

Recognizing Handwritten Digits with Machine Learning

2. Dataset Acquisition : MNIST dataset.

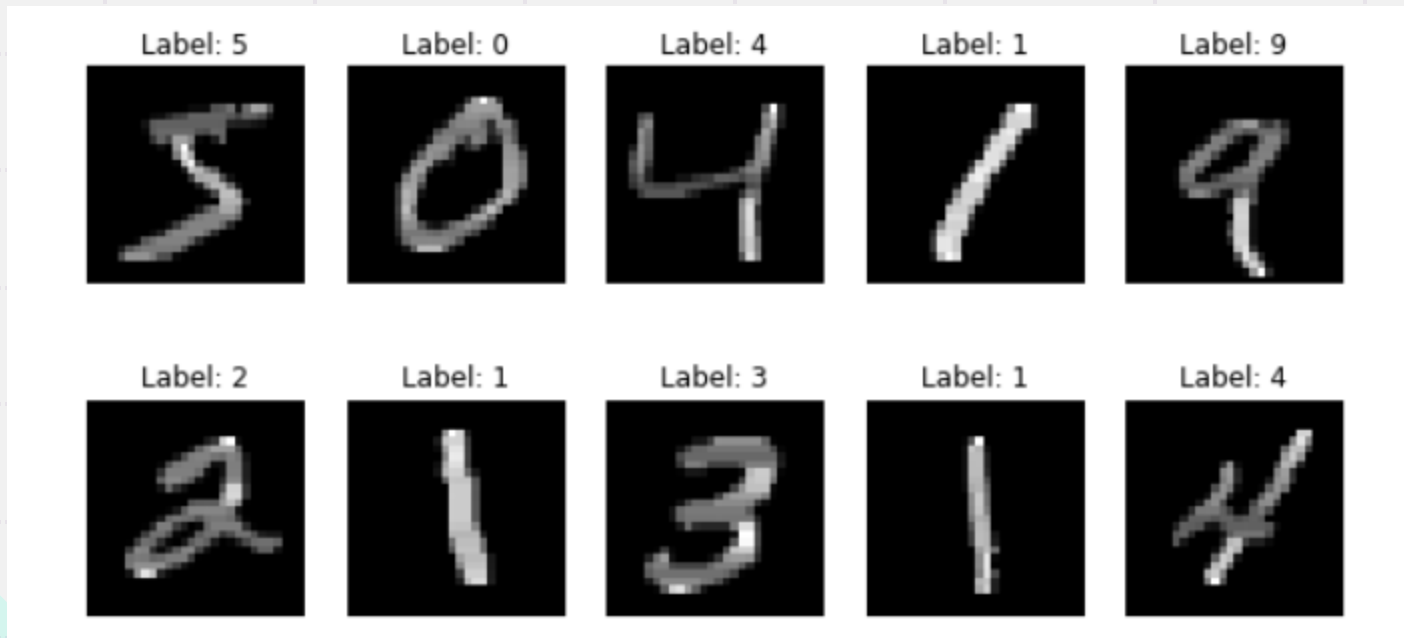
- MNIST dataset includes handwritten digits total of 70,000 images
- 60,000 examples in training set and
- 10,000 examples in testing set,
- both with labeled images from 10 digits (0 to 9).
- Handwritten digits are images in the form of $28 * 28$ gray scale

• 3. Dataset Preprocessing:

