better accuracy and less error for CIFAR 10 dataset.

- RNN works better in FFNN in general because of the high representational power of RNN than FFNN, as RNN contains more no of neurons for computations as compared to FFNN. This is also the reason that the accuracy for RNN is much higher than in case of FFNN.