CNG483 INTRODUCTION TO COMPUTER VISION

PROJECT 2: AGE PREDICTION BASED ON IRIS BIOMETRIC DATA

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ABSTRACT

We aimed to implement an age prediction system based on deep learning methods in our project and we evaluated with mainly 2 required dataset, which we have that are Iris Geometric Features and Iris Texture Features also, each dataset has both training and testing set data. We first started our project by reading the datasets and converted them to the appropriate format. Afterwards, we tested the hidden layers in order of 1, 2, 3, 4 in Machine Learning. Then we evaluated our test cases for Iris Geometric Features, Iris Texture Features, and both.

***Index Terms*—** Iris, Geometric Features, Texture Features, Hidden Layers, Age Prediction

1. TRAINING WITH GEOMETRIC FEATURES

A. Results with 4 different Hidden Layer NN

Hidden Layer 1

```
Epoch 145/150
23/23 [==============================] - 0s 2ms/step - loss: 0.7533 - accuracy: 0.6699
Epoch 146/150
23/23 [==============================] - 0s 1ms/step - loss: 0.7674 - accuracy: 0.6595
Epoch 147/150
23/23 [==============================] - 0s 1ms/step - loss: 0.7518 - accuracy: 0.6670
Epoch 148/150
23/23 [==============================] - 0s 1ms/step - loss: 0.7571 - accuracy: 0.6606
Epoch 149/150
23/23 [==============================] - 0s 1ms/step - loss: 0.7319 - accuracy: 0.6765
Epoch 150/150
23/23 [==============================] - 0s 1ms/step - loss: 0.7399 - accuracy: 0.6719
15/15 [==============================] - 0s 773us/step - loss: 0.8922 - accuracy: 0.5329
Correct prediction rate: 53.28947305679321
```

Hidden Layer 2

```
Epoch 145/150
23/23 [==============================] - 0s 2ms/step - loss: 0.7752 - accuracy: 0.6593
Epoch 146/150
23/23 [==============================] - 0s 2ms/step - loss: 0.7453 - accuracy: 0.6746
Epoch 147/150
23/23 [==============================] - 0s 2ms/step - loss: 0.7693 - accuracy: 0.6643
Epoch 148/150
23/23 [==============================] - 0s 2ms/step - loss: 0.7477 - accuracy: 0.6602
Epoch 149/150
23/23 [==============================] - 0s 2ms/step - loss: 0.7749 - accuracy: 0.6503
Epoch 150/150
23/23 [==============================] - 0s 2ms/step - loss: 0.7422 - accuracy: 0.6665
15/15 [==============================] - 0s 844us/step - loss: 0.9643 - accuracy: 0.5132
Correct prediction rate: 51.31579041481018
```

Hidden Layer 3

```
Epoch 145/150
23/23 [==============================] - 0s 2ms/step - loss: 0.7178 - accuracy: 0.6658
Epoch 146/150
23/23 [==============================] - 0s 2ms/step - loss: 0.7305 - accuracy: 0.6864
Epoch 147/150
23/23 [==============================] - 0s 2ms/step - loss: 0.7172 - accuracy: 0.6798
Epoch 148/150
23/23 [==============================] - 0s 2ms/step - loss: 0.7209 - accuracy: 0.7046
Epoch 149/150
23/23 [==============================] - 0s 2ms/step - loss: 0.7491 - accuracy: 0.6794
Epoch 150/150
23/23 [==============================] - 0s 2ms/step - loss: 0.7066 - accuracy: 0.7022
15/15 [==============================] - 1s 895us/step - loss: 0.9354 - accuracy: 0.5022
Correct prediction rate: 50.21929740905762
```

Hidden Layer 4

```
Epoch 145/150
23/23 [==============================] - 0s 2ms/step - loss: 0.7292 - accuracy: 0.6741
Epoch 146/150
23/23 [==============================] - 0s 1ms/step - loss: 0.7444 - accuracy: 0.6762
Epoch 147/150
23/23 [==============================] - 0s 2ms/step - loss: 0.7578 - accuracy: 0.6720
Epoch 148/150
23/23 [==============================] - 0s 2ms/step - loss: 0.7392 - accuracy: 0.6742
Epoch 149/150
23/23 [==============================] - 0s 2ms/step - loss: 0.7218 - accuracy: 0.6902
Epoch 150/150
23/23 [==============================] - 0s 2ms/step - loss: 0.7491 - accuracy: 0.6693
15/15 [==============================] - 1s 1ms/step - loss: 0.9776 - accuracy: 0.5175
Correct prediction rate: 51.754385232925415
```

