

DL ASSIGNMENT 5

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Question.1

The image displays two screenshots of a Google Colab notebook titled 'Untitled4.ipynb'. The notebook is open to a file named 'dl_5.py'.

Top Screenshot: Shows the execution of a Keras model. The code includes training the model for 10 epochs, saving the best weights, and evaluating the model on a test set. The output shows the test accuracy is 0.91499977118164.

```
[9] Epoch 8: val_loss improved from 0.24596 to 0.23914, saving model to model.weights.best.hdf5
860/860 [=====] - 94s 109ms/step - loss: 0.2847 - accuracy: 0.8959 - val_loss: 0.2391 - val_accuracy: 0.9114
Epoch 9/10
859/860 [=====] - ETA: 0s - loss: 0.2748 - accuracy: 0.8980
Epoch 9: val_loss improved from 0.23914 to 0.23548, saving model to model.weights.best.hdf5
860/860 [=====] - 89s 104ms/step - loss: 0.2748 - accuracy: 0.8980 - val_loss: 0.2355 - val_accuracy: 0.9096
Epoch 10/10
859/860 [=====] - ETA: 0s - loss: 0.2654 - accuracy: 0.9034
Epoch 10: val_loss improved from 0.23548 to 0.22609, saving model to model.weights.best.hdf5
860/860 [=====] - 95s 110ms/step - loss: 0.2654 - accuracy: 0.9034 - val_loss: 0.2261 - val_accuracy: 0.9146
<keras.callbacks.History at 0x7f28439b0dc0>

[10] # Load the weights with the best validation accuracy
model.load_weights('model.weights.best.hdf5')

# Evaluate the model on test set
score = model.evaluate(x_test, y_test, verbose=0)

# Print test accuracy
print('\n', 'Test accuracy:', score[1])

Test accuracy: 0.91499977118164

y_hat = model.predict(x_test)

# Plot a random sample of 10 test images, their predicted labels and ground truth
figure = plt.figure(figsize=(20, 8))
for i, index in enumerate(np.random.choice(x_test.shape[0], size=15, replace=False)):
    ax = figure.add_subplot(3, 5, i + 1, xticks=[], yticks=[])
```

Bottom Screenshot: Shows the execution of a Keras model with a different configuration. The code includes training the model for 10 epochs, saving the best weights, and evaluating the model on a test set. The output shows the test accuracy is 0.915.

```
epochs=10,
validation_data=(x_val15, y_val15),
callbacks=[Checkpoint()])

Epoch 1/10
859/860 [=====] - ETA: 0s - loss: 0.6154 - accuracy: 0.7719
Epoch 1: val_loss improved from inf to 0.37499, saving model to model.weights.best.hdf5
860/860 [=====] - 94s 109ms/step - loss: 0.6152 - accuracy: 0.7720 - val_loss: 0.3750 - val_accuracy: 0.8718
Epoch 2/10
860/860 [=====] - ETA: 0s - loss: 0.4151 - accuracy: 0.8498
Epoch 2: val_loss improved from 0.37499 to 0.32863, saving model to model.weights.best.hdf5
860/860 [=====] - 95s 110ms/step - loss: 0.4151 - accuracy: 0.8498 - val_loss: 0.3286 - val_accuracy: 0.8788
Epoch 3/10
860/860 [=====] - ETA: 0s - loss: 0.3489 - accuracy: 0.8643
Epoch 3: val_loss improved from 0.32863 to 0.29651, saving model to model.weights.best.hdf5
860/860 [=====] - 88s 102ms/step - loss: 0.3489 - accuracy: 0.8643 - val_loss: 0.2965 - val_accuracy: 0.8918
Epoch 4/10
859/860 [=====] - ETA: 0s - loss: 0.3437 - accuracy: 0.8760
Epoch 4: val_loss improved from 0.29651 to 0.27224, saving model to model.weights.best.hdf5
860/860 [=====] - 99s 115ms/step - loss: 0.3435 - accuracy: 0.8760 - val_loss: 0.2722 - val_accuracy: 0.8996
Epoch 5/10
860/860 [=====] - ETA: 0s - loss: 0.3218 - accuracy: 0.8819
Epoch 5: val_loss improved from 0.27224 to 0.26542, saving model to model.weights.best.hdf5
860/860 [=====] - 103s 120ms/step - loss: 0.3218 - accuracy: 0.8819 - val_loss: 0.2654 - val_accuracy: 0.8996
Epoch 6/10
860/860 [=====] - ETA: 0s - loss: 0.3082 - accuracy: 0.8869
Epoch 6: val_loss improved from 0.26542 to 0.25555, saving model to model.weights.best.hdf5
860/860 [=====] - 101s 118ms/step - loss: 0.3082 - accuracy: 0.8869 - val_loss: 0.2555 - val_accuracy: 0.9036
Epoch 7/10
859/860 [=====] - ETA: 0s - loss: 0.2982 - accuracy: 0.8904
Epoch 7: val_loss improved from 0.25555 to 0.24596, saving model to model.weights.best.hdf5
860/860 [=====] - 98s 109ms/step - loss: 0.2982 - accuracy: 0.8904 - val_loss: 0.2460 - val_accuracy: 0.9182
Epoch 8/10
859/860 [=====] - ETA: 0s - loss: 0.2847 - accuracy: 0.8959
Epoch 8: val_loss improved from 0.24596 to 0.23914, saving model to model.weights.best.hdf5
860/860 [=====] - 94s 109ms/step - loss: 0.2847 - accuracy: 0.8959 - val_loss: 0.2391 - val_accuracy: 0.9114
Epoch 9/10
859/860 [=====] - ETA: 0s - loss: 0.2748 - accuracy: 0.8980
Epoch 9: val_loss improved from 0.23914 to 0.23548, saving model to model.weights.best.hdf5
860/860 [=====] - 89s 104ms/step - loss: 0.2748 - accuracy: 0.8980 - val_loss: 0.2355 - val_accuracy: 0.9096
Epoch 10/10
859/860 [=====] - ETA: 0s - loss: 0.2654 - accuracy: 0.9034
Epoch 10: val_loss improved from 0.23548 to 0.22609, saving model to model.weights.best.hdf5
860/860 [=====] - 95s 110ms/step - loss: 0.2654 - accuracy: 0.9034 - val_loss: 0.2261 - val_accuracy: 0.9146
<keras.callbacks.History at 0x7f28439b0dc0>

[10] # Load the weights with the best validation accuracy
model.load_weights('model.weights.best.hdf5')
```

