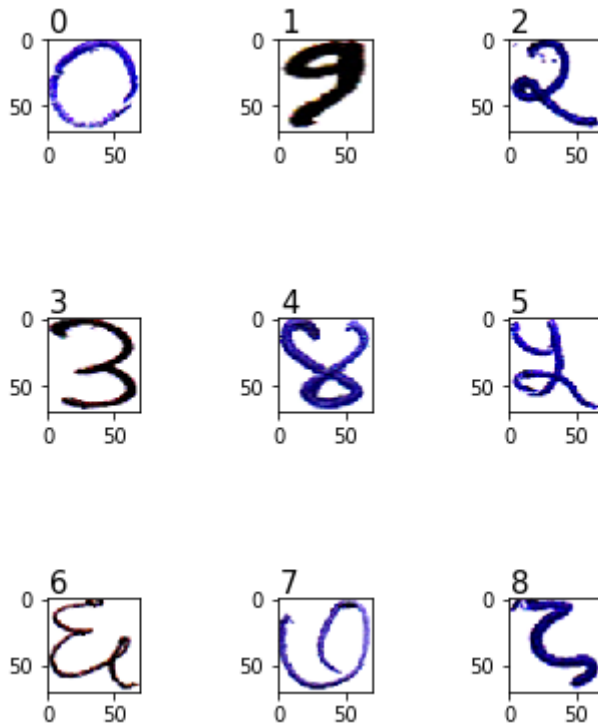**Lab Assignment 5 – Digit Recognition**

Automatic digit recognition i.e identifying letters from the images is of popular interest today. Deep Learning techniques makes it possible for object recognition in image data . This practice problem is meant to give you a kick start in deep learning. Several devenagri (Hindi) digits are given below:

Create Neural Network model for the Automatic digit recognition. (See example above for images of devnagri digits 0-9)

Note: this is an interesting problem, because there is very small difference in digit 1 and digit 9:

| Digit 9 | Digit 1 |
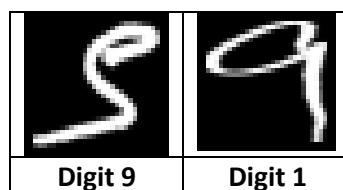
Steps

1. **Dataset Creation**: The data set used for this problem is taken from Hindi character dataset. For more details about the data set, visit archive.ics.uci.edu/ml/machine-learning-databases/00389/
2. **Pre-processing**:
    a. Read the image dataset and extract features out of it. Pefrorm preprocessing including normalization.
    b. Since output labels range from 0-9 digits, perform encoding.
3. **Dataset Preparation**: Split the dataset (75% training and 25% testing) into training and testing sets with encoded data as input X, digit class as target label Y.
4. **Model Creation**: Train a single layer Neural Network model with 32 nodes (using Keras preferably) for 100 epochs.
5. **Analysis**: Do the following analysis

a. Run different single layer Neural Network models with number of nodes as 8, 16, 32, 64, 128, 256, 512 and 1028. For all the models plot the training accuracy, testing accuracy and running time for testing in bar chart.

b. Run different Neural Network models with number of layers as 2, 3, 4, and 5, each layer with 32 nodes. For all the models plot the training accuracy, testing accuracy and running time for testing in bar chart. Analyse the results and discuss what you discovered!