A Novel Method for Handwritten Digit Recognition System

INTRODUCTION:

The handwritten digit recognition is the ability to recognize human handwritten digits by computers. It is considered to be a hard task for the machine because handwritten digits are not perfect and can be made with many different techniques. A solution to this problem is handwritten digit recognition which uses the image of a digit and thereby recognizes the digit present in it. Handwritten digit recognition is widely used in the field of automatic processing of bank cheques ,postal addresses etc. Some of the existing systems also include computational intelligence techniques such as artificial neural networks while others may be just large lookup tables. Although the artificial neural networks had been developed since 1940s but they have been widely applied to a large variety of disciplines only since the past fifteen years. Originating from the simple mathematical model of a biological neuron i.e. An artificial neuron, many varieties of neural networks exist these days. Although some are implemented in hardware but the majority are always simulated in software. Artificial neural nets have been successfully applied to handwritten digit recognition numerous times, with very small margins of errors.

HANDWRITTEN DIGIT RECOGNITION:

For a beginner aspirant, starting hurdle in the field of deep learning and machine learning is the MNIST dataset for Handwritten Digit Recognition and this system involves understanding and recognition of 10 handwritten digits (0- 9) by a machine. Handwritten Digit

Recognition from the MNIST dataset has been very popular among researchers as by using various classifiers for different algorithms and parameters, the error rate has been reduced a lot such as from linear classifier (1-layer NN) with 12% to 0.23% by a committee of 35 convolution neural networks (Yann LeCun, the MNIST database of Handwritten Digits). The scope of this study is to build an offline Handwritten Digit Recognition system and compare the different classifiers and combination methods by focusing on to achieve near the human performance.
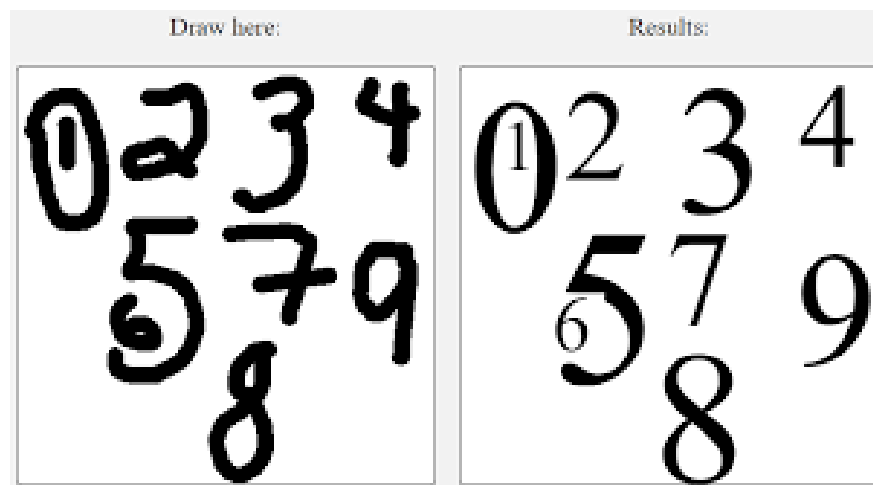
HARDSHIPS IN RECOGNITION:

The handwritten digits are not always of the same size, thickness, or orientation and position relative to the margins. For a task of writing different digits (0-9) for different persons the general problem faced would be of digit classification problem and the similarity between the digits like 1 and 7, 5 and 6, 3 and 8, 9 and 8 etc. Also people write the same digit in many different ways. Finally, the uniqueness and variety in the handwriting of different individuals also influence the formation and appearance of the digits. Here comes the use of deep learning and machine learning. In recent years, deep learning and machine learning have become necessary for image processing, object detection, handwritten digit recognition, character recognition, segmenting images, and building automated machines which might process on their own.
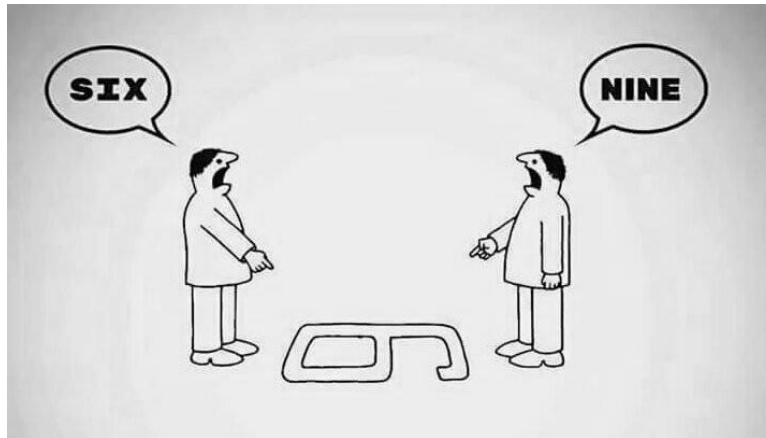
REQUIREMENT ANALYSIS:

