A NOVEL METHOD FOR HANDWRITTEN DIGIT RECOGNITION SYSTEM

INTRODUCTION

Presently, many people use images to depict and transfer information. It is also popular to extract important features from an image that provide valuable information. Image recognition is a growing domain in that field of research because of its wide variety of applications.

In the comparatively young and emerging field of computer pattern recognition, one of the challenges lies in the accurate automated recognition of human handwriting. This is quite a challenging task taking into consideration the difference in handwriting from one person to another. Although, this variance in handwriting does not cause much problems to humans, it is tricky and quite a comprehensive task in teaching a generic handwriting to a computer.

For the problem of handwritten digit classification through image pattern recognition, it is very important to analyze how information is represented in images. The image pixels are not the ones that contain information, but it is the features of images which have high level illustration. In the case of handwritten digit recognition, features relating to the structure of the digits should be first extracted from the style in which the digits are written. These features which are extracted can be used to recognize the handwritten digit. Most of the classification and regression machine learning algorithms that are present currently are shallow learning algorithms. It is difficult to represent complex functions effectively, and ability to generalize them is limited for the complicated classification problems.

Deep learning is a recently discovered algorithm consisting of a multilayer network of neurons. Applications of deep learning to a number of problems has brought a substantial difference in the number of recent studies ranging from classification of images and recognition of speech to classification of audio. It has changed the realm of machine learning, and making huge advancements in artificial intelligence. Deep Learning algorithms are best used because of their high efficiency in image recognition tasks, in this case, MNIST digit recognition.

LITERATURE SURVEY

[1] M. M. Abu Ghosh and A. Y. Maghari

This paper shows the Approaches through Neural Networks . The three famous Neural Network approaches are deep neural network (DNN), deep belief network (DBN) and convolutional neural network (CNN). The three approaches are compared based on their accuracy and performance. Random and standard dataset of handwritten digits have been used for conducting the experiments. The results show that among the 3 NN approaches, DNN is the most accurate algorithm as it has an accuracy rate of 98.08%. However, the execution time of DNN is comparable with the two other algorithms. Every algorithm has an error rate of 1-2% because of the similarity in digit shapes, specially, with the digits (1,7), (3,5), (3,8), (8,5) and (6,9).

[2] Jürgen Schmidhuber

This paper reviews deep supervised learning (also recapitulating the history of backpropagation), unsupervised learning, reinforcement learning & evolutionary computation, and developing short programs encoding deep and large networks.

[3] Han, X. and Y. Li.

This paper explains about Convolutional neural networks which combines artificial neural networks and recent deep learning methods. This paper summarizes the latest development of convolutional neural networks and expounds the relative analysis of image recognition technology and explains how convolutional neural networks can be used in handwritten numeral recognition.

[4] Ciresan, D. et al

This paper explains how Small (often minimal) receptive fields of convolutional winner-take-all neurons gain massive network depth, leading to several sparsely connected neural layers. Many deep neural columns become well trained on inputs preprocessed in various ways; their predictions are averaged. On this sophisticated MNIST handwriting benchmark, the proposed method is the very first to achieve near-human performance. The paper has mentions to improve on a plethora of common image classification benchmarks.

[5] Niu n Xiao-Xiao and Y. Suen Ching

This paper describes the method involved to classify Arabic Handwritten Digits as there are deficient works accomplished on Arabic pattern digits because Arabic digits are more challenging than English patterns. Hence, the lack of research using Arabic digits endeavors the authors to work deeper by creating a challenge of Arabic Handwritten Digits recognition, which consists of

more than 45,000 samples. As a challenging dataset is used for evaluation, a robust deep convolutional neural network is used for classification and superior results are achieved.

[6] Ahlawat S, Choudhary A, Nayyar A, Singh S, Yoon B

The aim of this paper is to find choices in Model design parameters like number of layers, stride size, receptive field, kernel size, padding and dilution for CNN-based handwritten digit recognition. Additionally, the paper aims to evaluate various SGD optimization algorithms to enhance the performance of handwritten digit recognition. The objective is to achieve comparable accuracy by using a pure CNN architecture without ensemble architecture, as ensemble architectures raises computational cost and features greater testing complexity. Thus, a CNN architecture is proposed to attain accuracy better than that of ensemble architectures that offers reduced operational complexity and cost. An appropriate combination of learning parameters is presented in designing a CNN that achieved 99.87% recognition accuracy rate on MNIST dataset.

[7] Fabien Lauer, Ching Y. Suen, Gérard Bloch

This article focuses on the problems of extraction of features and handwritten digit recognition. A feature tractor model which is trainable and based on the LeNet5 convolutional neural network architecture is introduced to solve the problem of feature extraction in a high level manner without much previous knowledge on the data being used. The classification task is performed by SVM to enhance the ability with which LeNet5 is able to generalize. In order to enhance the rate at which it recognizes, new samples for the purpose of training are generated subject to various transformations and distortions. Various experiments conducted on the standard MNIST dataset show that the approach used can perform better than both SVMs and LeNet5 while providing performances reminiscent of the simplest performance on the given dataset.

[8] L. Bottou et al

This paper compares the performance of several classifier algorithms on a customary set of handwritten digits. The paper not only considers the accuracy obtained, but also time taken to train, time consumed for recognition, the amount of memory required and carefully analyzing the patterns that should be rejected so that the rate at which the classifications of the remaining patterns made are false are less than a well defined threshold.

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