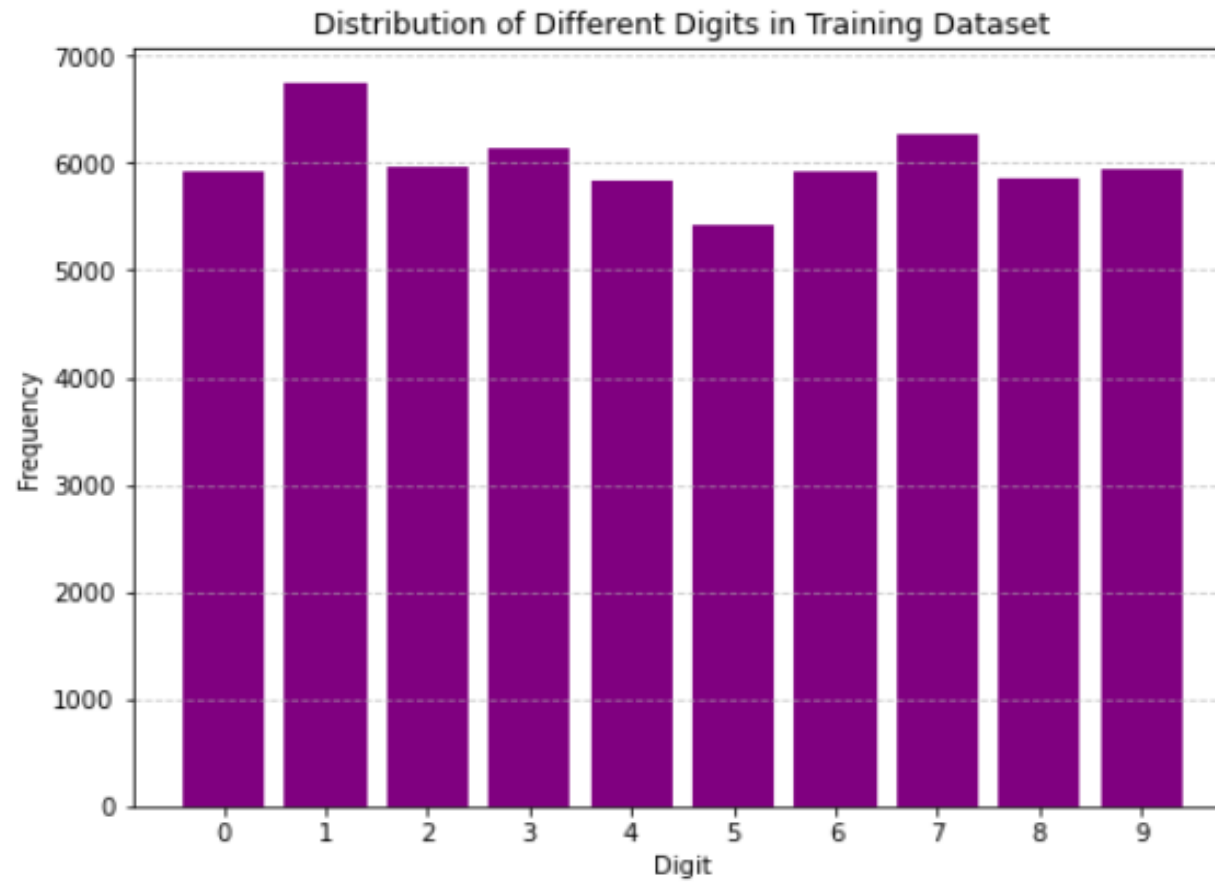
- 1- Normalizing pixel values.
- 2- Reshaping images.
- 3- Encoding labels using one-hot encoding

4. Exploratory Data Analysis (EDA)

1- Visualizing sample images from the dataset using matplotlib.

