Brief Understanding on Why Neural Networks is novel today and how it has changed the world of AI.

Neural networks, have this amazing power to extract meaning from complex information. It can be used to find patterns and detect trends that are too complicated to be perceived by either humans or even computers. A trained neural network can be thought of as an efficient data analyst who can be used to stipulate predictions given new unseen scenarios. The greatest advantage lies in the fact that it self-organizes information as data is fed to it and has the ability to learn to perform tasks based on its initial experience.

Project Representation:

The task consists of hand-written digit recognition from 0-9. There are 5000 training examples, where each training example is a 20 pixel by 20-pixel grayscale image of the digit. The 20 by 20 grid of pixels is unrolled into a 400-dimensional vector This gives us a 5000 by 400 matrix X where every row is a training example for a handwritten digit image.

Methodology:

The NN I implemented has 3 layers – an input layer, a hidden layer and an output layer. our inputs are pixel values of digit images. of size 20 ⇥ 20, this gives us 400 input layer units (not counting the extra bias unit which always outputs +1). The parameters have dimensions that are sized for a neural network with 25 units in the second layer and 10 output units (corresponding to the 10 digit classes). I was provided with a set of network parameters (theta (1), theta (2)) that were already trained. For Back-propagation I trained the neural network by minimizing the cost function using an advanced optimizer “fmincg”. Also I used vectorization which was much easier to implement.

I also tried out different learning settings for the neural network to see how the performance of the neural network varies with the regularization parameter lambda and number of training steps.

Results:

It was extremely interesting to see how logistic regression and NN behave on the same dataset. In this particular case NN (97.2%) performed better at recognizing digits such that it increased the accuracy rate by 3 percent as compared to logistic regression (~94 %). Also tweeking of lambda showed that the accuracy could be increased to 100 % but that raised the concern of over-fitting.

Discussion:

In-order to implement this network, it is very important to understand the architecture behind it. The ability to perform complex tasks lies in its structure. It took me several days to understand the logic behind this algorithm and even now I am not even close to say that I have fully-understood it. I would further like to explore how the same data would result in using other algorithms.

*Implementation of the digit recognition is in octave as a project assignment to ML course I completed on coursera.*