Literature Survey

A Novel Method for Handwritten Digit Recognition System

INTRODUCTION:

Handwritten digit recognition is the ability of a computer system to recognize the handwritten inputs like digits, characters etc. from a wide variety of sources like emails, papers, images, letters etc. This has been a topic of research for decades. Some of the research areas include signature verification, bank check processing, postal address interpretation from envelopes etc. Here comes the use of Deep Learning.

In the past decade, deep learning has become the hot tool for Image Processing, object detection, handwritten digit and character recognition etc. A lot of machine learning tools have been developed like scikit-learn, scipy-image etc. and pybrains, Keras, Theano, Tensorflow by Google, TFLearn etc. for Deep Learning. These tools make the applications robust and therefore more accurate. The Artificial Neural Networks can almost mimic the human brain and are a key ingredient in image processing field. For example, Convolutional Neural Networks with Back Propagation for Image Processing, Deep Mind by Google for creating Art by learning from existing artist styles etc..

Handwritten Recognition has an active community of academics studying it. The biggest conferences for handwriting recognition are the International Conference on Frontiers in Handwriting Recognition (ICFHR), held in even-numbered years, and the International Conference on Document Analysis and Recognition (ICDAR), held in odd-numbered years. Both of these conferences are endorsed by the IEEE. Active areas of research include: Online Recognition, OfflineRecognition, Signature Verification, Postal-Address Interpretation,Bank-Check Processing, Writer Recognition.

Classification of images and patterns has been one of the major implementation of Machine Learning and Artificial Intelligence. People are continuously trying to make computers intelligent so that they can do almost all the work done by humans. Handwriting recognition system is the most basic and an important step towards this huge and interesting area of Computer Vision.

A Novel Handwritten Digit Classification System Based on Convolutional Neural Network Approach:

In recent decades, the image classification problem has been widely addressed in the literature, and it is still an active research field in image processing today. In this field, convolutional neural networks have made a substantial breakthrough in visual recognition, especially handwritten digit recognition [1–5]. These networks have a great ability for learning and extracting image features easily. CNN architectures for image classification have two different types of layers: convolutional layers for extracting image features and fully connected layers for performing the classification task based on the features extracted by the preceding convolutional layers [6,7]. The handwritten digit recognition problem is a topic of heated debate in recent years. Despite that there are enormous convolutional neural network algorithms proposed for handwritten digit recognition, issues such as recognition accuracy and computation time still require further improvement [8]. In the literature, there are massive studies based on different techniques that have been proposed for handwritten digit recognition: in [9], Ali et al. have used MNIST handwritten digits as a dataset. The authors proposed to utilize DL4J framework for handwritten digit recognition and convolutional neural network as a classifier, and they achieved a reasonable accuracy of 99.21%.

A Novel Method for Handwritten Digit Recognition using Deep Learning Rohini.M, Dr.D.Surendran, Sri Krishna College of Engineering and Technology:

Handwritten digit recognition has recently been of very interest among the researchers because of the evolution of various Machine Learning, Deep Learning and Computer Vision algorithms. In this report, We compare the results of some of the most widely used Machine Learning Algorithms like CNN- convolution neural networks and with Deep Learning algorithm like multilayer CNN using Keras with Theano and Tensorflow. MNIST is a dataset which is widely used for handwritten digit recognition. The dataset consist of 60,000 training images and 10,000 test images. The artificial neural neworks can all most mimic the human brain and are a key ingredient in image processing field.For example Convolution Neural networks with back propagation for image processing. The applications where these handwritten digit recognition can be used are Banking sector where it can be used to maintain the security pin numbers, it can be also used for blind peoples by using sound output.