B. Discussion

- There is no noticeable difference between hidden layers in Iris Geometric Features. When doing machine learning we attribute these changes to a randomness rather than an exact result.
- Since we do not have a very large dataset, we used 150 epochs with each have size of 50.
- Our best result is 53.28% and worst result is 50.21%, also the moderate is 51%.

2. TRANING WITH TEXTURE FEATURES

A. Results with 4 different Hidden Layer NN

Hidden Layer 1

```
Epoch 145/150
23/23 [==============================] - 0s 5ms/step - loss: 4.8776e-06 - accuracy: 1.0000
Epoch 146/150
23/23 [==============================] - 0s 5ms/step - loss: 7.5874e-06 - accuracy: 1.0000
Epoch 147/150
23/23 [==============================] - 0s 5ms/step - loss: 2.2226e-06 - accuracy: 1.0000
Epoch 148/150
23/23 [==============================] - 0s 5ms/step - loss: 1.3649e-06 - accuracy: 1.0000
Epoch 149/150
23/23 [==============================] - 0s 5ms/step - loss: 2.6704e-06 - accuracy: 1.0000
Epoch 150/150
23/23 [==============================] - 0s 5ms/step - loss: 2.2957e-06 - accuracy: 1.0000
15/15 [==============================] - 1s 1ms/step - loss: 10.7969 - accuracy: 0.5373
Correct prediction rate: 53.72806787490845
```

Hidden Layer 2

```
Epoch 145/150
23/23 [==============================] - 0s 5ms/step - loss: 1.9491e-07 - accuracy: 1.0000
Epoch 146/150
23/23 [==============================] - 0s 5ms/step - loss: 8.9619e-08 - accuracy: 1.0000
Epoch 147/150
23/23 [==============================] - 0s 5ms/step - loss: 1.1186e-07 - accuracy: 1.0000
Epoch 148/150
23/23 [==============================] - 0s 5ms/step - loss: 9.0316e-08 - accuracy: 1.0000
Epoch 149/150
23/23 [==============================] - 0s 5ms/step - loss: 5.7196e-08 - accuracy: 1.0000
Epoch 150/150
23/23 [==============================] - 0s 6ms/step - loss: 3.0072e-08 - accuracy: 1.0000
15/15 [==============================] - 1s 2ms/step - loss: 12.6846 - accuracy: 0.4934
Correct prediction rate: 49.34210479259491
```

Hidden Layer 3

```
Epoch 145/150
23/23 [==============================] - 0s 5ms/step - loss: 0.0000e+00 - accuracy: 1.0000
Epoch 146/150
23/23 [==============================] - 0s 5ms/step - loss: 0.0000e+00 - accuracy: 1.0000
Epoch 147/150
23/23 [==============================] - 0s 5ms/step - loss: 0.0000e+00 - accuracy: 1.0000
Epoch 148/150
23/23 [==============================] - 0s 6ms/step - loss: 0.0000e+00 - accuracy: 1.0000
Epoch 149/150
23/23 [==============================] - 0s 6ms/step - loss: 0.0000e+00 - accuracy: 1.0000
Epoch 150/150
23/23 [==============================] - 0s 6ms/step - loss: 0.0000e+00 - accuracy: 1.0000
15/15 [==============================] - 1s 2ms/step - loss: 7.3052 - accuracy: 0.4649
Correct prediction rate: 46.49122953414917
```