Convolutional Neural Network (CNN):

CNN (Convolutional Neural Network or ConvNet) is a type of feed-forward artificial network where the connectivity pattern between its neurons is inspired by the organization of the animal visual cortex. The visual cortex has a small region of cells that are sensitive to specific regions of the visual field.

Machine Learning:

Machine Learning is a field of inquiry devoted to understanding and structure styles that learn, that is, styles that work data to ameliorate performance on some set of tasks.

MNIST Dataset:

The MNIST dataset is an acronym that stands for the Modified National Institute of Standards and Technology dataset. It is a dataset of 60,000 small square 28×28 pixel grayscale images of handwritten single digits between 0 and 9.

Accuracy:

Machine Learning model delicacy is the dimension used to determine which model is stylish at relating connections and patterns between variables in a dataset grounded on the input, or training, data.

PROGRESS:

In this paper, the MNIST data set is used as handwritten digital historical data. The MNIST data set is a very classic data set in the field of machine learning. An early notable attempt in the area of digit recognition research was made. The origin of a great deal of exploration work in the early sixties was grounded on an approach known as analysis- by- conflation system. In view of the increasing demand for handwritten digit recognition, a handwritten digit recognition model based on convolutional neural network is proposed.

The model includes 1 input layer and 2 convolutional layers (5*5 convolution Core), 2 pooling layers (2*2 pooling core), 1 fully connected layer, 1 output layer, and use the MNIST data set for model training and prediction. After a lot of training and participation, the accuracy rate of the training set was finally reached to 100%, and the accuracy rate of 98.25% was also achieved on the test set, which can meet the requirements of recognizing handwritten digits.

With the humanization of machines, there has been a substantial quantum of exploration and development work that has given a swell to deep literacy and machine literacy along with artificial intelligence. With time, machines are getting Further and more sophisticated, from calculating the introductory totalities to doing retina recognition they've made our lives more secure and manageable. Likewise, handwritten text recognition is an important application of deep learning and machine learning which is helpful in detecting forgeries and a wide range of research has already been done that encompasses a comprehensive study and implementation of various popular algorithms like works done by S M Shamim, Anuj Dutt , Norhidayu binti and Hongkai Wang to compare the different models of CNN with the fundamental machine learning algorithms on different grounds like performance rate, execution time, complexity and so on to assess each algorithm explicitly.

S M Shamim concluded that the Multilayer Perceptron classifier gave the most accurate results with minimum error rate followed by Support Vector Machine, Random Forest Algorithm, Bayes Net, Naive Bayes, j48, and Random Tree respectively while Anuj Dutt presented a comparison between SVM, CNN, KNN, RFC and were able to achieve the highest accuracy of 98.72% using CNN (which took maximum execution time) and lowest accuracy using RFC. Norhidayu binti did the detailed study-comparison on SVM, KNN and MLP models to classify the handwritten text and concluded that KNN and SVM predict all the classes of dataset correctly with 98.25% accuracy but the thing process goes little complicated with MLP when it was having trouble classifying number 9, for which the authors suggested to use CNN with Keras to improve the classification.

The comparison of the algorithms (Support vector machines, Multi-layered perceptron and Convolutional neural network) is grounded on the characteristic map of each algorithm on common grounds like dataset, the number of ages, complexity of the algorithm, delicacy of each algorithm, specification of the device used to execute the program and runtime of the algorithm, under ideal condition.

CONCLUSION:

The Handwritten number Recognition using Deep learning algorithm has been enforced. The most extensively used Machine learning algorithms, KNN, CNN have been trained and tested on the same data in order acquire the comparison between the classifiers. Utilizing these deep learning ways, a high quantum of delicacy can be attained. Compared to other exploration styles, this system focuses on which classifier works more by perfecting the delicacy of bracket models by further than 99.