

EE 399 SPRING QUATER 2023

Instructor: **J. Nathan Kutz**

HOMEWORK #4:

DUE: Midnight on 5/8 (Extra credit if turned in by 5/5)

I Reconsider the data from homework one:

```
X=np.arange(0,31)
Y=np.array([30, 35, 33, 32, 34, 37, 39, 38, 36, 36, 37, 39, 42, 45, 45, 41,
40, 39, 42, 44, 47, 49, 50, 49, 46, 48, 50, 53, 55, 54, 53])
```

- (i) Fit the data to a three layer feed forward neural network.
- (ii) Using the first 20 data points as *training data*, fit the neural network. Compute the least-square error for each of these over the training points. Then compute the least square error of these models on the *test data* which are the remaining 10 data points.
- (iii) Repeat (iii) but use the first 10 and last 10 data points as training data. Then fit the model to the test data (which are the 10 held out middle data points). Compare these results to (iii)
- (iv) Compare the models fit in homework one to the neural networks in (ii) and (iii)

II Now train a feedforward neural network on the MNIST data set. You will start by performing the following analysis:

- (i) Compute the first 20 PCA modes of the digit images.
- (ii) Build a feed-forward neural network to classify the digits. Compare the results of the neural network against LSTM, SVM (support vector machines) and decision tree classifiers.

NOTE: You will write a narrative report about this homework on your github page. You will also upload your python code to canvas with a comment at the top indicating your github page so the TAs can look at your narrative on github.