Hidden Layer 4

```
Epoch 145/150
23/23 [==============================] - 0s 3ms/step - loss: 2.0140e-10 - accuracy: 1.0000
Epoch 146/150
23/23 [==============================] - 0s 4ms/step - loss: 3.6314e-10 - accuracy: 1.0000
Epoch 147/150
23/23 [==============================] - 0s 5ms/step - loss: 4.3263e-10 - accuracy: 1.0000
Epoch 148/150
23/23 [==============================] - 0s 6ms/step - loss: 2.6950e-10 - accuracy: 1.0000
Epoch 149/150
23/23 [==============================] - 0s 5ms/step - loss: 2.3707e-10 - accuracy: 1.0000
Epoch 150/150
23/23 [==============================] - 0s 3ms/step - loss: 7.2316e-10 - accuracy: 1.0000
15/15 [==============================] - 1s 2ms/step - loss: 24.7896 - accuracy: 0.4956
Correct prediction rate: 49.56140220165253
```

B. Discussion Effects of number of layers

- We can clearly see that the correctness rate decreases when the number of layer increases.
- We tried different number of epochs and batch size, but we get the best and fastest result around values with 150 epochs and 50 batch sizes.
- Our best result is 53.72% and worst result is 46,49%, also the moderate is 49%.

3. TRAINING WITH GEOMETRIC AND TEXTURE FEATURES

A. Results with 4 different Hidden Layer NN

Hidden Layer 1

```
Epoch 145/150
23/23 [==============================] - 0s 6ms/step - loss: 0.0000e+00 - accuracy: 1.0000
Epoch 146/150
23/23 [==============================] - 0s 5ms/step - loss: 0.0000e+00 - accuracy: 1.0000
Epoch 147/150
23/23 [==============================] - 0s 5ms/step - loss: 0.0000e+00 - accuracy: 1.0000
Epoch 148/150
23/23 [==============================] - 0s 5ms/step - loss: 0.0000e+00 - accuracy: 1.0000
Epoch 149/150
23/23 [==============================] - 0s 5ms/step - loss: 0.0000e+00 - accuracy: 1.0000
Epoch 150/150
23/23 [==============================] - 0s 5ms/step - loss: 0.0000e+00 - accuracy: 1.0000
15/15 [==============================] - 1s 2ms/step - loss: 6.6770 - accuracy: 0.4934
Correct prediction rate: 49.34210479259491
```

Hidden Layer 2

```
Epoch 145/150
23/23 [==============================] - 0s 5ms/step - loss: 0.0011 - accuracy: 0.9998
Epoch 146/150
23/23 [==============================] - 0s 5ms/step - loss: 0.0022 - accuracy: 0.9986
Epoch 147/150
23/23 [==============================] - 0s 4ms/step - loss: 0.0013 - accuracy: 0.9982
Epoch 148/150
23/23 [==============================] - 0s 4ms/step - loss: 4.7265e-04 - accuracy: 0.9994
Epoch 149/150
23/23 [==============================] - 0s 5ms/step - loss: 0.0017 - accuracy: 0.9990
Epoch 150/150
23/23 [==============================] - 0s 4ms/step - loss: 5.6912e-04 - accuracy: 0.9992
15/15 [==============================] - 1s 2ms/step - loss: 13.9957 - accuracy: 0.4189
Correct prediction rate: 41.885966062545776
```

Hidden Layer 3

```
Epoch 145/150
23/23 [==============================] - 0s 4ms/step - loss: 0.0022 - accuracy: 0.9989
Epoch 146/150
23/23 [==============================] - 0s 5ms/step - loss: 0.0021 - accuracy: 0.9983
Epoch 147/150
23/23 [==============================] - 0s 6ms/step - loss: 0.0019 - accuracy: 0.9988
Epoch 148/150
23/23 [==============================] - 0s 5ms/step - loss: 0.0052 - accuracy: 0.9934
Epoch 149/150
23/23 [==============================] - 0s 5ms/step - loss: 0.0020 - accuracy: 0.9992
Epoch 150/150
23/23 [==============================] - 0s 5ms/step - loss: 0.0037 - accuracy: 0.9971
15/15 [==============================] - 1s 2ms/step - loss: 13.8015 - accuracy: 0.4781
Correct prediction rate: 47.80701696872711
```

