**Team Id :** PNT2022TMID45281

Team members :

1. Partheeban K - 812119104023

2.Timple Rosni Augustina N - 812119104037

3.Kamali P - 812119104012

4.Lavanya S - 812119104301

5.Dhayathipathy B - 812119104005

**Project Name :** A Novel Method for Handwritten Digit Recognition System

# Objective :

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 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. A web application is created where the user can upload an image of a handwritten digit. this image is analysed by the model and the detected result is returned on to the UI.

**Methodology :**

Anaconda Navigator is a free and open-source distribution of the Python and R programming languages for data science and machine learning related applications. It can be installed on Windows, Linux, and macOS. Conda is an open-source, cross-platform, package management system. Anaconda comes with so very nice tools like JupyterLab, Jupyter Notebook, QtConsole, Spyder, Glueviz, Orange, Rstudio, Visual Studio Code. For this project, we will be using Jupiter notebook and spyder. TensorFlow is an end-to-end open-source platform for machine learning. It has a comprehensive, ﬂexible ecosystem of tools, libraries, and community resources that lets researchers push the state-of-the-art in ML and developers can easily build and deploy ML powered applications. Flask to build web app. Keras leverages various optimization techniques to make high level neural network API easier and more performant. It supports the following features:

* Consistent, simple and extensible API.
* Minimal structure - easy to achieve the result without any frills.
* It supports multiple platforms and backend.
* It is a user-friendly framework which runs on both CPU and GPU.
* Highly scalability of computation.

# Novelty :

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 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. Though there are some OCR and digit recognition software are available on the market, they are not widely used in the banking industry and many of them are not so accurate. Our goal is to build a digit recognition system with high accuracy.

# Problem :

Cheque transactions account for almost 2 - 3 % of the total transactions in India. Almost more than half a billion cheques are being processed each year. Manual cheque processing leads to delay in processing cheques causing customer dissatisfaction. The department of traﬃc enforcement does manual monitoring which is error prone. Integrating digit recognition tool with image processing software leads to automatically imposing penalty online for speeding, enforcing law to prevent accidents and ensure road safety.

# What would happen when it is ﬁxed :

Business Model Speed up the cheque approval process Store transaction records Social impact Ensure road safety by identifying the owner of the speeding vehicle by using the registration number of that vehicle.

# Why is it important to ﬁx this issue :

Automating these tasks removes the need for human effort which is error prone in performing these kinds of tedious works and improves speed as well as eﬃciency.

# Proposed Solution Template:

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| --- | --- | --- |
| **S.No.** | **Parameter** | **Description** |

|  |  |  |
| --- | --- | --- |
| 1. | Problem Statement (Problem to be solved) | 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 science and technology, everything is being digitized to reduce human effort. Hence, there comes a need for handwritten digit recognition in many real time applications. Most of the banks are still relying on the manual cheque processing which is both time-consuming and error prone. Handwriting recognition system with a reliable accuracy can have  an impact in these business ﬁelds. |
| 2. | Idea / Solution description | 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. We opt to use multi-layer neural networks as deep NN. Due to data is Image, the best type of neural network satisfying our goal is **Convolutional Neural Networks**. As we have to do for most of the data, normalization plays an important role in our process. Before doing any tasks, pre- processing images (our data-set) is highly recommended. Consequently better accuracy will be achieved by pre- processed data. After pre-processing and normalizing, the prepared data set could be used as input to our deep convolutional neural network. Then deep NN will be run and ﬁt to our data and the  result will be produced by that. |

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| 3. | Novelty / Uniqueness | A web application is created where the user can upload an image of a handwritten digit. this image is analysed by the model and the detected result is returned on to the UI. One of the major decisions that had to be made was choosing the suitable programming language to satisfy our goal of extracting knowledge from our data. After some searching the suitable decision has been made by selecting Python as the project programming language. Due to the fact that, a lot of tools and frameworks are available for Python to create powerful Artiﬁcial Neural Networks. Also IBM Watson helps to predict future outcomes,automate complex processes,and optimize user’s time. And also the result accuracy will be increased from 70% which is the accuracy of the test results that the previous developed  codes produced. |
| 4. | Social Impact / Customer Satisfaction | Can ensure road safety by identifying the owner of the speeding vehicle by using the registration number of that vehicle. Can automate data entry jobs and speed  up cheque approval process |
| 5. | Business Model (Revenue Model) | Can collaborate with banks to speed-up the cheque approval process, which  improves customer experience. |
| 6. | Scalability of the Solution | This project will help us to detect digits more precisely. Also we can develop this  model to recognize alphabets. |

**IBM Cloud model :**

















