Contents

Problem 1: Facial Age Estimation using VGG16

Network Implementation:

```
Layer (type)                     Output Shape              Param #
=================================================================
conv2d (Conv2D)                  (None, 48, 48, 64)        1792

conv2d_1 (Conv2D)                (None, 48, 48, 64)        36928

max_pooling2d (MaxPooling2D)     (None, 24, 24, 64)        0

conv2d_2 (Conv2D)                (None, 24, 24, 128)       73856

conv2d_3 (Conv2D)                (None, 24, 24, 128)       147584

max_pooling2d_1 (MaxPooling2     (None, 12, 12, 128)       0

conv2d_4 (Conv2D)                (None, 12, 12, 256)       295168

conv2d_5 (Conv2D)                (None, 12, 12, 256)       590080

conv2d_6 (Conv2D)                (None, 12, 12, 256)       590080

max_pooling2d_2 (MaxPooling2     (None, 6, 6, 256)         0

conv2d_7 (Conv2D)                (None, 6, 6, 512)         1180160

conv2d_8 (Conv2D)                (None, 6, 6, 512)         2359808

conv2d_9 (Conv2D)                (None, 6, 6, 512)         2359808

max_pooling2d_3 (MaxPooling2     (None, 3, 3, 512)         0

conv2d_10 (Conv2D)               (None, 3, 3, 512)         2359808

conv2d_11 (Conv2D)               (None, 3, 3, 512)         2359808

conv2d_12 (Conv2D)               (None, 3, 3, 512)         2359808

max_pooling2d_4 (MaxPooling2     (None, 1, 1, 512)         0

flatten (Flatten)                (None, 512)               0

dense (Dense)                    (None, 4096)              2101248

dense_1 (Dense)                  (None, 4096)              16781312

dense_2 (Dense)                  (None, 1)                 4097
=================================================================
Total params: 33,601,345
Trainable params: 33,601,345
Non-trainable params: 0
```

Result after Hyperparameter Grid Search:

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Grid Search Completed
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Results after performing Grid Search:
Best Hyperparameters:
  Epochs=  30
  Learning Rate=  0.01
  Mini Batch Size=  64


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ReTraining on Best Hyperparameters :
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Epoch 1/30
85/85 [==============================] - 170s 2s/step - loss: 318767.0312 - root_mean_squar
```

Output:

```
Epoch 00025: val_loss did not improve from 142.07187
Epoch 26/30
85/85 [==============================] - 190s 2s/step - loss: 38.2118 - root_mean_squared_error: 6.1816 - val_loss: 172.4267 - val_root_mean_squared_error: 13.1311

Epoch 00026: val_loss did not improve from 142.07187
Epoch 27/30
85/85 [==============================] - 190s 2s/step - loss: 26.6383 - root_mean_squared_error: 5.1612 - val_loss: 180.9102 - val_root_mean_squared_error: 13.4503

Epoch 00027: val_loss did not improve from 142.07187
Epoch 28/30
85/85 [==============================] - 191s 2s/step - loss: 21.6283 - root_mean_squared_error: 4.6506 - val_loss: 176.8010 - val_root_mean_squared_error: 13.2967

Epoch 00028: val_loss did not improve from 142.07187
Epoch 29/30
85/85 [==============================] - 190s 2s/step - loss: 14.5597 - root_mean_squared_error: 3.8157 - val_loss: 174.5995 - val_root_mean_squared_error: 13.2136

Epoch 00029: val_loss did not improve from 142.07187
Epoch 30/30
85/85 [==============================] - 191s 2s/step - loss: 10.4984 - root_mean_squared_error: 3.2401 - val_loss: 165.7084 - val_root_mean_squared_error: 12.8728

Epoch 00030: val_loss did not improve from 142.07187

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Performance Evaluation
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RMSE Loss on Test Dataset : 12.323576927185059
```

Recorded RMSE Loss on Test Dataset: **12.3235769**