





HandWritten Digit Recognizer

This is a simple yet powerful web app built using **Streamlit** and **TensorFlow**. It allows users to draw a digit (0–9) on a canvas and uses a **Convolutional Neural Network (CNN)** model trained on the **MNIST dataset** to recognize the digit.

Features

-  Draw digits on a canvas (white on black)
-  Real-time digit prediction using a CNN model
-  Visualization of the preprocessed input
-  Built using TensorFlow, OpenCV, and Streamlit

Tech Stack

Component	Technology Used
Backend	Python, TensorFlow
Frontend	Streamlit, Canvas plugin
Image Processing	OpenCV
Model Input	Grayscale 28x28 images

How It Works

1. **User draws** a digit on the canvas.
2. The canvas image is **converted to grayscale**, resized to **28x28**, and **inverted** to match the MNIST format.
3. The processed image is passed to a **CNN model trained on MNIST**.
4. The **predicted digit** is displayed with confidence.

Setup Instructions

Clone the repository:

```
git clone https://github.com/jhanani14/Handwritten_Digit_Recognition-MNIST-.git
```

```
cd mnist-digit-recognizer
```

Create and activate a virtual environment (optional but recommended):

```
python -m venv venv  
venv\Scripts\activate # On Windows
```

Install dependencies:

```
pip install -r requirements.txt
```

Train the model (if mnist_cnn_model.h5 is not already included):

```
python train_model.py
```

Run the Streamlit app:

```
streamlit run app.py
```

Project Structure

```
mnist-digit-recognizer/
```

```
|
```

```
|— app.py          # Main Streamlit app
```

```
|— train_model.py  # CNN model training code
```

```
|— mnist_cnn_model.h5  # Trained Keras model (optional)
```

```
|— requirements.txt   # List of Python dependencies
```

```
|— README.md
```

Model Overview

- **Input:** 28x28 grayscale image

- **Architecture:** 2 Conv layers → Flatten → Dense → Output(10 classes)
- **Dataset:** MNIST handwritten digits
- **Accuracy:** ~99%

Requirements

streamlit

tensorflow

opencv-python

streamlit-drawable-canvas

numpy

Future Improvements

- Add voice output of prediction
- Add bar chart showing prediction confidence
- Deploy on Streamlit Cloud
- Allow drawing multiple digits and segmenting