Literature survey on Handwritten Digit Recognition System

Title: *A Novel method for Handwritten Digit Recognition System*

Abstract:

Character recognition is becoming more and more important in today's society. It aids in the completion of human work and the resolution of more challenging problems. Handwritten character recognition is one example, and it is widely used all around the world. For use in mail sorting, this method was developed to recognize zip numbers or postal codes. People can use this to help with the challenging postal code mail sorting procedure. For more than 30 years, researchers have been developing handwriting recognition technology. Over the past few years, the number of businesses engaged in handwriting recognition research has significantly increased numerous years. Improved identification rates and the use of complex systems are just two of the reasons contributing to the advancement of handwriting processing. Some handwriting recognition software allows us to enter our handwriting. You can carry out this with either a mouse or an external drawing tablet. The input can either be typed in or left as a handwritten "ink object" by the user. Any Microsoft Office software file that we want the system to recognize can also have the content manually entered into it. We can achieve this by entering 1s and 0s. This functions as a Boolean parameter.

Literature Survey

Paper 1: A Novel Handwritten Digit Classification System Based on Convolutional Neural Network Approach

Year: *2021*

Authors: *Ali Abdullah Yahya, Jieqing Tan, Min Hu*

There have been a ton of CNN classification algorithms put forth in the literature. However, these algorithms do not consider the proper filter size selection, data preparation, dataset restrictions, or noise. As a result, few algorithms have been able to significantly increase classification accuracy. The paper makes the following contributions to solve these methods' drawbacks: First, the size of the effective receptive field (ERF) is determined after taking domain knowledge into account. They choose a typical filter size with the aid of the ERF calculation, improving the classification accuracy of our CNN. Second, excessive data produces inaccurate results, which has a detrimental impact on classification accuracy. Before carrying out the data classification task, data preparation is conducted to ensure that the dataset is devoid of any redundant or irrelevant variables to the goal variable. Thirdly, data augmentation has been suggested as a way to reduce training and validation errors and prevent dataset limitations. Fourthly, the paper suggests adding an additive white Gaussian noise with a threshold of 0.5 to the MNIST dataset in order to imitate the natural factors that can affect image quality in the real world. With a recognition accuracy of 99.98% and 99.40% with 50% noise, our CNN algorithm achieves state-of-the-art performance in handwritten digit recognition.

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

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 categorizing MNIST handwritten digits. We conducted extensive trials and achieved 99.87% recognition accuracy for an MNIST dataset