# LITERATURE SURVEY

A Novel Method for Handwritten Digit Recognition System

## Handwritten Digit Recognition System Based on Convolutional Neural Network :

**Base paper link: https://ieeexplore.ieee.org/document/9213619**

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.

**ADVANTAGE:**

1) the system not only produces a classification of the digit but also a rich description of the instantiation parameters which can yield information such as the writing style

2) the generative models can perform recognition driven segmentation;

**Handwritten Digit Recognition Using Machine Learning:**

**Base paper link: https://ieeexplore.ieee.org/document/8976601**

The task for handwritten digit recognition has been troublesome due to various variations in writing styles. Therefore, we have tried to create a base for future researches in the area so that the researchers can overcome the existing problems. The existing methods and techniques for handwritten digit recognition were reviewed and understood to analyze the most suitable and best method for digit recognition. A number of 60,000 images were used as training sets of images with pixel size of 28×28. The images/training sets were matched with original image. It was found out after complete analysis and review that classifier ensemble system has the least error rate of just 0.32%. In this paper, review of different methods handwritten digit recognition were observed and analyzed.

**ADVANTAGE:**

1) the method involves a relatively small number of parameters and hence training is relatively easy and fast

2) unlike many other recognition schemes, it does not rely on some form of pre-normalization of input images, but can handle arbitrary scalings, translations and a limited degree of image rotation. We have demonstrated that our method of fitting models to images does not get trapped in poor local minima. The main disadvantage of the method is that it requires much more computation than more standard OCR techniques.

## Comparative Study on Handwritten Digit Recognition Classifier Using CNN and Machine Learning Algorithms:

**Base paper link: https://ieeexplore.ieee.org/document/9753756**

Digit Recognition is essential for interpreting image processing and pattern recognition since a machine cannot classify handwritten digits. Many real-time applications include OCR (Optical Character Recognition), which recognizes characters and digitizes printed texts. Converting handwritten digits to digital characters has been a challenging problem since the past. The physical documents cannot be efficiently processed without converting them to digital copies and it requires a lot of time and efforts. To provide a solution to handwritten classification, several algorithms and techniques have been proposed over the years. The objective of this research is to use Convolutional Neural Networks (CNN), K-Nearest Neighbor, and Support Vector Machine to recognize isolated handwritten digits. After implementing and training the models on the same dataset and comparing the results

obtained for three different models, the results show that CNN is the most optimal machine learning technique to classify handwritten digits with an accuracy of 99.59 percent

**MERITS & DEMERITS:**

The main advantage of an OCR is the ability to scan the characters accurately. The disadvantage of an OCR is limited number of characters offered by it.

**An Enhanced Handwritten Digit Recognition Using Convolutional Neural Network:**

**Base paper link: https://ieeexplore.ieee.org/document/9544669**

Handwritten digit recognition have great impact in the applications of deep learning. Convolutional Neural Network in the deep learning has become one of the major methods and one of the important factors in the various success in recent times and deep learning is used majorly in the area of object recognition. In the paper work, the speech output feature is integrated along with the text output. Convolutional Neural Network model is applied in the image classification. The dataset used to train and test is the MNIST dataset. There are various applications of handwritten digit recognition in the real time. It is applied in detection of vehicle number, reading of bank cheques, the arrangement of letters in the post office.

**DISADVANTAGE:**

Handwriting recognition tends to have problems when it comes to accuracy. People can struggle to read others' handwriting.

The issue is that there's a wide range of handwriting – good and bad. This makes it tricky for programmers to provide enough examples of how every character might look. Plus, sometimes, characters look very similar, making it hard for a computer to recognise accurately.

Joined-up handwriting is another challenge for computers. When your letters all connect, it makes it hard for computers to recognise individual characters. Consider, for instance, an 'r' and an 'n'. Joined up, these letters could be mistaken for an 'm'.

In the case of handwriting recognition from photos, there are also awkward angles to consider. The angle the photo is taken could obscure the character, making it harder for the computer to identify.

## REFERENCES:

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