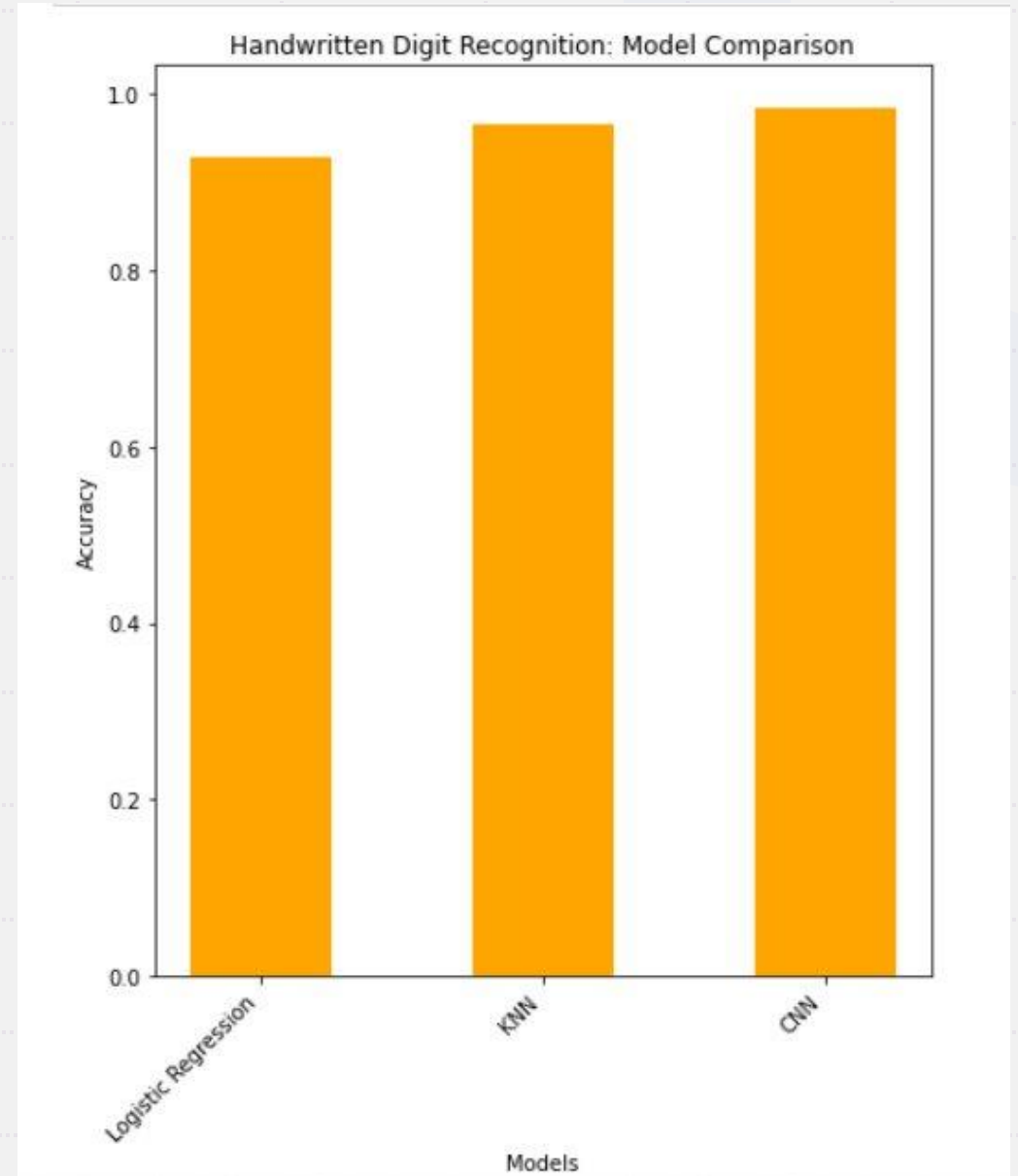


2- Exploring the distribution of different digit classes.



5. Model Selection and Training :

- Logistic Regression with **accuracy = 92%**
- k-Nearest Neighbors.(KNN) with **accuracy = 97%**
- Convolutional Neural Networks (CNN) with **accuracy = 98%**



6. What we learn:

1 - Model Performance: The CNN outperformed both Logistic Regression and KNN in terms of accuracy and precision-recall metrics. This suggests that for complex tasks like handwritten digit recognition, more advanced models like CNNs are highly effective.

2 - Pattern Recognition: CNNs are specifically designed for image recognition tasks and excel at identifying complex patterns and features within images, which is evident from the superior performance