# Project Design Phase-I Solution Architecture

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| Date | 15.10.2022 |
| Team ID | PNT2022TMID09881 |
| Project Name | A Novel Method for Handwritten Digit Recognition System |
| Maximum Marks | 4 Marks |

**Solution Architecture:**

* **The input layer:** It distributes the features of our examples to the next layer for calculation of activations of the next layer.
* **The hidden layer:** They are made of hidden units called activations providing nonlinear ties for the network. A number of hidden layers can vary according to our requirements.
* **The output layer:** The nodes here are called output units. It provides us with the final prediction of the Neural Network on the basis of which final predictions can be made.
* A neural network is a model inspired by how the brain works. It consists of multiple layers having many activations, this activation resembles neurons of our brain. A neural network tries to learn a set of parameters in a set of data which could help to recognize the underlying relationships. Neural networks can adapt to changing input; so the network generates the best possible result without needing to redesign the output criteria.
* We have implemented a Neural Network with 1 hidden layer having *100* activation units (excluding bias units). The data is loaded from a *.mat* file, features(X) and labels(y) were extracted. Then features are divided by *255* to rescale them into a range of *[0,1]* to avoid overflow during computation. Data is split up into *60,000* training and *10,000* testing examples. Feedforward is performed with the training set for calculating the hypothesis and then backpropagation is done in order to reduce the error between the layers. The regularization parameter lambda is set to 0.1 to address the problem of overfitting. Optimizer is run for 70 iterations to find the best fit model.
* Handwriting number recognition is a challenging problem researchers had been research into this area for so long especially in the recent years. In our study there are many fields concern with numbers, for example, checks in banks or recognizing numbers in car plates, the subject of digit recognition appears. A system for recognizing isolated digits may be as an approach for dealing with such application. In other words, to let the computer understand the Arabic numbers that is written manually by users and views them according to the computer process. Scientists and engineers with interests in image processing and pattern recognition have developed various approaches to deal with handwriting number recognition problems such as, minimum distance, decision tree and statistics.

Example - Solution Architecture Diagram:

