**Handwritten Digit Recognition using Machine Learning and Deep Learning**

**Overview**

Handwritten Digit Recognition is a fundamental problem in the field of computer vision and pattern recognition. This project aims to classify handwritten digits (0-9) using various machine learning and deep learning algorithms. The project includes implementations of K Nearest Neighbors (KNN), Support Vector Machines (SVM), Random Forest Classifier (RFC), and Convolutional Neural Networks (CNN) for accurate digit classification.

**Requirements**

Python 3.5 or higher

Scikit-Learn (latest version)

NumPy (+ mkl for Windows)

Matplotlib

TensorFlow (for CNN implementation)

Theano (for CNN implementation)

**DATASET**

The MNIST dataset is used for training and testing the models. You can download the dataset from the following links:

MNIST Training Dataset

MNIST Training Labels

MNIST Test Dataset

MNIST Test Labels

Alternatively, download the dataset from here and place the files in the respective folders.

**USAGE**

Setup MNIST Dataset:

Download and place the MNIST dataset files in the appropriate folders as instructed in the project's README.

**Navigate to Algorithm Directory:**

Open a command prompt and navigate to the directory of the algorithm you want to run (e.g., KNN, SVM, RFC, CNN).

Run Python File:

Execute the Python file for the chosen algorithm. For example:

Copy code

python knn.py

View Results:

The results will be logged into the "summary.log" file. You can also modify the code to print the results directly on the command prompt.

CNN Model Saving/Loading:

For the CNN model, you can save and load model weights using command-line arguments. Follow the provided instructions in the README.

Results

Machine Learning Algorithms:

K Nearest Neighbors: 96.67%

Support Vector Machines (SVM): 97.91%

Random Forest Classifier (RFC): 96.82%

Deep Learning Algorithms:

Three Layer Convolutional Neural Network (TensorFlow): 99.70%

Three Layer Convolutional Neural Network (Keras with Theano): 98.75%

Video Link

Watch the demonstration video on YouTube: Handwritten Digit Recognition Video

Test Images Classification Output

Output Image

This project demonstrates the effectiveness of machine learning and deep learning techniques in accurately classifying handwritten digits, showcasing high accuracy rates achieved through different algorithms.