AI Assignment 5 report

The model is done using the python module keras and tensorflow is used for Stochastic Gradient Descent tensorflow is used.

When the program is executed, the file optdigits-orig.windep is loaded into the python and all the lines are inserted into an array first. As we know there are 1797 images that are given in the file and the data starts to load only from line number 22. So the first 22 lines are skipped and the rest of the lines are loaded in such a way that every 32 lines is taken and appended into an array which is called the inputFiles and the 33rd line is taken as the target value for the image loaded. These 2 arrays correspond with each other so that the index of the input file matches with that of the target value.

The target values are then converted into an array with the shape of (10, 1) which has 10 elements in each array and the index of max value in the array corresponds to the output.

The neural network has 4 layers,

1. Convolutional 2D network as the input layer.
2. Convolutional 2D network with 75 neurons as the first hidden layer.
3. Convolutional 2D network with 50 neurons as the second hidden layer.
4. A dense output layer with softmax activation as the output layer

The output layer provides a 10 dimensional vector which has the predicted values. The one with the highest value will be taken as the output.

At the end of the program the graphs with cross entropy loss and the accuracy are plotted as shown below -

Cross Entropy Loss

Classification Accuracy
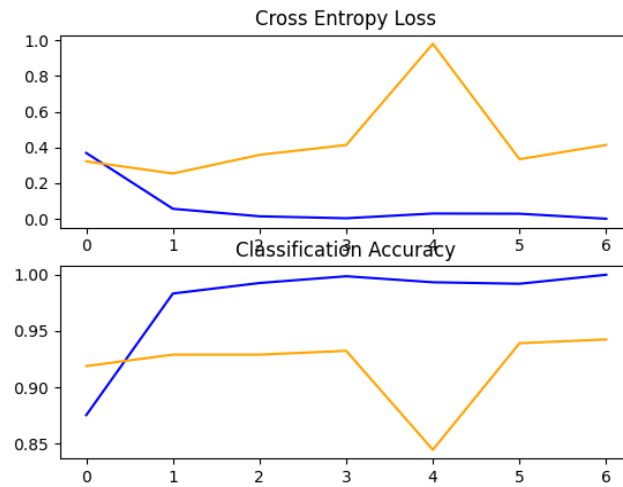
Description of the layers used is as shown below:

```
Model: "sequential_3"
_____
 Layer (type)                Output Shape              Param #
=================================================================
 conv2d_6 (Conv2D)           (None, 30, 30, 100)       1000

 conv2d_7 (Conv2D)           (None, 28, 28, 75)        67575

 conv2d_8 (Conv2D)           (None, 26, 26, 50)        33800

 flatten_3 (Flatten)         (None, 33800)             0

 dense_3 (Dense)             (None, 10)                338010

=================================================================
Total params: 440,385
Trainable params: 440,385
Non-trainable params: 0
```

Comparisons -

3 layer model -
1. By varying the epocs.
    a. Number of epochs - 2
        i. Training time - 42.058 seconds
        ii. Accuracy - 91.928%
    b. Number of epochs - 5
        i. Training time - 143.671 seconds
        ii. Accuracy - 94.932%
    c. Number of epochs - 7
        i. Training time - 142.425 seconds
        ii. Accuracy - 92.905%

2 layer model -
1. By varying the epocs.
    a. Number of epochs - 2
        i. Training time - 12.609 seconds
        ii. Accuracy - 89.189%
    b. Number of epochs - 5
        i. Training time - 30.215 seconds
        ii. Accuracy - 94.257%
    c. Number of epochs - 7
        i. Training time - 41.19 seconds
        ii. Accuracy - 93.581%