Assignment 2

Score: 15

Implement a model, based on the perceptron algorithm, that will be able to classify hand written digits

For training, use the mnist dataset. This can be found, in a format that can be easily worked with in python, at the following url:
https://github.com/mnielsen/neural-networks-and-deep-learning/raw/master/data/mnist.pkl.gz

The dataset is split in 3 sets: training_set, validation_set, test_set. Each of these 3 sets contains two vectors of equal length:

1. A set of digits written as a vector of length 784. The digits from the mnist dataset have the shape 28x28 pixels and are represented as a vector (each of the 28 lines from the 28x28 matrix are written one after each other, thus forming a vector of 784 elements). Each pixel from the matrix has a value between 0 and 1, where 0 represents white, 1 represents black and the value between 0 and 1 is a shade of grey.
2. A label for each element from the first vector: a number between 0 and 9 representing the digit from the image

The 3 sets have the following meaning:

- training_set (used for training your model); 50000 elements
- validation_set (usually used to adjust hyper-parameters and to perform a first evaluation of the resulted model); 10000 elements
- test_set (dataset used for testing. Use it only after you've fine-tuned the algorithm using the validation set. Do not use it for fine-tuning); 10000 elements

The dataset was saved using the cPickle python module. (it is very used for datasets serialization)

To load the dataset, use the following code.

Use the following code to load the dataset:

```
import cPickle, gzip, numpy
import pickle, gzip, numpy
with gzip.open('mnist.pkl.gz', 'rb') as fd:
    train_set, valid_set, test_set = pickle.load(fd, encoding='latin')
```

The classification algorithm must use 10 perceptrons. Each of the 10 perceptrons will be trained to distinguish elements that represent a specific digit from the rest of the elements in the dataset. For example, the 0 perceptron will be trained to classify 0 from the digits 1,2,3,4,5,6,7,8,9

When you want to classify a digit from the test set, you will get the output of each of the 10 perceptrons. The value will be given by the perceptron number with the output 1 or by the perceptron number with the greatest output before the activation function.