LITERATURE SURVEY ON NOVEL METHOD FOR HANDWRITTEN DIGIT RECOGNITION SYSTEM

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A novel method for handwritten digit recognition system

Name of paper: A Novel Approach for Handwritten Character Recognition Using K-NN Classifier

Published year: February 2020

Author: Abhay Mishra, Krishan Kumar, Parveen Kumar and Prakhar Mittal

Overall Inference:

In our day-to-day life, the use of the handwritten digits and words are important to identify. It is the very first step toward the identification of the writer. The use of this approach can lead us to identify the fake writer present in a system. Moreover, in this digital era, we cannot risk the information to some of the intruders. It can affect our system by accessing our personal information. In addition to this, they can further use the information to harm us as they can use that information to gain our bank details. They can withdraw our hard-earned money or they can send us some fake information to us by the name of someone else. Hence, this challenge can create chaos in our life. However, a system can easily identify the fake ones, using the character reorganization approaches.

In this paper, the authors proposed an integrated system to recognize the character from the handwritten documents. The database used for the digits is the MINST dataset which contains approximately 5000 different written digits which we can use as training and testing our model. The database used for the words are letter recognition data which contains total of 20,000 characters present in it. The entire dataset is divided into training and testing set.

K-nearest neighbor approach is used where an image is the input, then it is converted in the form of cells [8]. The challenges are faced by us to detect the hand written digit and words accurately while every person handwriting is different and may follow the different shape and sizes, which makes more difficult the process for recognizing the character. For employing the K-NN, deciding the value of K is the challenge to us.

The proposed model is divided into two parts, where first phase for preprocessing, while in second phase, the character is recognized using the python libraries such as numpy, pandas, openCV and matplotlib.

This paper shows a novel approach to recognize the digits and alphabets with better accuracy than the existing models. The model employed four Python libraries to enhance the accuracy of the model. K-NN classifier is applied on the trained model. This integrated model outperforms the existing one. The model may be applicable for writer identification, license number plate recognition, and many more real-time applications.

Name of paper: Multi-Language Handwritten Digits Recognition based on Novel Structural Features

Published year: October 2019

Author: Jaafar M. Alghazo, Ghazanfar Latif, Loay Alzubaidi, Ammar Elhassan

Overall inference:

Handwritten scripts are intricate with several factors affecting their complexity, including writer-specific variations subject to inter-writer and intra-writer variables. This applies to all handwritten scripts including numerals. Several recognition algorithms have been developed for offline handwritten recognition for various applications. With the increase in popularity and type variation of gesture, touchscreen, and handheld devices, the need for novel algorithms to detect and automatically recognize handwritten/gestured numerals becomes a significant requirement that determines success of these devices. The number of applications that depend on accurate, automatic online recognition of handwritten numerals is increasing. Applications vary from teaching children to write numerals to secure banking sector. In all cases, a robust and accurate handwritten numeral recognition system is needed.

The proposed method includes three main phases of numeral recognition systems. The first phase consists of what is referred as 'preprocessing phase' which includes segmentation, binarization, noise removal, size, and slope normalization. The second phase is the feature extraction. We propose a novel feature extraction method based on 65 local features. These 65 features, explained in detail later, are the basis for a multi-language handwritten numeral recognition system. The third and final phase consists of applying a classification technique to recognize the numerals. In this paper, we applied four different classification techniques: Artificial Immune, Multi-layer Perceptron, Logistic and Random Forest. The Random Forest classifier was found to achieve the best recognition rate for multi-language recognition with an average accuracy of 96.7%.

This paper targeted many languages even though their digits do not resemble each other. In this study, we proposed 65 geometrically based local features. The proposed method is tested on six different well-known databases of different languages by using RF. It can be observed that the proposed method produced very low error rates and very low confusion rates with other digits. Future work may include using fuzzy logic to further reduce the confusion between different digits, thereby increasing the recognition accuracy even further. The possibility of redesigning the system in a cloud-based environment will also be part of future work in order to achieve a continuous learning curve and obtain a continuous accuracy improvement.

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

Published year: April 2021

Author: Ali Abdullah Yahya , Jieqing Tan 2 and Min Hu

Overall Inference:

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. 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.

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. 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%.

In this paper, they presented a novel convolutional neural network architecture based on data preparation, receptive field, data augmentation, optimization, normalization, and regularization techniques for handwritten digit recognition. To guarantee the dataset does not contain any unnecessary details and that it is fit for applying in our CNN model, data preparation is conducted as an essential first step in our proposed model. Without applying data preparation to the raw data, it is highly possible that unnecessary data leads to misleading results. In our work, filter sizes are determined by calculating the size of the ERF. Calculating this size can help in enhancing the performance of our CNN.

The experimental results show that using data augmentation with CNN gives better recognition accuracy compared to CNN without data augmentation. Utilizing the data augmentation technique has helped to expand our training dataset, resulting in improving the performance and classification capability of the model. On the very competitive MNIST handwritten digits benchmark, the proposed CNN model has achieved superiority over state-of-the-art methods for handwritten digits recognition. In our experiments, batch normalization has been used to improve the training performance and enhance the stability of the model.

Name of paper: A Novel Approach for Handwritten Digit Recognition using Multilayer Perceptron Neural Network

Published year: February 2022

Author: Toufik Datsi, Khalid Aznag, Ahmed El Oirrak

Overall Inference:

Handwritten Digit Recognition (HDR) is a challenging research area in the field of Optical Character Recognition. In the branch of computer vision, HDR gaining a huge demand and become the popular machine learning problem. Recognition methods based on Artificial Neural Networks have been studied for several years in order to achieve performances close to those observed in humans.

Artificial Neural Networks are proved their effectiveness in the areas of image processing. The existing methods in current image recognition use as inputs all the pixels of the image. The purpose of this work is to minimize the number of pixels by using as input the data extracted and calculated from the initial image. The approach consists of transforming the image of the digit in the binary format then encode each column by value i.e. passage of the binary representation in decimal value. This technique called column decimal coding. The architecture of Artificial Neural Network used in this research is based on a multilayer perceptron neural network in order to recognize and predict the handwritten digit from 0 to 9. A dataset of 6000 samples was obtained from the MNIST database. For better training and testing dataset, we have used the back propagation as a learning algorithm.

The proposed approach in this paper consists of four stages such as data preparation, pre-processing. After pre-processing the data is given to the ANN model and finally it is classified and recognized. For performing these processes, the system consists of input layer, hidden layer and output layer for recognizing the scanned input images. The input layer distributes the features of our examples to the next layer for calculation of activations of the next layer. Hidden layer are made of hidden units called activations providing nonlinear ties for the network. The output layer provides us with the final prediction of the Neural Network on the basis of which final predictions are made.The proposed approach presented in this work gives the best accuracy in the majority of the test.