

A NOVEL METHOD FOR HANDWRITTEN DIGIT RECOGNITION SYSTEM

Abstract: Humans with the help of their brain can recognize the things that they see. Similarly, deep neural networks is developed for the computers to recognize what they see through the User Interface(UI). Handwritten digit recognition is the ability of a computer to receive and interpret intelligible handwritten digit input from sources such as paper documents, photographs, touch-screens and other devices. The applications of digit recognition include in postal mail sorting, bank check processing, form data entry, etc. The heart of the problem lies within the ability to develop an efficient algorithm that can recognize hand written digits and which is submitted by users by the way of a scanner, tablet, and other digital devices.

Keywords:CNN, AlexNet, Handwritten Digit Recognition, MNIST.

Objectives:

1. To develop a deep neural model using AlexNet, which is an architecture of CNN to recognize the handwritten digit .
2. To obtain greater accuracy with the use of a GPU rather than using a CPU, which consumes time for large data sets.

Literature Survey:

S.NO	Author Name	Paper Title	Journal/C onference title	Page No/ Volume No	Year of Publicat ion	Description

1	Savita Ahlawat, Amit Choudhary, Anand Nayyar, Saurabh Singh and Byungun Yoon.	Improved Handwritten Digit Recognition Using Convolutional Neural Networks (CNN)	IEEE Sensors Journal		2020	In this paper, with the aim of improving the performance of handwritten digit recognition, they evaluated variants of a convolutional neural network to avoid complex pre-processing, costly feature extraction and a complex ensemble (classifier combination) approach of a traditional recognition system.
2	Vijayalaxmi R Rudraswamimath, Bhavanishankar and Channasandra.	Handwritten Digit Recognition using CNN	International Journal of Innovative Science and Research Technology	Volume-4 Issue-6	2019	In this paper, the most widely used Machine learning algorithms, KNN, SVM, RFC and CNN have been trained and tested on the same data in order to acquire the comparison between the classifiers.
3	Fathma Siddique, Shadman Sakib and Md. Abu Bakr Siddique.	Recognition of Handwritten Digit using Convolutional Neural Network in	5th International Conference on Advances in Electrical Engineering (ICAEE)		2019	In this paper, they observed the variation of accuracies of CNN to classify handwritten digits for 15

		Python with Tensorflow and Comparison of Performance for Various Hidden Layers				epochs using various numbers of hidden layers and epochs and to make the comparison between the accuracies. For this performance evaluation of CNN, they performed the experiment using Modified National Institute of Standards and Technology(MNIST) dataset.
4	Akanksha Gupta, Ravindra Pratap Narwaria and Madhav Singh.	Review on Deep Learning Handwritten Digit Recognition using Convolutional Neural Network	International Journal of Recent Technology and Engineering (IJRTE)	Volume-9 Issue-5	2021	In this paper, Object Character Recognition (OCR) is used on printed or documented letters to convert them into text. The database has training image database of 60,000 images and testing image database of 10,000 images. The KNN algorithm describes categorical value by making

						use of majority of votes of K - nearest neighbors, the K value used to differ here.
5	Md. Anwar Hossain and Md. Mohon Ali	Recognition of Handwritten Digit using Convolutional Neural Network (CNN)	Global Journal of Computer Science and Technology: D Neural & Artificial Intelligence	Volume-19 Issue-2	2019	<p>The goal of this work will be to create a model that will be able to identify and determine the handwritten digit from its image with better accuracy using using the concepts of Convolutional Neural Network and MNIST dataset.</p> <p>Later it can be extended for character recognition and real-time person's handwriting. The results can be made more accurate with more convolution layers and more number of hidden neurons.</p>

Drawbacks of the Existing System:

- The **different architectures** of CNN, hybrid CNN, CNN - RNN and CNN-HMM models, and **domain - specific recognition system**, are not thoroughly inquired and evolutionary algorithms are not clearly explored for optimizing CNN learning parameters ,the number of layers, learning rate and kernel sizes of convolutional filters.
- The fluctuation of accuracies for handwritten digits was observed for 15 epochs by varying the hidden layers. There is no clear explanation given for observing variation in the overall classification **accuracy** by varying the number of hidden layers and batch size.

Problem Definition:

Handwriting recognition is one of the compelling research works going on because every individual in this world has their own style of writing. It is the capability of the computer to identify and understand handwritten digits or characters automatically. Because of the progress in the field of science and technology, everything is being digitalized to reduce human effort. Hence, there comes a need for handwritten digit recognition in many real-time applications. MNIST data set is widely used for this recognition process and it has 70000 handwritten digits. We use Artificial neural networks to train these images and build a deep learning model. Web application is created where the user can upload an image of a handwritten digit. this image is analyzed by the model and the detected result is returned on to UI(User Interface).

Proposed Solution:

This project proposes to create a deep learning model using Convolutional Neural Network. Convolutional Neural Networks (CNNs) is very well known deep learning algorithm which can be used to process image. It assigns weights and biases to various parts of the image and is competent of differentiating one image from another image.

Here we intend to use AlexNet as it allows multi GPU training. By doing so, half of the data can be trained in one GPU and the rest is trained in another. The main objective is to obtain greater accuracy with the use of a GPU rather than using a CPU, which consumes time for large data sets.