LITERATURE SURVEY

Date	17 September 2022
Team ID	PNT2022TMID30180
Project Name	A NOVEL METHOD FOR HANDWRITTEN DIGIT RECOGNITION SYSTEM
Maximum Marks	2 Marks

1. A NOVEL APPROCH FOR HANDWRITTEN DIGIT RECOGNITION USING MULTILAYER PERCEPTION NEUTRAL NETWORK [Toufik Datsi, Khalid Aznag, Ahmed El Oirrak, 2022]

This paper is focused on field of Optical Character Recognition. It is also based on Artificial Neural Networks which are proved their effectiveness in the areas of image processing. It is about 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. 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. For better training and testing dataset, we have used the backpropagation as a learning algorithm. A dataset of 6000 samples was obtained from the MNIST database. For better training and testing dataset, we have used the backpropagation as a learning algorithm.

2. A NOVEL HANDWRITTEN DIGIT CLASSIFICATION SYSTEM BASED ON CONVOLUTIONAL NEUTRAL NETWORK APPROACH [Ali Abdullah Yahya, Jieqing Tan, et al, 2021]

An enormous number of CNN classification algorithms have been proposed in the literature. Nevertheless, in these algorithms, appropriate filter size selection, data preparation, limitations in datasets, and noise have not been taken into consideration. As a consequence, most of the algorithms have failed to make a noticeable improvement in classification accuracy. To address the shortcomings of these algorithms, our paper presents the following contributions: After taking the domain knowledge into consideration, the size of the effective receptive field (ERF) is calculated. Calculating the size of the ERF helps us to select a typical filter size which leads to enhancing the classification accuracy of our CNN. Unnecessary data leads to misleading results and this, in turn, negatively affects classification accuracy. To

guarantee the dataset is free from any redundant or irrelevant variables to the target variable, data preparation is applied before implementing the data classification mission. To decrease the errors of training and validation, and avoid the limitation of datasets, data augmentation has been proposed to simulate the real-world problems.

3. EFFECTIVE HANDWRITTEN DIGIT RECOGNITION USING CONVOLUTION NEURAL NETWORK [Yellapragada SS Bharadwaj, Rajaram P, et al, 2020]

This paper proposed a simple neural network approach towards handwritten digit recognition using convolution. With machine learning algorithms like KNN, SVM/SOM, recognizing digits is considered as one of the unsolvable tasks due to its distinctiveness in the style of writing. In this paper, Convolution Neural Networks are implemented with an MNIST dataset of 70000 digits with 250 distinct forms of writings. The proposed method achieved 98.51% accuracy for real-world handwritten digit prediction with less than 0.1 % loss on training with 60000 digits while 10000 under validation. Advancements in the field of computer vision using deep neural networks attract attention; thus, many A.I. practitioners are moving towards it. One of the influencing projects that opted for deep learning is OCR. Handwritten digit recognition (HDR) is a snippet of OCR where instead of taking the whole character's data, HDR detects digits. Comparing to OCR, HDR is light and faster. In fields like medical, banking, student management, and taxation process, HDR possesses great flexibility.

4. IMPROVED HANDWRITTEN DIGIT RECOGNITION USING CONVOLUTUIONAL NEURAL NETWORK [Savita Ahlawat, Amit Choudhary, et al, 2020]

Traditional systems of handwriting recognition have relied on handcrafted features and a large amount of prior knowledge. Training an Optical character recognition (OCR) system based on these prerequisites is a challenging task. Research in the handwriting recognition field is focused around deep learning techniques and has achieved breakthrough performance in the last few years. Still, the rapid growth in the amount of handwritten data and the availability of massive processing power demands improvement in recognition accuracy and deserves further investigation. Convolutional neural networks (CNNs) are very effective in perceiving the structure of handwritten characters/words in ways that help in automatic extraction of distinct features and make CNN the most suitable approach for solving handwriting recognition problems. Our aim in the proposed work is to explore the various

design options like number of layers, stride size, receptive field, kernel size, padding and dilution for CNN-based handwritten digit recognition. In addition, we aim to evaluate various SGD optimization algorithms in improving the performance of handwritten digit recognition.

5. HANDWRITTEN DIGIT RECOGNITION USING ENSEMBLE LEARNING [Kuppa Venkata Padmanabha Nandan, Manoj Panda, S. Veni, 2020]

This paper is mainly focused on Ensemble learning. In pattern recognition, the recognition of handwritten digits has always been a very challenging and tedious task. In this work, a simple novel approach is proposed to recognize the handwritten digits. The primary goal of this work is recognition of the handwritten digits by using ensemble learning. Ensemble learning improves convergence by decreasing the complexity of the model to facilitate accurate and improved decision. This is also helpful to know about distribution of data in the random split and class-wise split. It's about analysis of how the load is distributed among the base learners and how it impacts the model accuracy and training time. The overall trends of the ensemble model have also been analysed in this paper.

6. HYBRID CNN – SVM CLASSIFIER FOR HANDWRITTEN DIGIT RECOGNITION [Savita Ahlawat, Amit Choudhary,2020]

The aim of this paper is to develop a hybrid model of a powerful Convolutional Neural Networks (CNN) and Support Vector Machine (SVM) for recognition of handwritten digit from MNIST dataset. The proposed hybrid model combines the key properties of both the classifiers. In the proposed hybrid model, CNN works as an automatic feature extractor and SVM works as a binary classifier. The MNIST dataset of handwritten digits is used for training and testing the algorithm adopted in the proposed model. The MNIST dataset consists of handwritten digits images which are diverse and highly distorted. The receptive field of CNN helps in automatically extracting the most distinguishable features from these handwritten digits. The experimental results demonstrate the effectiveness of the proposed framework by achieving a recognition accuracy of 99.28% over MNIST handwritten digits dataset. In the area of handwriting recognition, several methods have been proposed in the literature such as Artificial Neural Network (ANN), Neuro-Fuzzy Systems (NFS), Support Vector Machine (SVM) and deep learning-based classifiers [1-9]. Although decent recognition accuracy has been reported by these classifiers; handwriting digit recognition is still an open research problem and demands for exploring new techniques and methodologies that would further improve the performance in terms of recognition accuracy, running time and computational complexity.

7. MULTI-LANGUAGE HANDWRITTEN DIGIT RECOGNITION BASED ON NOVEL STRUCTURAL FEATURAL [Jaafar M. Alghazo, Ghazanfar Latif, 2019]

Automated handwritten script recognition is an important task for several applications. In this article, a multi-language handwritten numeral recognition system is proposed using novel structural features. A total of 65 local structural features are extracted and several classifiers are used for testing numeral recognition. Random Forest was found to achieve the best results with an average recognition of 96.73%. The proposed method is tested on six different popular languages, including Arabic Western, Arabic Eastern, Persian, Urdu, Devanagari, and Bangla. In recent studies, single language digits or multiple languages with digits that resemble each other are targeted. In this study, the digits in the languages chosen do not resemble each other. Yet using the novel feature extraction method a high recognition accuracy rate is achieved. Experiments are performed on well-known available datasets of each language. A dataset for Urdu language is also developed in this study and introduced as PMU-UD. Results indicate that the proposed method gives high recognition accuracy as compared to other methods. Low error rates and low confusion rates were also observed using the novel method proposed in this study.