A Survey of Handwritten Character Recognition with MNIST and EMNIST by Alejandro Baldominos, Yago Saez and Pedro Isasi:

This paper summarizes the top state-of-the-art contributions reported on the MNIST dataset for handwritten digit recognition. This dataset has been extensively used to validate novel techniques in computer vision, and in recent years, many authors have explored the performance of convolutional neural networks (CNNs) and other deep learning techniques over this dataset. To the best of our knowledge, this paper is the first exhaustive and updated review of this dataset; there are some online rankings, but they are outdated, and most published papers survey only closely related works, omitting most of the literature. This paper makes a distinction between those works using some kind of data augmentation and works using the original dataset out-of-the-box. Also, works using CNNs are reported separately; as they are becoming the state-of-

the-art approach for solving this problem. Nowadays, a significant amount of works have attained a test error rate smaller than 1% on this dataset; which is becoming nonchallenging. By mid-2017, a new dataset was introduced: EMNIST, which involves both digits and letters, with a larger amount of data acquired from a database different than MNIST's. In this paper, EMNIST is explained and some results are surveyed.

A Literature Survey on Handwritten Character Recognition by Ayush Purohit, Shardul Singh Chauhan:

Handwriting recognition has gained a lot of attention in the field of pattern recognition and machine learning due to its application in various fields. Optical Character Recognition (OCR) and Handwritten Character Recognition (HCR) has specific domain to apply. Various techniques have been proposed to for character recognition in handwriting recognition system. Even though, sufficient studies and papers describes the techniques for converting textual content from a paper document into machine readable form. In coming days, character recognition system might serve as a key factor to create a paperless environment by digitizing and processing existing paper documents. This paper presents a detailed review in the field of Handwritten Character Recognition.

CONCLUSION:

An implementation of Handwritten Digit Recognition using Deep Learning has been implemented in this paper. Additionally, some of the most widely used Machine Learning algorithms i.e. CNN using Tensorflowhave been trained and tested on the same data to draw a comparison as to why we require deep learning methods in critical applications like Handwritten Digit Recognition. Using the Convolutional Neural Network with Keras and Theano as backend, I am able to get an accuracy of 95.72%. Every tool has its own complexity and accuracy. Although, we see that the complexity of the code

and the process is bit more as compared to normal Machine Learning algorithms but looking at the accuracy achieved, it can be said that it is worth it. Also, the current implementation is done only using the CPU Thus we settled on classifying a given handwritten digit image as the required digit using three different algorithms and consequently testing its accuracy.

References:

[1]Dr.Kusumgupta2 ,"a comprehensive review on handwritten digit recognition using various neural network approaches", international journal of enhanced research in management & computer applications, vol. 5, no. 5, pp. 22-25, 2016.

[2] Ishani Patel, ViragJagtap and OmpriyaKale."A Survey on Feature Extraction Methods for Handwritten Digits Recognition", International Journal of Computer Applications, vol. 107, no. 12, pp. 11-17, 2014.

[3] Y LeCun,"COMPARISON OF LEARNING ALGORITHMS FOR HANDWRITTEN DIGIT RECOGNISATION".In:International conference on Artificial Neural networks, France, pp. 53–60. 1995.

[4] Hossain, M.A.; Ali, M.M. Recognition of handwritten digit using convolutional neural network (CNN). Glob. J. Comput. Sci. Technol. Neural Artif. Intell. 2019, 19, 27–33. [CrossRef]

[5]He, K.; Zhang, X.; Ren, S.; Sun, J. Deep residual learning for image recognition. In Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition (CVPR), Las Vegas, NV, USA, 27–30 June 2016; pp. 1–12.

A NOVEL BASED METHOD FOR HANDWRITTEN DIGIT RECOGNITION SYSTEM

PROBLEM STATEMENT:

Getting an image as an input which contains human handwritten digits or letters. Pre-process the image to split up each handwritten digit. Recognize the digit from the image by using the trained model.

Who does the problem affects?	Individual: It is useful for those who want to extract digit from the written document.
What are the boundaries of the problem?	Organisation: Service like post uses the application of handwritten digit recognition. Not all peoples style of handwritings are same. So different type of handwritings are to be analysed.
What is the issue?	In case of manual recognition, it is monotonous work has to be done and human error might be possible.
When does the issue occur?	There are different types of position, orientation of digits in handwriting. While scanning those digit image, issue can be occurred. So different types of images are to be processed.
Where is the issue occurring?	While doing a manual work of digit recognition, error can occur at recognition. Even at digital recognition, different orientation of digits are difficult to identify.