

**Ideation Phase**  
**Define the Problem Statements**

Date	19 September 2022
Team ID	PNT2022TMID06900
Project Name	Project – A NOVEL METHOD FOR HANDWRITTEN DIGIT RECOGNITION
Maximum Marks	2 Marks

**PROBLEM STATEMENT:**

<b>Problem Statement (PS)</b>	<b>I am (Customer)</b>	<b>I'm trying to</b>	<b>But</b>	<b>Because</b>	<b>Which makes me feel</b>
PS-1	I am a bank employee	Add the account credentials of the customers into the database	It takes more time	Needs to be entered manually	Exhausted
PS-2	I am a bank customer	Trying to verify the credentials of the cheque	Needs to wait for long time	The bank employees need to check them manually	Frustrated

# **LITERATURE SURVEY ON HANDWRITTEN DIGIT RECOGNITION**

## **1.INTRODUCTION**

Handwritten Digit Recognition (HDR) is the process of converting images of handwritten digit into digital format. A lot of money is wasted on converting the information that is in paper to digital format.

## **2.EXISTING SOLUTIONS AND ITS DRAWBACKS**

<b>EXISTING SOLUTIONS</b>	<b>DRAWBACKS</b>
1. Ensemble neural networks that combined with ensemble decision tree	Less accuracy with accuracy rate of 84%
2. Using classifier methods in handwritten digit recognition <ul style="list-style-type: none"><li>• Baseline Linear Classifier</li><li>• LeNet 1</li><li>• Le Net 4</li><li>• Large fully connected multi network</li></ul>	Much complex networks with high computation time with accuracy rates <ul style="list-style-type: none"><li>• 92.2%</li><li>• 98.3%</li><li>• 98.9%</li><li>• 98.4%</li></ul>
3. Digit recognition using single layer neural Network with principal component analysis	<ul style="list-style-type: none"><li>• Consumes more training time</li><li>• Accuracy rate - 98.39%</li></ul>
4. Recognition using Simple Neural network and back propagation	<ul style="list-style-type: none"><li>• Higher processor required</li><li>• High cost</li><li>• Time consuming</li><li>• Accuracy rate - 99.1</li></ul>

In addition to this systems,

KNN and SVM predict all the classes of dataset correctly with 99.26% accuracy but the thing process goes little complicated with MLP when it was having trouble classifying number 9.

## **3.SOLUTION TO OVERCOME EXISTING DRAWBACKS**

- Convolutional Neural Networking (CNN) is being used in many fields like object detection, face recognition, spam detection, image classification.
- Many algorithms have been developed for hand written digit recognition. But due to infinite variation in writing styles they are still not up to mark.
- Poor contrast, image text vagueness, disrupted text stroke, unwanted objects, deformation, disoriented patterns and also inter-class and intra-class similarity also cause mis-classification in handwritten numeral recognition system.

- The drawbacks of the existing systems can be overcome by using **CNN algorithm for training on the Modified National Institute of Standards and Technology (MNIST) dataset using OpenCV, a machine learning library written in python** can provide an accuracy rate of **99.63%**.

#### **4.APPLICATIONS:**

Various fields such as post mail sorting system where scanned images of mail envelopes are made into queue and extract the section describing postcode to be delivered. With the help of digit recognizer, sorting of mails can be done based on these postcodes according to their region. This handwritten digit recognition system can be able to recognize the digit present in the post mail.

#### **5.CONCLUSION**

Convolutional Neural Network gets trained from the real-time data and makes the model very simple by reducing the number of variables and gives relevant accuracy. A comparison on different Machine Learning algorithms like Random Forest Classifier, Convolutional Neural Network, Linear Regression, K-Nearest Neighbors, Support vector machine is done, in which the accuracy for CNN is 99.63%.

#### **6.REFERENCES**

1. L. Bottou, C. Cortes, "Comparison of Classifier methods a case study in handwritten digit recognition", Pattern Recognition, 1994. Vol. 2 Conference B; Image Processing, Proceedings of the 12th IAPR International. Conference IEEE, 06 August 2002.
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