

## Homework - 5

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For this Back-Propagation Assignment Both Na and I worked on our own codes individually and compared our results at the end to find the best result.

## Part 1: Implementation

This assignment was based on the concept of Neural network, which is technically a network of perceptrons. For this assignment, we have implemented Numpy arrays as our data structure because numpy helps in solving highly complex and high dimensional matrices easily. Also, for reading the .pgm files we used the 'mpimg' function from the matplotlib.image library and converting the image files into matrices. This procedure was straightforward and not much complicated.

After converting the grayscale images into data matrices, we performed a few transformations on the images in order to reshape them before passing them through the network.

The most challenging part of this assignment was implementing the backpropagation method. After computing the new weights by passing the input through the feed-forward network and then updating those weights by subtracting the squared error was quite challenging.

However, after many iterations we were able to obtain quite a decent accuracy score of around 83 percent on the test image set. This accuracy score may change because of error in sampling data. Final results are displayed below.

```
Predictions: [0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0]
The accuracy rate is: 83.13%, it may fluctuate due to sampling data.
```

```
Process finished with exit code 0
```

## Part 2: Software Familiarization

Neural Networks are part of a growing research field in deep learning. This assignment as well as all other projects requiring image processing could be easily done in Python with the help of some incredibly useful and handy frameworks like TensorFlow and PyTorch. These frameworks automate heavy computing with minimal lines of code making it easier to deal with problems in deep learning.

### **Part 3: Applications**

These days scientists and researchers are making use of mathematics and computer science to make machines more intelligent. Just like human beings, machines can also learn by examples. With the help of Neural networks, also called artificial neural networks, we can find solutions to highly complex problems for which “algorithmic methods are highly expensive or do not exist.

Today, applications of Neural networks cover almost all the genres in modern technology including, Speech Recognition, character recognition, signature verification, facial recognition, etc.