A Novel Method for Handwritten Digit Recognition System

Domain: Artificial Intelligence

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Abstract:

In today's society, character recognition is becoming increasingly vital. It facilitates human work and aids with the resolution of more difficult issues. One illustration is handwritten character recognition, which is extensively used worldwide. This technique was created to recognise zip codes or postal codes for use in mail sorting. This can aid people in the difficultto-read postal code mail sorting process. Researchers have been working on handwriting recognition for more than thirty years. The number of firms participating in handwriting recognition research has steadily expanded over the last several years. Handwriting processing has advanced due to a mix of factors such as improved recognition rates and the usage of

complicated systems. We can enter our handwriting into some handwriting recognition systems. Either using a mouse or a third-party drawing tablet, you can accomplish this. We have the option of typing the input or leaving it as an "ink object" with our own handwriting. Additionally, we can manually type the content into any Microsoft Office software file that we want the system to identify. Typing 1s and 0s will allow us to do this. As a Boolean variable, this operates.

Paper 1:
A novel method for Handwritten Digit Recognition with Neural Networks

Malothu Nagu, N Vijay Shankar, K. Annapurna

Character recognition plays an important role in the modern world. It can solve more complex problems and makes humans' job easier. An example is handwritten character recognition. This is a system widely used in the world to recognize zip code or postal code for mail sorting. There are different techniques that can be used to recognize handwritten characters. Two techniques researched in this paper are Pattern Recognition and Artificial Neural Network (ANN). Both techniques are defined and different methods for each technique is also discussed. Bayesian Decision theory, Nearest Neighbour rule, and Linear Classification or Discrimination is types of methods for Pattern Recognition. Shape recognition, Chinese Character and Handwritten Digit recognition uses Neural Network to recognize them. Neural Network is used to train and identify written digits. After training and testing, the accuracy rate reached 99%. This accuracy rate is very high.

Paper 2:
Novel Deep Neural Network Model for Handwritten Digit Classification and Recognition

Year: 2021

Authors: Ayush Kumar Agrawal and Vineet Kumar Awasthi

An artificial neural network has one hidden layer between the input and output layers, whereas a deep neural network has numerous hidden layers with input and output layers. Deep neural networks use several hidden layers to increase model performance and achieve higher accuracy compared to accuracy of machine learning models. Most researchers do their research in the area of pattern recognition. In the field of pattern recognition, there are many patterns that can be used, including handwritten numbers, characters, pictures, faces, sounds, and speech. This study focuses on the classification and recognition of handwritten digits.1000 were utilized as test samples and 1000 were training samples.10000 picture samples make up the USPS dataset, of which 7291 serve as training samples and 2007 serve as testing samples. We've used the proposed deep neural network technique in this paper to classify and identify data from the ARDIS and USPS datasets. The suggested model consists of six layers with SoftMax and relu activation functions. After model implementation, accuracy for ARDIS samples reached 98.70% testing and 99.76% training, which is greater than accuracy from prior research. Additionally, using the USPS samples dataset, 98.22% training accuracy and 93.01% testing accuracy were attained. When compared to earlier methodologies, the data show that deep neural networks perform incredibly well.

Paper 3:
Handwritten digits recognition with artificial Neural Network

K. Islam, G. Mujtaba, R.G. Raj, H.F. Nweke

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In a computer vision system, handwritten digits recognition is a complex task that is central to a variety of emerging applications. It has been widely used by machine learning and computer vision researchers for implementing practical applications like computerized bank check numbers reading. In this study, we implemented a multi-layer fully connected neural network with one hidden layer for handwritten digits recognition. The testing has been conducted from publicly available MNIST handwritten database. From the MNIST database, we extracted 28,000 digits images for training and 14,000 digits images for performing the test. Our multilayer artificial neural network has an accuracy of 99.60% with test performance

Paper 4:
Handwritten Character Recognition using Neural Network and TensorFlow
Year: 2019

Authors: Megha Agarwal, Shalika, Vinam Tomar, Priyanka Gupta

The offline handwritten character recognition in this study will be carried out using TensorFlow and a convolutional neural network. a process known as using SoftMax Regression, one may assign probabilities to one of the many characters in the handwritten text that offers the range of values from 0 to 1, summed to 1. The objective is to create software that is extremely accurate and that has a minimum level of spatial and temporal complexity.

It was determined that strategies for feature extraction like diagonal and direction are significantly better at producing high accuracy.
Outcomes in comparison to other conventional vertical and horizontal techniques moreover use the best Neural network tried layers provides the benefit of a higher accurate outcome by having a high noise tolerance.

The feed forward model in neural networks is the back-propagation algorithm that was primarily used to classify the characters, recognise them, and receive training continually more.

In addition to these, normalizing along with feature extraction, the results were better and more effective. Character recognition is the outcome of accuracy.

The paper will describe the best approach to get more than 90% accuracy in the field of Handwritten Character Recognition (HCR).

Paper 5:
Improved Handwritten Digit Recognition Using Convolutional Neural Networks (CNN)

Year: 2020

Authors: Savita Ahlawat, Amit Choudhary, Anand Nayyar, Saurabh Singh and Byungun Yoon

Customized features and a vast quantity of past knowledge have been used in traditional handwriting recognition systems. It is difficult to train an optical character recognition (OCR) system based on these conditions. Deep learning approaches have enabled significant performance in the field of handwriting recognition research in recent years. Nonetheless, the increasing increase in the amount of handwritten data, along with the availability of vast computing capacity, necessitates improvements in recognition accuracy and warrants additional exploration. Convolutional neural networks (CNNs) are extremely excellent in perceiving the structure of handwritten characters/words in ways that aid in the automatic extraction of distinguishing features, making CNN the best solution for solving handwriting recognition challenges.

The proposed work aims to investigate several design alternatives for CNN-based handwritten digit recognition, such as the number of layers, stride size, receptive field, kernel size, padding, and dilution. Furthermore, we intend to assess the effectiveness of several SGD optimization techniques in enhancing the performance of handwritten digit recognition. Using ensemble architecture improves the recognition accuracy of a network. In this case, we want to obtain equal accuracy by employing a pure CNN design without ensemble architecture, because ensemble structures increase computational overhead and testing complexity. As a result, a CNN design is developed in order to obtain higher accuracy than ensemble systems while reducing operational complexity and expense. Furthermore, we demonstrate an appropriate combination of learning parameters in the design of a CNN that leads us to a new absolute record in categorising MNIST handwritten digits. We conducted extensive trials and achieved 99.87% recognition accuracy for an MNIST dataset.