LITERATURE SURVEY

A Novel Method for Handwritten Digit Recognition System

1. **Handwritten Digit Recognition Using Various Machine Learning Algorithms and Models**

SSRN 2020

Pranit Patil

Handwritten digit recognition is a technique or technology for automatically recognizing and detecting handwritten digital data through different Machine Learning models. In this paper we use various Machine Learning algorithms to enhance the productiveness of technique and reduce the complexity using various models. Machine Learning is an application of Artificial Intelligence that learns from previous experience and improves automatically through experience. We illustrate various Machine learning algorithms such as Support Vector Machine, Convolutional Neural Network, Quantum Computing, K-Nearest Neighbour Algorithm, Deep Learning used in Recognition technique.

2. **Recognition of Handwritten Digit using Convolutional Neural Network in Python with TensorFlow and Comparison of Performance for Various Hidden Layers**

IEEE 2019

Fathma Siddique, Shadman Sakib, Md. Abu Bakr Siddique

In recent times, with the increase of Artificial Neural Network (ANN), deep learning has brought a dramatic twist in the field of machine learning by making it more artificially intelligent. Deep learning is remarkably used in vast ranges of fields because of its diverse range of applications such as surveillance, health, medicine, sports, robotics, drones, etc. In deep learning,

Convolutional Neural Network (CNN) is at the center of spectacular advances that mixes Artificial Neural Network (ANN) and up to date deep learning strategies. It has been used broadly in pattern recognition, sentence classification, speech recognition, face recognition, text categorization, document analysis, scene, and handwritten digit recognition. The goal of this paper is to observe the variation of accuracies of CNN to classify handwritten digits using various numbers of hidden layers and epochs and to make the comparison between the accuracies. For this performance evaluation of CNN, we performed our experiment using Modified National Institute of Standards and Technology (MNIST) dataset. Further, the network is trained using stochastic gradient descent and the backpropagation algorithm.

3. Handwritten Digit Recognition System Based on Convolutional Neural Network

IEEE 2020

Jinze Li; Gongbo Sun; Leiye Yi; Qian Cao; Fusen Liang; Yu Sun

Image recognition is widely used in the field of computer vision today. As a kind of image recognition, digit recognition is widely used. Today, the online recognition technology in digit recognition is relatively mature while the offline recognition technology is not. This paper mainly introduces an offline recognition system for handwritten digits based on convolutional neural networks. The system uses the MINST dataset as a training sample and pre-processes the picture with the Opencv toolkit. Then it uses LeNet-5 in the convolutional neural network to extract the handwritten digit image features, repeatedly convolution pooling, and pull the result into a one-dimensional vector. And finally find the highest probability point to determine the result to achieve handwritten digit recognition with the Softmax regression model. The application of this system can greatly reduce labor costs and improve work efficiency, which is of great significance in many fields.

4. A Comparative Study on Handwriting Digit Recognition Using Neural Networks

IEEE 2017

Mahmoud M. Abu Ghosh; Ashraf Y. Maghari

The handwritten digit recognition problem becomes one of the most famous problems in machine learning and computer vision applications. Many machine learning techniques have been employed to solve the handwritten digit recognition problem. This paper focuses on Neural Network (NN) approaches. The most three famous NN approaches are deep neural network (DNN), deep belief network (DBN) and convolutional neural network (CNN). The handwritten digit recognition problem becomes one of the most famous problems in machine learning and computer vision applications. Many machine learning techniques have been employed to solve the handwritten digit recognition problem. This paper focuses on Neural Network (NN) approaches. The most three famous NN approaches are deep neural network (DNN), deep belief network (DBN) and convolutional neural network (CNN).

5. A Robust Model for Handwritten Digit Recognition using Machine and Deep Learning Technique

IEEE 2021
Ayush Kumar Agrawal; A.K. Shrivas; Vineet kumar Awasthi

In the era of research, pattern recognition is one of the most famous and widely used area in the field of research work. There are various types of patterns are available for the researches like: audio, video, handwritten digit images and handwritten characters images etc. In this paper, we concentrate in the field of handwritten digit recognition for classification of patterns. We have used famous handwritten digit datasets named as MNIST, which is collection of 70000 images. In this research work, we have suggested CNN as deep learning technique on keras for MNIST handwritten

digit recognition and compare the performance of CNN with SVM and KNN. The proposed CNN based on keras model used to classify handwritten digit images with RMSprop optimizer for optimizing the model. The proposed CNN model achieves 99.06% of training accuracy and 98.80% of testing accuracy with epoch 10.

6. Handwritten Digit Recognition using Adaptive Neuro-Fuzzy System and Ranked Features

IEEE 2019
Savita Ahlawat; Rahul Rishi

This paper investigates Adaptive Neuro-Fuzzy Inference System (ANFIS) for recognition of handwritten digits. First, an efficient feature extraction module based on five feature extraction techniques has been performed. Second, an optimal feature selection method for feature ranking and feature reduction has been proposed. Third, a classification based on ANFIS has been done. The Experiments has been performed on standard handwritten digit dataset to evaluate the performance of the proposed system. Simulation result revels the proposed system has low testing and checking error with high recognition accuracy.

7. Segmentation and Recognition Strategy of Handwritten Connected Digits Based on the Oriented Sliding Window

IEEE 2013

Abdeljalil Gattal; Youcef Chibani

In this paper, a system to recognize handwritten digit strings, which constitutes a difficult task because of overlapping and/or joining of adjacent digits. To resolve this problem, we use a segmentation-recognition of handwritten connected digits based on the oriented sliding window. The proposed approach allows separating adjacent digits according the connection configuration by finding at the same time the interconnection points between

adjacent digits and the cutting path. The segmentation-recognition using the global decision module allows the rejection or acceptance of the processed image. Experimental results conducted on the handwritten digit database NIST SD19 show the effective use of the sliding window for segmentation-recognition.