

# **A novel method for handwritten digits recognition**

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## **1. INTRODUCTION**

### **1.1 Project Overview**

-> Machine learning and deep learning play an important role in computer technology and Artificial Intelligence. With the use of Deep Learning and Machine learning, human effort can be reduced in recognizing, learning, predictions and in many more areas.

-> Handwritten Digit Recognition is the ability of Computer systems to recognize handwritten digits from various sources, such as images, documents, and so on. This project aims to let users take advantage of machine learning to reduce manual tasks in recognizing digits.

### **1.2 Purpose**

Digit Recognition system are capable of recognizing the digits from different sources like emails, bank cheques, papers, images, etc. and in different real-world scenarios for online handwriting recognition on computer, tablets or systems, recognize number plates of vehicles, processing bank cheque amounts, numeric entries in forms filled up by hand (tax forms) and so on.

## **2. LITERATURE SURVEY**

### **2.1 Existing problem**

1. The different architectures of CNN, hybrid CNN, CNN - RNN and CNNHMM models, and domain - specific recognition system, are not thoroughly inquired and evolutionary algorithms are not clearly explored for optimizing CNN learning parameters, the number of layers, learning rate and kernel sizes of convolutional filters.
2. The fluctuation of accuracies for handwritten digits was observed for 15 epochs by varying the hidden layers. There is no clear explanation given for observing variation in the overall classification accuracy by varying the number of hidden layers and batch size.

### **3. Problem Statement Definition**

-> Handwriting recognition is one of the compelling research works going on because every individual in this world has their own style of writing. It is the capability of the computer to identify and understand handwritten digits or characters automatically.

Because of the progress in the field of science and technology, everything is being digitalized to reduce human effort.

-> Hence, there comes a need for handwritten digit recognition in many real time applications. MNIST data set is widely used for this recognition process and it has 70000 handwritten digits. We use Artificial neural networks to train these images and build a deep learning model. Web application is created where the user can upload an image of a handwritten digit. This image is analyzed by the model and the detected result is returned on to UI (User Interface).

### **4. ADVANTAGES & DISADVANTAGES**

## **Advantages**

1. Reduces manual work.
2. More accurate than average human.
3. Capable of handling a lot of data.
4. Can be used anywhere from any device.

## **Disadvantages**

1. Cannot handle complex data.
2. All the data must be in digital format.
3. Requires high performance server for faster predictions.
4. Prone to occasional errors.

## **5. CONCLUSION**

This project demonstrated a web application that uses machine learning to recognize handwritten numbers. Flask, HTML, CSS, JavaScript, and a few other technologies were used to create this project. The model predicts the handwritten digit using a CNN network. During testing, the model achieved a 99.61% recognition rate. The proposed project is scalable and can easily handle a huge number of users. Since it is a web application, it is compatible with any device that can run a browser. This project is extremely useful in real-world scenarios such as recognizing number plates of vehicles, processing bank cheque amounts, numeric entries in forms filled up by hand (tax forms) and so on. There is so much room for improvement, which can be implemented in subsequent versions.

## **6. FUTURE SCOPE**

This project is far from complete and there is a lot of room for improvement. Some of the improvements that can be made to this project are as follows:

1. Add support to detect from digits multiple images and save the results.
2. Add support to detect multiple digits.
3. Improve model to detect digits from complex images.
4. Add support to different languages to help users from all over the world.