Testing accuracy is 91.15%.

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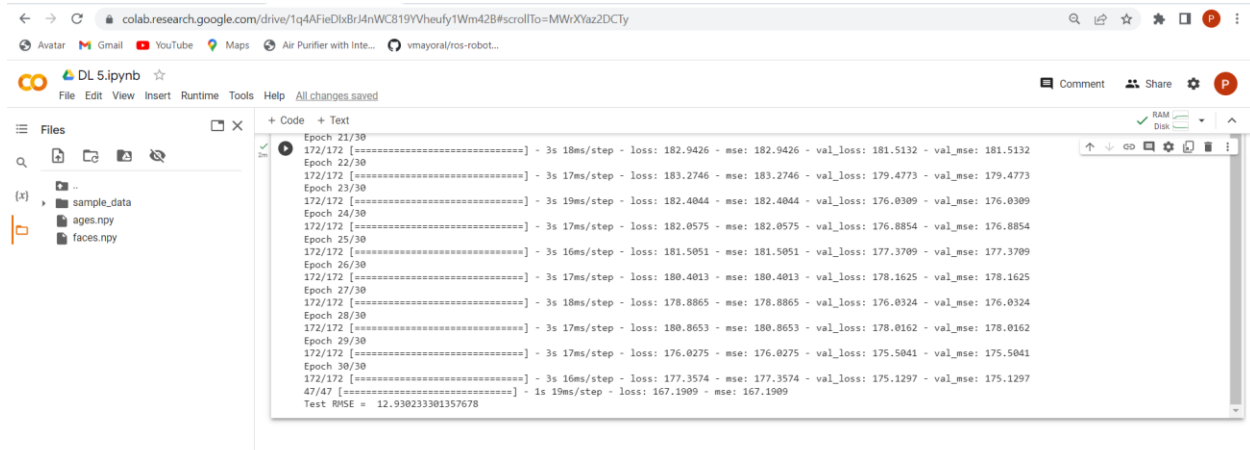
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Question. 2:

```
7/2/172 [.....] - 3s 17ms/step - loss: 202.9240 - mae: 202.9240 - val_loss: 191.1630 - val_mae: 191.1630
epoch 5/30
7/2/172 [.....] - 3s 17ms/step - loss: 196.6190 - mae: 196.6190 - val_loss: 189.6192 - val_mae: 189.6192
epoch 6/30
7/2/172 [.....] - 3s 17ms/step - loss: 194.9400 - mae: 194.9400 - val_loss: 190.3679 - val_mae: 190.3679
epoch 7/30
7/2/172 [.....] - 3s 17ms/step - loss: 194.4200 - mae: 194.4200 - val_loss: 181.2459 - val_mae: 181.2459
epoch 8/30
7/2/172 [.....] - 3s 17ms/step - loss: 193.4409 - mae: 193.4409 - val_loss: 200.7104 - val_mae: 200.7104
epoch 10/30
7/2/172 [.....] - 3s 17ms/step - loss: 191.3609 - mae: 191.3609 - val_loss: 182.5017 - val_mae: 182.5017
epoch 11/30
7/2/172 [.....] - 3s 17ms/step - loss: 188.9208 - mae: 188.9208 - val_loss: 197.2834 - val_mae: 197.2834
epoch 12/30
7/2/172 [.....] - 4s 24ms/step - loss: 188.7476 - mae: 188.7476 - val_loss: 180.3168 - val_mae: 180.3168
epoch 13/30
7/2/172 [.....] - 3s 20ms/step - loss: 188.1509 - mae: 188.1509 - val_loss: 179.4122 - val_mae: 179.4122
epoch 14/30
7/2/172 [.....] - 4s 20ms/step - loss: 184.4792 - mae: 184.4792 - val_loss: 181.0898 - val_mae: 181.0898
epoch 15/30
7/2/172 [.....] - 3s 18ms/step - loss: 186.3345 - mae: 186.3345 - val_loss: 184.3964 - val_mae: 184.3964
epoch 16/30
7/2/172 [.....] - 3s 20ms/step - loss: 185.9350 - mae: 185.9350 - val_loss: 178.3152 - val_mae: 178.3152
epoch 17/30
7/2/172 [.....] - 3s 17ms/step - loss: 183.1543 - mae: 183.1543 - val_loss: 190.0938 - val_mae: 190.0938
epoch 18/30
7/2/172 [.....] - 3s 18ms/step - loss: 188.1923 - mae: 188.1923 - val_loss: 203.6704 - val_mae: 203.6704
epoch 19/30
7/2/172 [.....] - 4s 21ms/step - loss: 181.7197 - mae: 181.7197 - val_loss: 179.1578 - val_mae: 179.1578
epoch 20/30
7/2/172 [.....] - 3s 19ms/step - loss: 183.7633 - mae: 183.7633 - val_loss: 177.1092 - val_mae: 177.1092
epoch 21/30
7/2/172 [.....] - 3s 18ms/step - loss: 182.9426 - mae: 182.9426 - val_loss: 181.5132 - val_mae: 181.5132
epoch 22/30
7/2/172 [.....] - 3s 17ms/step - loss: 183.2746 - mae: 183.2746 - val_loss: 179.4773 - val_mae: 179.4773
epoch 23/30
7/2/172 [.....] - 3s 19ms/step - loss: 182.4044 - mae: 182.4044 - val_loss: 176.6309 - val_mae: 176.6309
epoch 24/30
7/2/172 [.....] - 3s 17ms/step - loss: 182.0575 - mae: 182.0575 - val_loss: 176.8854 - val_mae: 176.8854
epoch 25/30
7/2/172 [.....] - 3s 16ms/step - loss: 181.9051 - mae: 181.9051 - val_loss: 177.3799 - val_mae: 177.3799
epoch 26/30
7/2/172 [.....] - 3s 17ms/step - loss: 180.4013 - mae: 180.4013 - val_loss: 178.1625 - val_mae: 178.1625
epoch 27/30
7/2/172 [.....] - 3s 18ms/step - loss: 178.8805 - mae: 178.8805 - val_loss: 176.9324 - val_mae: 176.9324
epoch 28/30
7/2/172 [.....] - 3s 17ms/step - loss: 180.8653 - mae: 180.8653 - val_loss: 178.6162 - val_mae: 178.6162
epoch 29/30
7/2/172 [.....] - 3s 17ms/step - loss: 176.0275 - mae: 176.0275 - val_loss: 175.5041 - val_mae: 175.5041
epoch 30/30
```

