



Practical NO:-7.

Title:- Classifying MNIST dataset using CNN


Theory:-

The MNIST (Modified National Institute of Standards and Technology) dataset is one of the most popular datasets used for image classification and computer vision. It contains 60,000 training images and 10,000 testing images of handwritten digits ranging from 0 to 9. Each image is of size 28×28 pixels and is stored in grayscale format.

A convolutional Neural Network (CNN) is a deep learning algorithm specially designed for processing data that has a grid-like topology, such as images. CNNs are widely used in tasks like image recognition, face detection, and handwriting analysis due to their high accuracy and efficiency.

CNN architecture typically includes.

- (1) Input layer
Takes the raw pixel values of the image as input.
- (2) Convolutional layer.
Applies multiple ~~layer~~ filters (kernels) to extract features such as edges, corners, textures, etc.
- (3) Activation function.
Applies non-linear transformation to introduce non-linearity, which helps the model to learn complex patterns.
- (4) Pooling layer (max Pooling):
Reduces the spatial dimensions of the feature maps & keeps the most significant information, which reduces overfitting and improves computational efficiency.
- (5) Flatten layer.
Converts the 2D feature maps into a 1D feature vector for the fully connected layers.
- (6) Fully connected layer (Dense):
Performs classification based on the features



extracted from previous layers.

- Output layer (softmax):
Outputs a probability distribution over the 10 classes (digit 0-9), and the class with the highest probability is chosen as the prediction.

Training process.

The CNN model is trained using a large number of labeled images from the MNIST dataset. During training, the model adjusts its weights using the backpropagation algorithm and an optimizer like Adam or SGD.

Conclusion:-

The experiment successfully demonstrated the use of a CNN for classifying handwritten digits using the MNIST dataset.