Project Report – by Amber Rastogi (UBID - 50097978)

Objective: To implement and evaluate classification algorithms.

Training data Source: GSC features extracted from CEDAR/UB for Handwritten Numerals.

Models used:

1. **Logistic Regression (LR):**

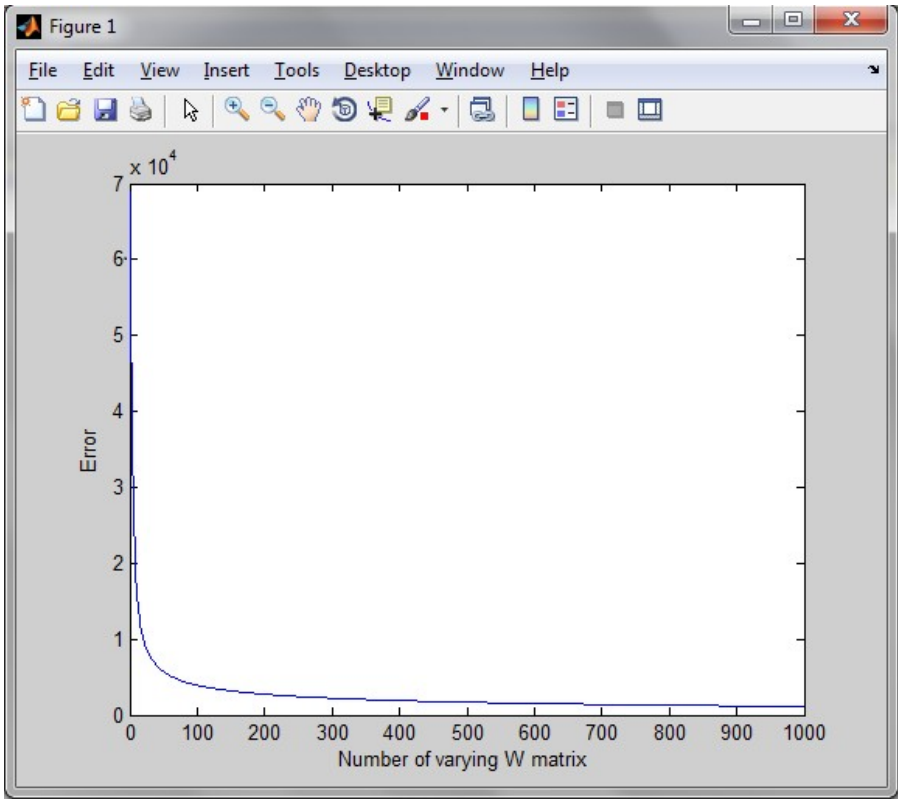
Soft-Max Function

$$p(\mathcal{C}_k|\phi) = y_k(\phi) = \frac{\exp(a_k)}{\sum_j \exp(a_j)}$$

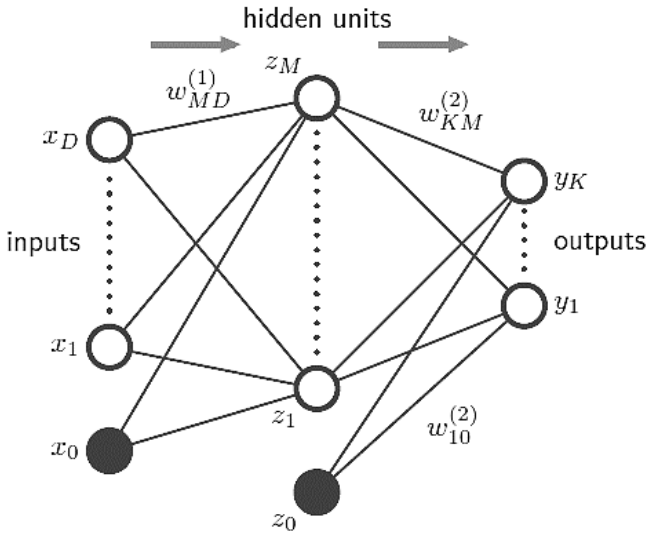
Cross – Entropy Error Function

$$E(\mathbf{w}_1, \ldots, \mathbf{w}_K) = -\sum_{n=1}^{N}\sum_{k=1}^{K} t_{nk} \ln y_{nk}$$

Error Convergence:



2. Neural network Model:



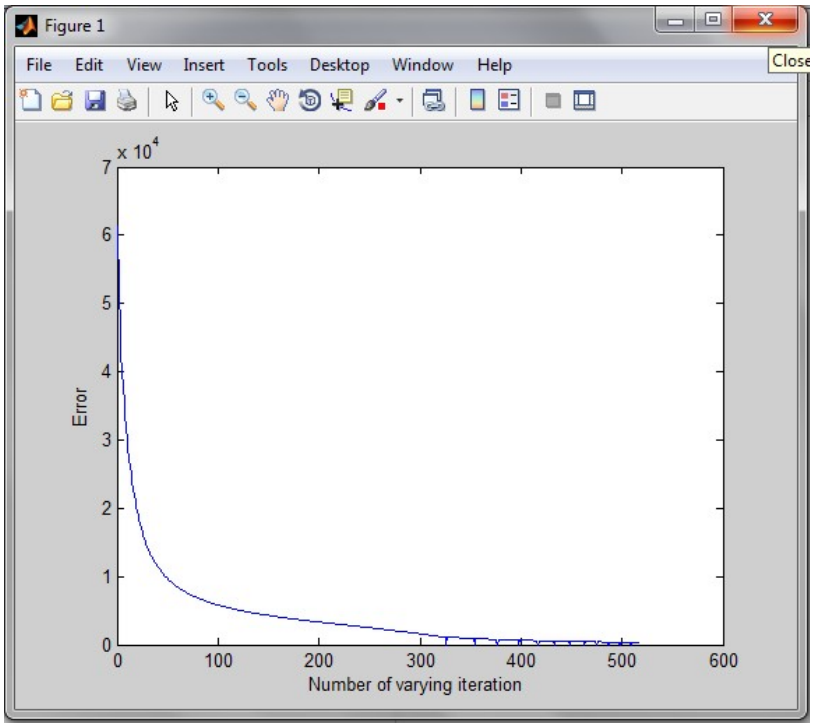
Activation Functions:

Soft-Max Function (Hidden Layer)

$$p(\mathcal{C}_k|\phi) = y_k(\phi) = \frac{\exp(a_k)}{\sum_j \exp(a_j)}$$

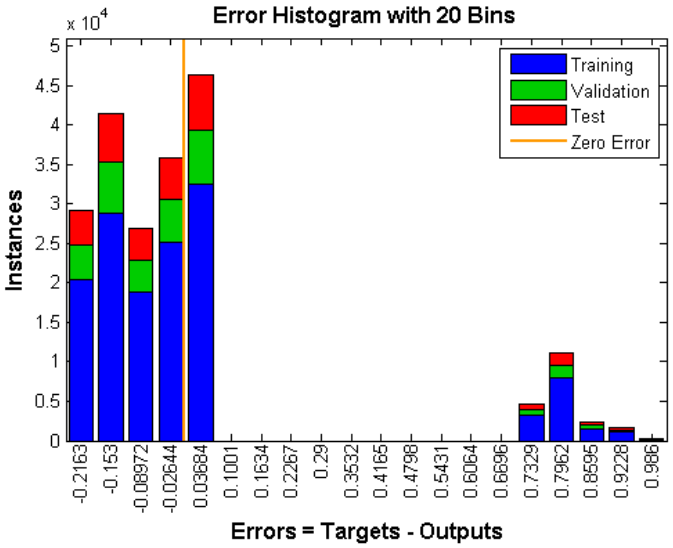
Linear (Output Layer)

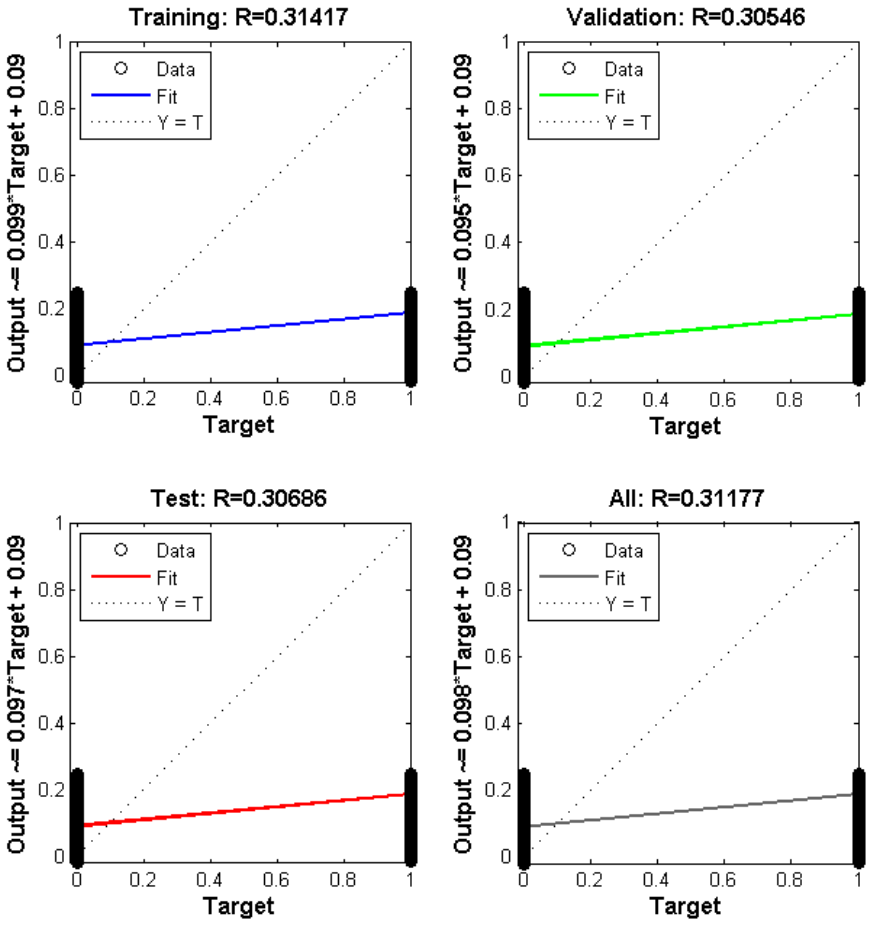
$$y_k = a_k$$



3. Neural Network Model (MATLAB package)

Implementing project using packages: Neural Network toolbox of Matlab.I put hidden layer neurons to 10 and the error rate came out to be 10% (Vary every time)





The Package could perform better if we use a machine with higher configurations which could support more hidden layers. My machine gave out of memory on using more than 10 neurons.

Comparison of the Models

Parameter	Logistic Sigmoid	Neural - Network	Neural-Network Package
Training Time	10 mins (apx)	30 mins (apx)	60 mins (apx)
Error Rate	3.2 % (apx)	2.5% (apx)	9% (apx)
Mean Reciprocal Rank (Test Data)	.989	.91081	.8808