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```
Epoch 21/30
172/172 [=====] - 3s 18ms/step - loss: 182.9426 - mse: 182.9426 - val_loss: 181.5132 - val_mse: 181.5132
Epoch 22/30
172/172 [=====] - 3s 17ms/step - loss: 183.2746 - mse: 183.2746 - val_loss: 179.4773 - val_mse: 179.4773
Epoch 23/30
172/172 [=====] - 3s 19ms/step - loss: 182.4044 - mse: 182.4044 - val_loss: 176.0309 - val_mse: 176.0309
Epoch 24/30
172/172 [=====] - 3s 17ms/step - loss: 182.0575 - mse: 182.0575 - val_loss: 176.8854 - val_mse: 176.8854
Epoch 25/30
172/172 [=====] - 3s 16ms/step - loss: 181.5051 - mse: 181.5051 - val_loss: 177.3709 - val_mse: 177.3709
Epoch 26/30
172/172 [=====] - 3s 17ms/step - loss: 180.4013 - mse: 180.4013 - val_loss: 178.1625 - val_mse: 178.1625
Epoch 27/30
172/172 [=====] - 3s 18ms/step - loss: 178.8865 - mse: 178.8865 - val_loss: 176.0324 - val_mse: 176.0324
Epoch 28/30
172/172 [=====] - 3s 17ms/step - loss: 180.8653 - mse: 180.8653 - val_loss: 178.0162 - val_mse: 178.0162
Epoch 29/30
172/172 [=====] - 3s 17ms/step - loss: 176.0275 - mse: 176.0275 - val_loss: 175.5041 - val_mse: 175.5041
Epoch 30/30
172/172 [=====] - 3s 16ms/step - loss: 177.3574 - mse: 177.3574 - val_loss: 175.1297 - val_mse: 175.1297
47/47 [=====] - 1s 19ms/step - loss: 167.1909 - mse: 167.1909
Test RMSE = 12.93023301357678
```

Reported RMSE values:

Testing: 12.93 years

Training: 13.31 years

Validation: 13.23 years