

Ex No: 4 Date: 28-08-2024	Handwritten digit recognition using CNN
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Objective:

To build a Convolutional Neural Network (CNN) classifier to recognize handwritten digits using the MNIST dataset.

Descriptions:

Handwritten digit recognition is a multiclass classification problem where the goal is to classify an input image of a digit into one of 10 categories (0 through 9). A Convolutional Neural Network (CNN) is a deep learning algorithm specifically designed for image processing tasks like this, where the input is an image, and the output is a predicted digit class.

The CNN architecture leverages convolutional layers to automatically learn spatial hierarchies of features from the images. Unlike traditional machine learning models, CNNs require minimal preprocessing, as they can learn to detect features directly from raw pixel data.

In this exercise, we will use the MNIST dataset, which consists of 28x28 grayscale images of handwritten digits. Each image corresponds to a digit label (0-9). The CNN model will take these images as input and predict the corresponding digit.

Model:

Model: "sequential_1"		
Layer (type)	Output Shape	Param #
conv2d_2 (Conv2D)	(None, 28, 28, 32)	320
conv2d_3 (Conv2D)	(None, 28, 28, 64)	18,496
max_pooling2d_1 (MaxPooling2D)	(None, 14, 14, 64)	0
dropout_2 (Dropout)	(None, 14, 14, 64)	0
flatten_1 (Flatten)	(None, 9216)	0
dense_2 (Dense)	(None, 256)	2,359,552
dropout_3 (Dropout)	(None, 256)	0
dense_3 (Dense)	(None, 10)	2,570
Total params: 2,742,016 (27.25 MB)		
Trainable params: 2,380,096 (23.08 MB)		
Non-trainable params: 0 (0.00 B)		
Optimizer params: 8,761,078 (83.17 MB)		

Layers:

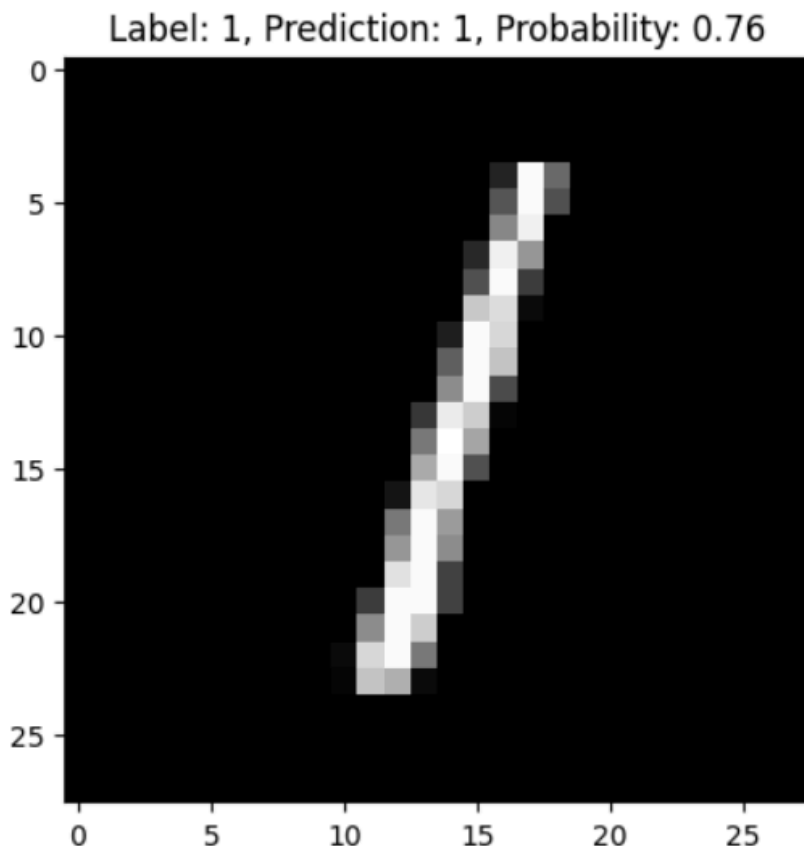
- First Layer: A convolutional layer with 32 filters to detect patterns in the image. It takes in the image shape.
- Second Layer: Another convolutional layer with 64 filters to detect more complex patterns.
- Pooling Layer: This layer reduces the image size, making the model faster.
- Dropout Layer: Drops out 25% of the neurons to avoid overfitting (when the model performs well on training data but poorly on new data).
- Flatten Layer: Converts the image data into a 1D vector to pass it to the next layers.
- Dense Layer: A fully connected layer with 256 neurons to further process the image.
- Dropout Layer: Drops 50% of neurons to prevent overfitting.
- Output Layer: A layer with 10 neurons, one for each digit (0-9). It uses softmax to give probabilities for each digit.

Model Compilation:

- The model uses a cross-entropy loss function, which is common for classification.
- The optimizer is Adadelta, which helps the model learn.
- The performance is measured by accuracy.

Results:

The model achieved an accuracy of 84.06% on the Handwritten Digits Recognition task.



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GitHub

Link:<https://github.com/Srikrishna-RVU/DeepLearn/blob/main/DL4/DL4.ipynb>