

# Handwritten Digit Recognition using ANN and CNN

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# Overview

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# Problem Statement

- Task: Automatically classify images of handwritten digits (0-9).
- Dataset: MNIST (60,000 training and 10,000 test images).
- Goal: Compare the performance of ANN and CNN.

# Why This Project?

- Classic deep learning problem.
- Excellent for understanding image classification.
- Provides a hands-on introduction to neural networks.

- Normalization: Convert pixel values from 0–255 to 0–1.
- One-hot encoding of labels.
- ANN: Flatten 28x28 image into 784 input nodes.
- CNN: Keep 2D shape (28x28x1) for spatial features.

## ANN Model:

- Dense (128)  $\rightarrow$  Dense (64)  $\rightarrow$  Output (10 softmax)

## CNN Model:

- Conv2D (32)  $\rightarrow$  MaxPool  $\rightarrow$  Conv2D (64)  $\rightarrow$  MaxPool  $\rightarrow$  Dense (128)  $\rightarrow$  Dropout  $\rightarrow$  Output

# Training Configuration

- Optimizer: Adam
- Loss: Categorical Crossentropy
- Epochs: 10
- Batch Size: 64
- Validation split: 20%

# Training Accuracy (ANN)

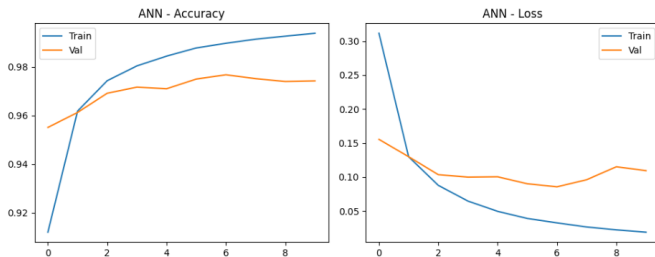


Figure: Training and validation accuracy and loss (ANN)



# Training Accuracy (CNN)

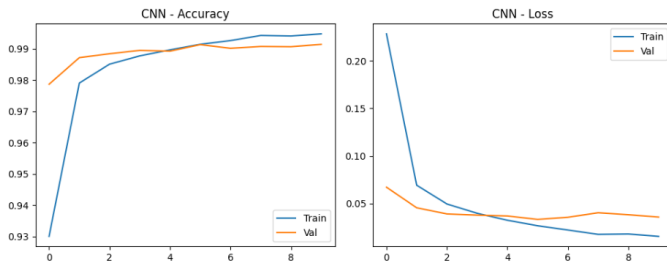
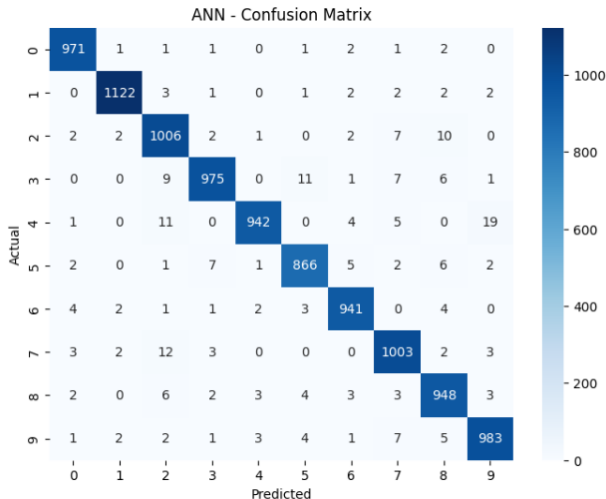
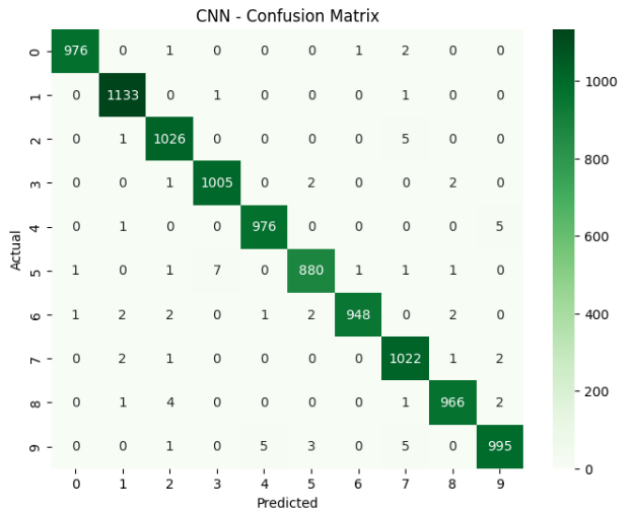


Figure: Training and validation accuracy and loss (CNN)

# Confusion Matrix (ANN)



# Confusion Matrix (CNN)



# Test Accuracy

<b>Model</b>	<b>Accuracy</b>
ANN	<b>0.98</b>
CNN	<b>0.99</b>

# Results Summary

- CNN slightly outperformed ANN on image data.
- CNN captures spatial structure effectively.
- ANN is simpler and faster but less accurate.

Thank you!