: RA2311047010016

S.No.	Date	Title	Signature
1	07.08.2025	Exploring the Deep learning platforms	
2.	07.08.2025	Implement a classifier using open source dataset	7/8/25
3.	14.08.2025	Study of classifiers with respect to Statistical parameters	14/8/25
4.	22.08.2025	To build and train a simple feed forward Network (~~FFNN~~) on MNIST dataset.	23/8/25
5.	22.8.25	Study different activation function used in NN	6/9/25
6.	9.9.25	Implement Gradient Descent & Backpropagation in ~~ANN~~ NN.	
7.	16.09.2025	Build a CNN model to classify Cat and dog image	23/9/25

22.05.2025

Lab-4

Aim: To Build and train a Simple feed forward Network (FFNN) on the MNIST dataset.

objective

→ Train a feedforward neural network to classify MNIST handwritten digits (0-9).

→ Input 28x28 grayscale images; Output: digit class (0-9)

→ Goal: Minimize classification error

Pseudocode:

→ Initialize network with input, hidden, and output layers.

→ Load and preprocess MNIST dataset.

→ For each training epoch:

→ For each batch:

→ Forward pass → predict outputs

→ Compute loss.

→ Backpropagate and update weights.

→ Evaluate model on test set.

→ Report test accuracy.

Observations:

→ Model achieves ~ 90-95% accuracy on MNIST.

→ Training loss decreases with epochs.

→ Simple feedforward networks work reasonably well but CNNs perform better.

→ ReLU activations and data normalization aid training.

Training:

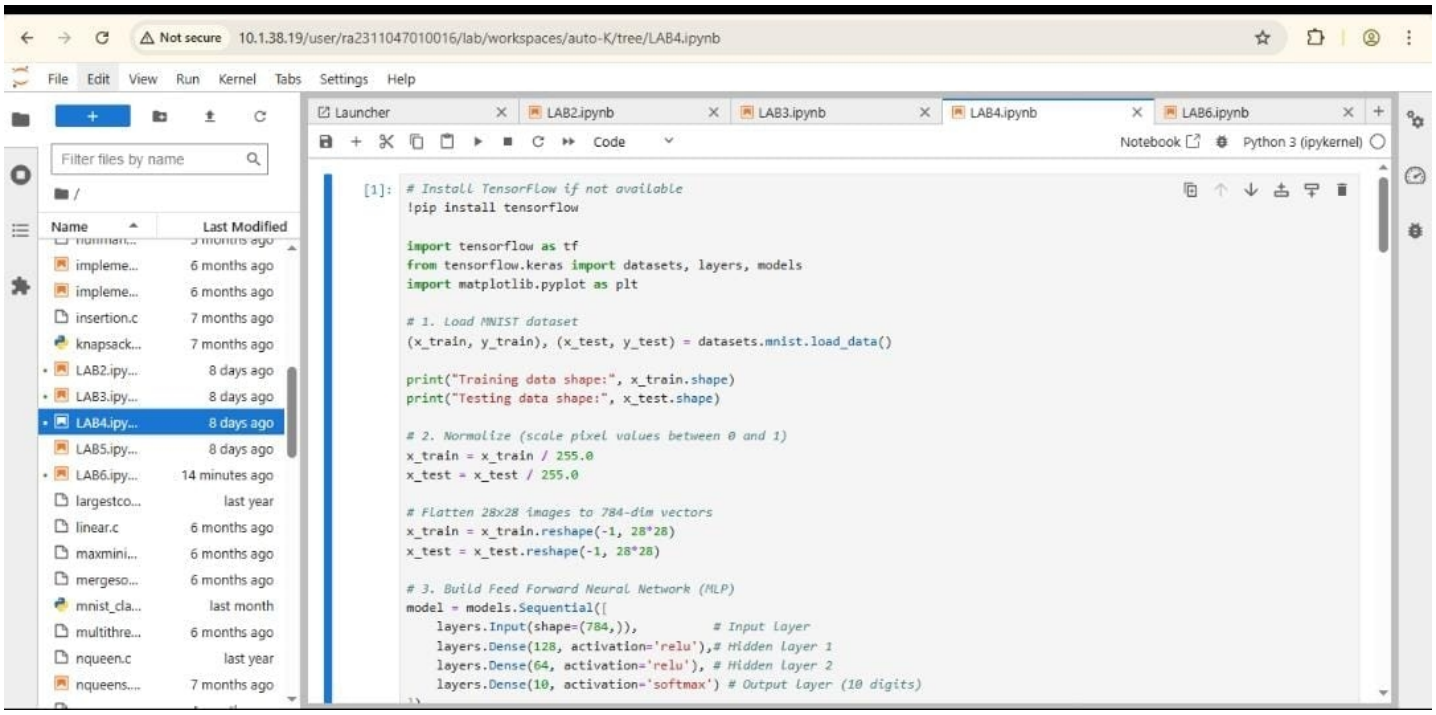
Epoch	Accuracy	Loss
1. 0.9929	0.9929	0.0232
2.	0.9968	0.0128
3.	0.9976	0.0091
4.	0.9976	0.0088
5.	0.9987	0.0058

Result:

Successfully implemented MNIST.

dataset which achieves 95% accuracy.

