110753201 資科碩一 曹昱維

1.
   - Test loss: 0.05518849566578865
     Test accuracy: 0.9666666388511658
     error rate:0.03333336114883423
   - 程式碼：詳見附檔
2.
   - 2.1.
     - network structures1: 每層 layer 的 neuron 數量為 2
       - DNN width = 2,
         Validation loss:0.4495222568511963,
         Validation accuracy:0.9391999840736389
       - model structures detail:

```
Model: "dnn_base_2-units"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 dense_3 (Dense)             multiple                  586

 dense_4 (Dense)             multiple                  6

 dense_5 (Dense)             multiple                  6

 dense_6 (Dense)             multiple                  6

 dense_7 (Dense)             multiple                  6

 dense_8 (Dense)             multiple                  3

=================================================================
Total params: 613
Trainable params: 613
Non-trainable params: 0
```

     - network structures2 : 每層 layer 的 neuron 數量為 10
       - DNN width = 10,
         Validation loss:0.06767494231462479,
         Validation accuracy:0.995199978351593
       - model structures detail:

```
Model: "dnn_base_10-units"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 dense_9 (Dense)             multiple                  2930

 dense_10 (Dense)            multiple                  110

 dense_11 (Dense)            multiple                  110

 dense_12 (Dense)            multiple                  110

 dense_13 (Dense)            multiple                  110

 dense_14 (Dense)            multiple                  11

=================================================================
Total params: 3,381
Trainable params: 3,381
Non-trainable params: 0
```

- network structures3 : 每層 layer 的 neuron 數量為 20
  - DNN width = 20,
    Validation loss:0.01158861257135868,
    Validation accuracy:0.9959999918937683
  - model structures detail:

```
Model: "dnn_base_20-units"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 dense_15 (Dense)            multiple                  5860

 dense_16 (Dense)            multiple                  420

 dense_17 (Dense)            multiple                  420

 dense_18 (Dense)            multiple                  420

 dense_19 (Dense)            multiple                  420

 dense_20 (Dense)            multiple                  21

=================================================================
Total params: 7,561
Trainable params: 7,561
Non-trainable params: 0
```

- 2.2.
  - 預測結果存放於附檔：q2.csv

3.

- 3.1.
  - Test loss: 0.08248109370470047
  - Test accuracy: 0.9750999808311462
- 3.2.
  - Noise level 0 Test loss: 1.471121907234192, Test accuracy: 0.5943999886512756
  - Noise level 1 Test loss: 5.825091361999512, Test accuracy: 0.2605000138282776
  - Noise level 2 Test loss: 10.472006797790527, Test accuracy: 0.17919999361038208
  - 隨著噪點的比例越高的模型的準確率隨之下降，可以由此推斷，噪點越多，越難以辨識
- 3.3
  - accuracy for regular test data:
    - Test loss: 0.06952483206987381
    - Test accuracy: 0.978600025177002
  - accuracy for with noise test data:

- Noise level 0 Test loss: 1.7064546346664429, Test accuracy: 0.6207000017166138
- Noise level 1 Test loss: 3.6914596557617188, Test accuracy: 0.4077000021934509
- Noise level 2 Test loss: 5.798006534576416, Test accuracy: 0.2851000130176544