

# Supervised learning

## Assignment 2

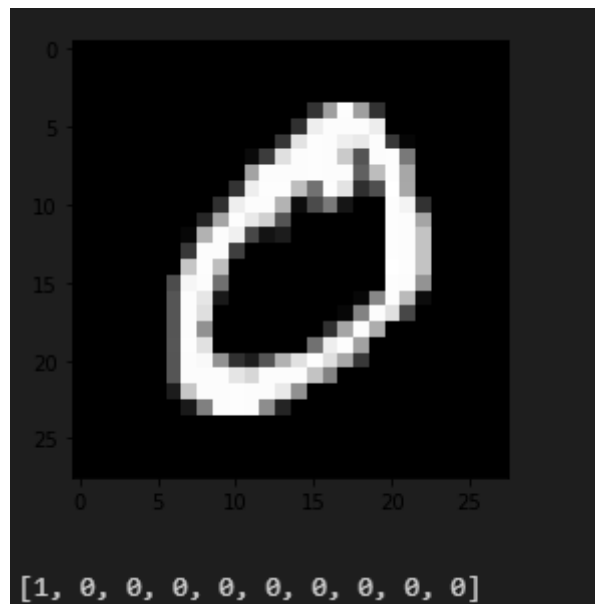
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## Report for MNIST dataset Assignment using neural network

It's required to implement a machine learning algorithm for classification of the handwritten digits (MNIST) using NN

### preprocessing phase:

60,000 samples are used from the dataset for training and 10,000 for testing and since its saved in a 1-dimensional array of size 784 so we will reshape it in form of 2-dimensional array with size of 28\*28 to be easily manipulated and visualized, we label it by creating a one-hot vector which contains 10 values(0-9 classes) where only one index is valued 1 which is the correct class then we will divide the photo into grids to help in feature extraction



### Feature extraction phase:

then in feature extraction phase the center of mass (centroid) of each grid is extracted from data and saved in feature vector so that each number has many feature vectors but close in value so that we can compare a feature vector of a test sample with the trained ones.

### Classification phase:

1. After training testing is applied and fit into NN model where Information is fed into the input layer which transfers it to the hidden layer
2. The interconnections between the two layers assign weights to each input randomly
3. The weighted sum is transferred to the activation function
4. The activation function determines which nodes it should fire for feature extraction
5. The model applies an application function to the output layer to deliver the output
6. Weights are adjusted, and the output is backpropagated to minimize error

Another example we used input layer of 32 nodes and a hidden layer of 16 nodes and an output layer of 10 nodes which specify the number of classes that we have from 0 to 9 classes

We used learning rate of 0.05 and 100 epochs and sigmoid function

The model uses a cost function to reduce the error rate.

1. The model compares the output with the original result
2. It repeats the process to improve accuracy

The model adjusts the weights in every iteration to enhance the accuracy of the output.

### Conclusion:

We conclude that using NN with more hidden layers and more nodes would achieve a higher accuracy percentage

Also, using squared grid of 7\*7 scored the highest accuracy of 87.36%