Optical Character Recognition using Neural Networks

-Dhawal Sanghvi.

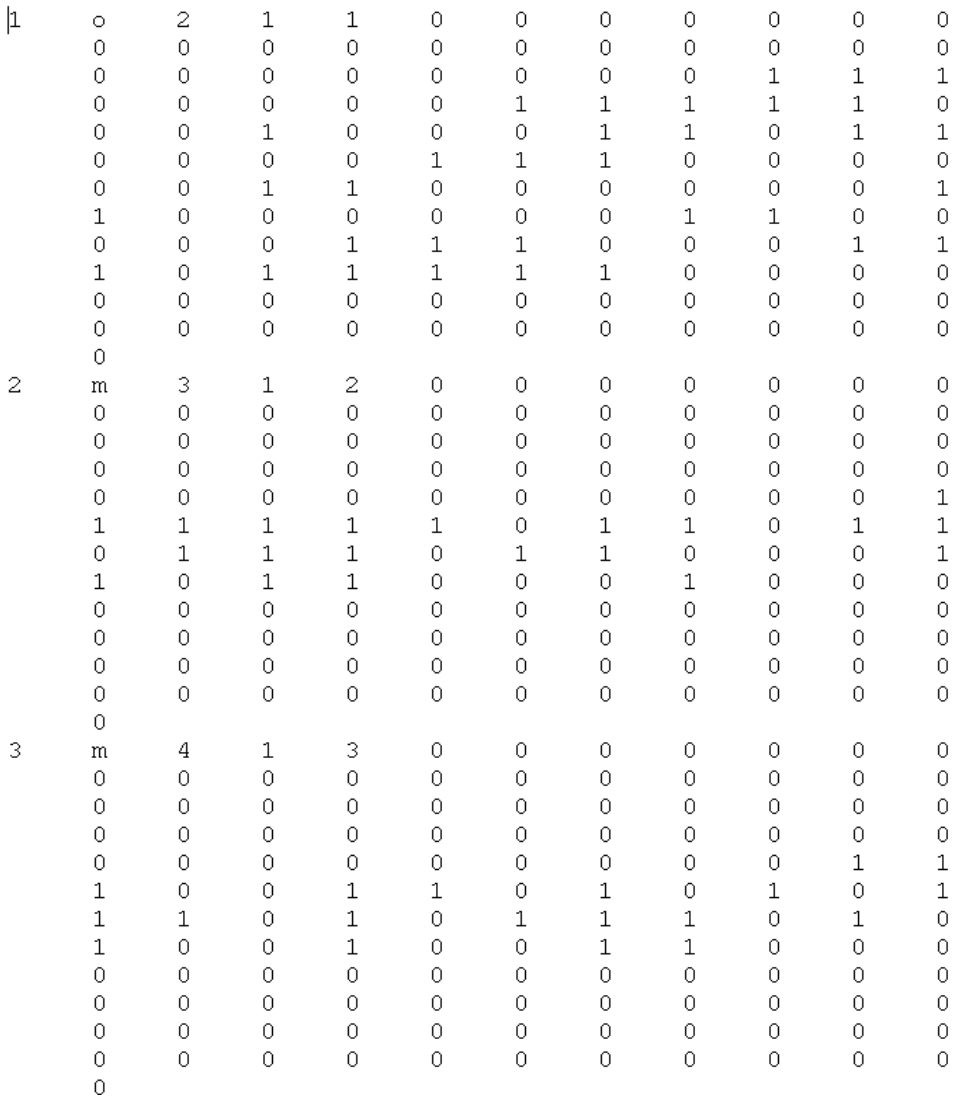
Project Overview:-

The project is aimed at getting an insight on how a Neural Network works and how it's parameters affect it.We take a dataset containing letters a-z and use a Neural Network to classify the letters.

DataSet :-

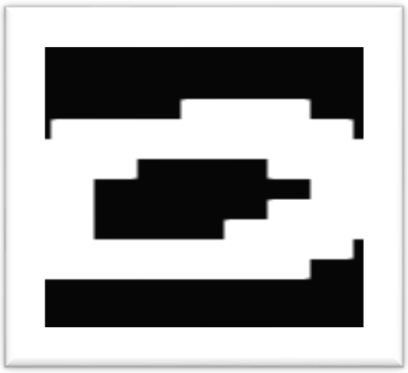
The Dataset consists of 1D arrays of length 128 that specify the 128 pixels of a image.The dataset also contains the labels and some other information about the images.

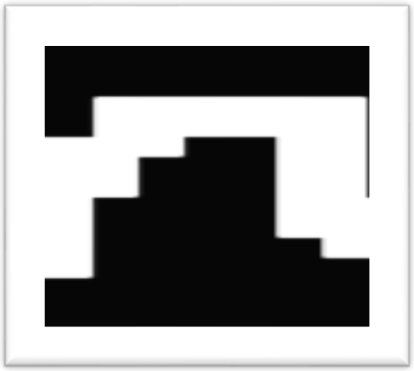
The DataSet looks like the following image :



Data Visualization:-

When visualized using OpenCV the images look like :





Further,we use Numpy arrays and Pandas DataFrame to preprocess and create the DataFrames.

