SUID: 387781563

Evolutionary Machine Learning – HW2

HW2: For the same problem, use an Evolution Strategies approach, and compare with the previous results (of HW1).

Dataset: Bank Marketing Dataset

Link:

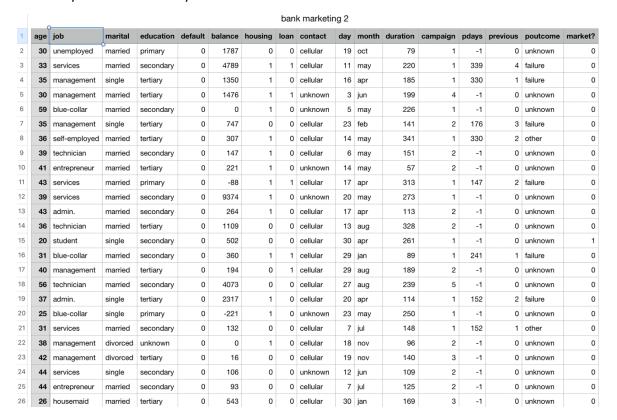
https://www.kaggle.com/chaithanya96/bankmarketing

The bank marketing dataset is the csv file with users details used to predict the marketing decision. The decision yes or no is represented with binary numbers 1 and 0. The sample columns included are:

- 1. 'age',
- 2. 'job',
- 3. 'marital',
- 4. 'education',
- 5. 'default',
- 6. 'balance',
- 7. 'housing',
- 8. 'loan',
- 9. 'contact',
- 10. 'day',
- 11. 'month',
- 12. 'duration',
- 13. 'campaign',
- 14. 'pdays',
- 15. 'previous',
- 16. 'poutcome',
- 17. 'market?'

The screenshot of the sample dataset is attached below:

Chaithanya Chikkannaswamy



Code execution steps:

CMA - Evolutionary Strategy

I have implemented the CMA Evolution strategy to train a shallow feedforward neural network for a 2-class classification task. The accuracy is then compared with the accuracy calculated using Genetic Algorithm implementation obtained in HW1.

The snapshot of the model summary is attached below:

```
model = Sequential()
model.add(Dense(20, activation='sigmoid', input_shape=(10,)))
model.add(Dense(1, activation='sigmoid'))
model.summary()
```

+ Code + Markdown

- 1. Cal_fitness function is defined to calculate the fitness of the individuals and to take the maximum fitness to find out the best solution.
- 2. The fitness calculation is done for several 100 generation and each time, the max fitness values are compared to store the maximum fitness value in each generation.
- 3. The program executed until the number of generations is 100.
- 4. The obtained accuracy is 0.71.

```
pri interaction actions and
```

```
this is the Mean Squared Error: 0.19037290790570838
this is the confusion matrix
[[768 252]
  [ 70 41]]
Accuracy Score 0.7152961980548187
[0.7152961980548187]
```

+ Code

+ Markdown

Chaithanya Chikkannaswamy

Conclusion:

The **CMA-ES** resulted in 0.715 test accuracy. **Genetic Neural Network** resulted in a test accuracy of 0.89 The **Sequential Neural Network** resulted in a test accuracy of 0.88 and the

References

- 1. http://cma.gforge.inria.fr/apidocs-pycma/cma.evolution_strategy.html
- 2. https://github.com/hardmaru/estool/blob/master/simple es example.ipynb
- 3. Discussed with classmates.