**Phase-1 Submission**

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**Institution:** PPG Institute of Technology

**Department:** B.Tech Information Technology

**Date of Submission:**27.04.2025

# 1. Problem Statement

*Handwritten digit recognition is a fundamental challenge in computer vision, with applications spanning automated data entry, banking, postal services, and digital education tools. The variability in human handwritinen.such as differences in style, size, and orientation.makes it a challenging problem for traditional machine learning methods. This project aims to develop an accurate and efficient system for recognizing handwritten digits using deep learning techniques, particularly Convolutional Neural Networks (CNNs). By training the model on labeled image datasets, the system will learn to identify and classify digits from 0 to 9 with high accuracy, even when faced with diverse handwriting styles.*

**2. Objectives of the Project**

*To design and implement a deep learning model for recognizing handwritten digits.*

*To evaluate the performance of the model using standard metrics such as accuracy, precision, recall, and F1-score.*

**3. Scope of the Project**

*Implementing a CNN-based model for handwritten digit recognition.*

*Analyzing the impact of data augmentation techniques on model performance.*

*Deploying the model as a web application for real-time digit recognition.*

*Limitations:*

*The model will be trained on a fixed dataset and may not generalize well to unseen handwriting styles.*

*Real-time performance may vary depending on the computational resources available.*

**4. Data Sources**

**Source:**

* Kaggle : <https://www.kaggle.com/datasets/oddrationale/mnist-in-csv>
* Yann LeCun’s official site : <http://yann.lecun.com/exdb/mnist/>
* UCI Machine Learning Repository : <https://archive.ics.uci.edu/ml/datasets/mnist+handwritten+digit>

**Nature :** Public dataset

**Type :** Static (downloaded onces , not updated in real – time)

**5. High-Level Methodology**

* **Data Collection:**

*The MNIST dataset will be downloaded from the official website or accessed via libraries such as TensorFlow or Keras.*

* **Data Cleaning**:

*The dataset is preprocessed to ensure uniformity in image size and format. No missing values or duplicates are present.*

* **Exploratory Data Analysis (EDA):**

*Visualizations such as histograms and sample images will be used to understand the distribution and characteristics of the dataset.*

* **Feature Engineering:**

*Data augmentation techniques like rotation, scaling, and translation will be applied to increase the diversity of the training data*

**6. Tools and Technologies**

* **Programming Language:***Python*
* **Notebook/IDE:***Google Colab or Jupyter Notebook*

** Libraries:***Data Processing: pandas, numpy*

* + *Visualization: matplotlib, seaborn*
  + *Machine Learning: TensorFlow, Keras, scikit-learn*
  + *Deployment: Flask, Streamlit*
* **Data Processing:**pandas, numpy
* **Visualization***: matplotlib, seaborn*
* **Machine Learning:***TensorFlow, Keras, scikit-learn*
* **Deployment***:Flask, Streamlit*
* **Optional Tools for Deployment***:Docker for containerization, Heroku for cloud deployment*

**7. Team Members and Roles**

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| **S.NO** | **NAME** | **ROLE** |
| 1. | DHANYA A | *Project Lead, Model Development & Evaluation* |
| 2. | VINOTHINI P | *Data Collection & Cleaning* |
| 3. | SRINATH M | *Exploratory Data Analysis & Visualization* |
| 4. | SRIKANTH M | *Feature Engineering & Model Tuning* |
| 5. | SARAN SELVAN P | *Dashboard Design* |