Neural Network Model:-

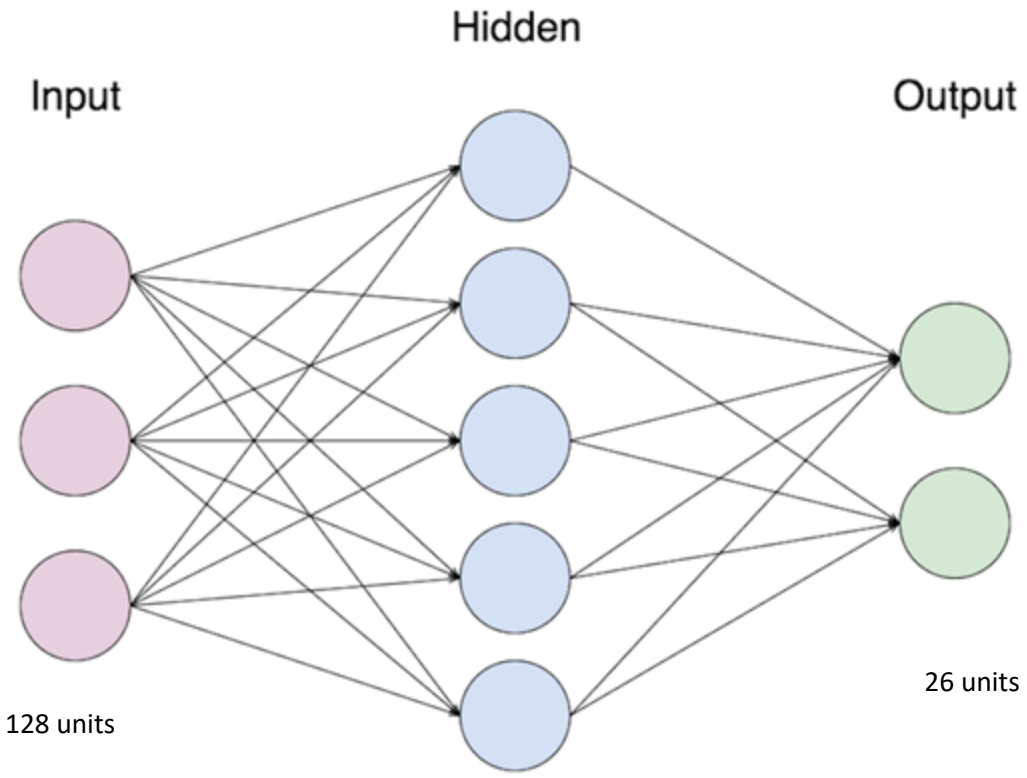
I have run the Model using various number of Hidden Layers.Finally I have made a Comparitive study of various Models based on the Network Parameters and the Model's performance.

The model which gave the best results was the one with 64 units in it's hidden layer.

In all my comparisons,Only one Hidden Layer has been used i.e. the Neural Network comprises of 3 layers:Input Layer,Hidden Layer and the Ouput Layer.

The Input layer and the Output Layer have a fixed number of units-128 and 26 respectively.We only vary the number of units of the hidden layer.

A comparitive study of various models was made by me.A critical insight that i got was that your Model is only as good as your training data.



Model Performance:-

The best model performance was achieved when:-

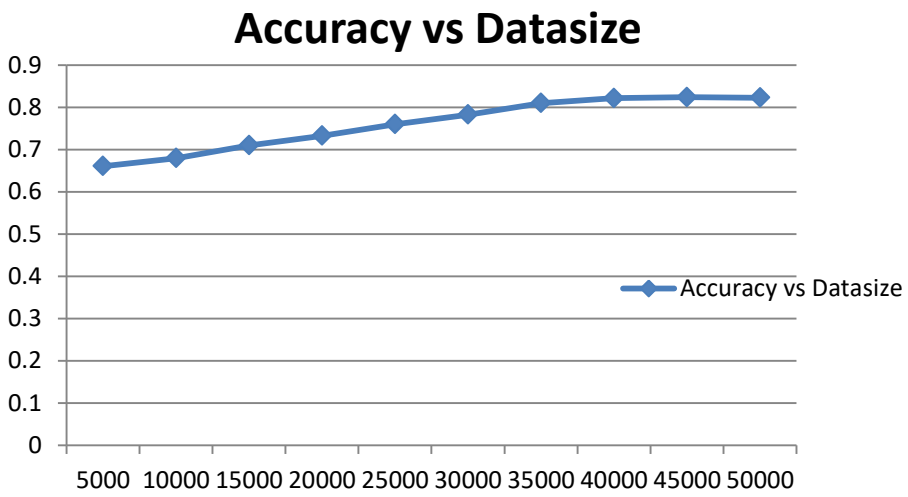
- Hidden units : 64
- Learning Rate : 0.001
- Activation FUnction : reLU
- Solver : Stochastic Gradient Descent

Comparisons between various parameters and performance :-

Datasize v/s Performance :

Random Data v/s Sequntial Data :

Data_Size	Accuracy
5000	0.661
10000	0.68
15000	0.71
20000	0.733
25000	0.76
30000	0.783
35000	0.81
40000	0.822
45000	0.824
50000	0.823



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Data_Size	Accuracy
5000	0.653
10000	0.67
15000	0.668
20000	0.704
25000	0.72
30000	0.743
35000	0.76
40000	0.782
45000	0.813
50000	0.816

Conclusion:-

I got a lot of insights on how Neural Networks actually work and I chose this particular dataset as it was not a very good one.As the dataset was not very good,I was able to see the capabilities of a Neural Network from a different perspective.Even with a bad DataSet the network perofrmed good enough having around 82% accuracy.The accuracy can further be enhanced by using a better dataset or by using more number of hidden layers.

Libraries Used:-

- Sklearn
- Numpy
- Pandas
- OpenCV