Hidden Layer 4

```
Epoch 145/150
23/23 [==============================] - 0s 5ms/step - loss: 2.1407e-10 - accuracy: 1.0000
Epoch 146/150
23/23 [==============================] - 0s 5ms/step - loss: 4.5793e-11 - accuracy: 1.0000
Epoch 147/150
23/23 [==============================] - 0s 5ms/step - loss: 1.8157e-10 - accuracy: 1.0000
Epoch 148/150
23/23 [==============================] - 0s 5ms/step - loss: 1.3475e-10 - accuracy: 1.0000
Epoch 149/150
23/23 [==============================] - 0s 5ms/step - loss: 3.8402e-10 - accuracy: 1.0000
Epoch 150/150
23/23 [==============================] - 0s 5ms/step - loss: 7.0249e-11 - accuracy: 1.0000
15/15 [==============================] - 1s 2ms/step - loss: 11.0750 - accuracy: 0.4803
Correct prediction rate: 48.02631437778473
```

B. Discussion Effects of number of layers

- We have fluctuations between results, but we affiliate this entirely to randomness in the Machine Learning algorithm.
- With the test and error method we decide our current hyper parameters gives us the best and fastest result.
- Our best result is 49.34% and worst result is 41.88%, also the moderate is 48%.

4. PREDICTION FROM IRIS BIOMETRIC DATA

- For Iris Geometric Features, Hidden Layer 1, epochs 150 and batch size 50

```
Epoch 145/150
23/23 [==============================] - 0s 2ms/step - loss: 0.7533 - accuracy: 0.6699
Epoch 146/150
23/23 [==============================] - 0s 1ms/step - loss: 0.7674 - accuracy: 0.6595
Epoch 147/150
23/23 [==============================] - 0s 1ms/step - loss: 0.7518 - accuracy: 0.6670
Epoch 148/150
23/23 [==============================] - 0s 1ms/step - loss: 0.7571 - accuracy: 0.6606
Epoch 149/150
23/23 [==============================] - 0s 1ms/step - loss: 0.7319 - accuracy: 0.6765
Epoch 150/150
23/23 [==============================] - 0s 1ms/step - loss: 0.7399 - accuracy: 0.6719
15/15 [==============================] - 0s 773us/step - loss: 0.8922 - accuracy: 0.5329
Correct prediction rate: 53.28947305679321
```

- For Iris Texture Features, Hidden Layer 1, epochs 150 and batch size 50

```
Epoch 145/150
23/23 [==============================] - 0s 5ms/step - loss: 4.8776e-06 - accuracy: 1.0000
Epoch 146/150
23/23 [==============================] - 0s 5ms/step - loss: 7.5874e-06 - accuracy: 1.0000
Epoch 147/150
23/23 [==============================] - 0s 5ms/step - loss: 2.2226e-06 - accuracy: 1.0000
Epoch 148/150
23/23 [==============================] - 0s 5ms/step - loss: 1.3649e-06 - accuracy: 1.0000
Epoch 149/150
23/23 [==============================] - 0s 5ms/step - loss: 2.6704e-06 - accuracy: 1.0000
Epoch 150/150
23/23 [==============================] - 0s 5ms/step - loss: 2.2957e-06 - accuracy: 1.0000
15/15 [==============================] - 1s 1ms/step - loss: 10.7969 - accuracy: 0.5373
Correct prediction rate: 53.72806787490845
```

- For Both Features, Hidden Layer 1, epochs 150 and batch size 50

```
Epoch 145/150
23/23 [==============================] - 0s 6ms/step - loss: 0.0000e+00 - accuracy: 1.0000
Epoch 146/150
23/23 [==============================] - 0s 5ms/step - loss: 0.0000e+00 - accuracy: 1.0000
Epoch 147/150
23/23 [==============================] - 0s 5ms/step - loss: 0.0000e+00 - accuracy: 1.0000
Epoch 148/150
23/23 [==============================] - 0s 5ms/step - loss: 0.0000e+00 - accuracy: 1.0000
Epoch 149/150
23/23 [==============================] - 0s 5ms/step - loss: 0.0000e+00 - accuracy: 1.0000
Epoch 150/150
23/23 [==============================] - 0s 5ms/step - loss: 0.0000e+00 - accuracy: 1.0000
15/15 [==============================] - 1s 2ms/step - loss: 6.6770 - accuracy: 0.4934
Correct prediction rate: 49.34210479259491
```

- Between the three parts at the end, we do not have too much difference in overall success rate that is around 50% whatever parameter we choose around 150 epochs and batch size 50. In addition, we believe that the any other different result is because of the algorithm's randomness.

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