22/8/25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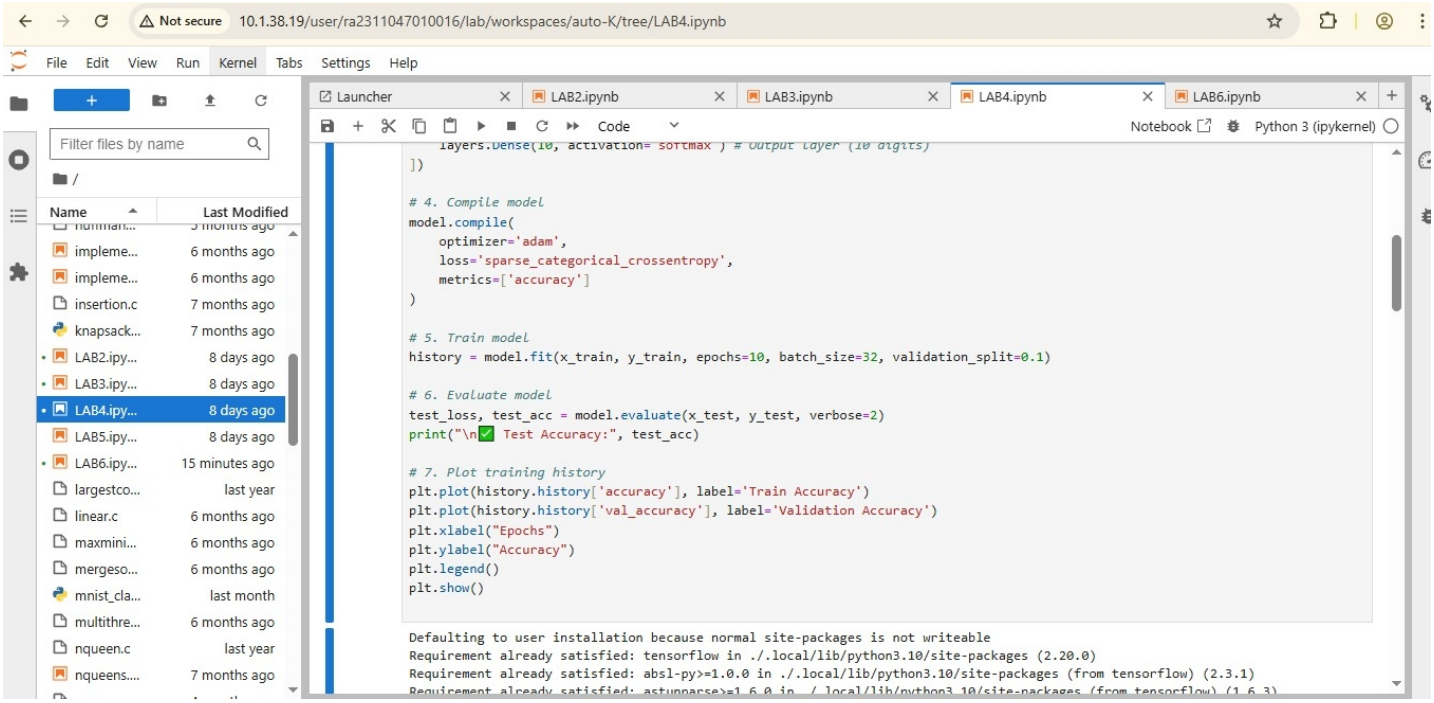
[1]:
Install Tensorflow if not available
!pip install tensorflow
import tensorflow as tf
from tensorflow.keras import datasets, layers, models
import matplotlib.pyplot as plt
# 1. Load MNIST dataset
(x_train, y_train), (x_test, y_test) = datasets.mnist.load_data()
print("Training data shape:", x_train.shape)
print("Testing data shape:", x_test.shape)
# 2. Normalize (scale pixel values between 0 and 1)
x_train = x_train / 255.0
x_test = x_test / 255.0
# Flatten 28x28 images to 784-dim vectors
x_train = x_train.reshape(-1, 28*28)
x_test = x_test.reshape(-1, 28*28)
# 3. Build Feed Forward Neural Network (MLP)
model = models.Sequential([
layers.Input(shape=(784,)), # Input layer
layers.Dense(128, activation='relu'),# Hidden layer 1
layers.Dense(64, activation='relu'), # Hidden layer 2
layers.Dense(10, activation='softmax') # Output layer (10 digits)
])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nqueens.... 7 months ago
layers.Dense(10, activation='softmax') # Output layer (10 digits)
])
4. Compile model
model.compile(
optimizer='adam',
loss='sparse_categorical_crossentropy',
metrics=['accuracy']
)
# 5. Train model
history = model.fit(x_train, y_train, epochs=10, batch_size=32, validation_split=0.1)
# 6. Evaluate model
test_loss, test_acc = model.evaluate(x_test, y_test, verbose=2)
print("\n✅ Test Accuracy:", test_acc)
# 7. Plot training history
plt.plot(history.history['accuracy'], label='Train Accuracy')
plt.plot(history.history['val_accuracy'], label='Validation Accuracy')
plt.xlabel("Epochs")
plt.ylabel("Accuracy")
plt.legend()
plt.show()
Defaulting to user installation because normal site-packages is not writeable
Requirement already satisfied: tensorflow in ./.local/lib/python3.10/site-packages (2.20.0)
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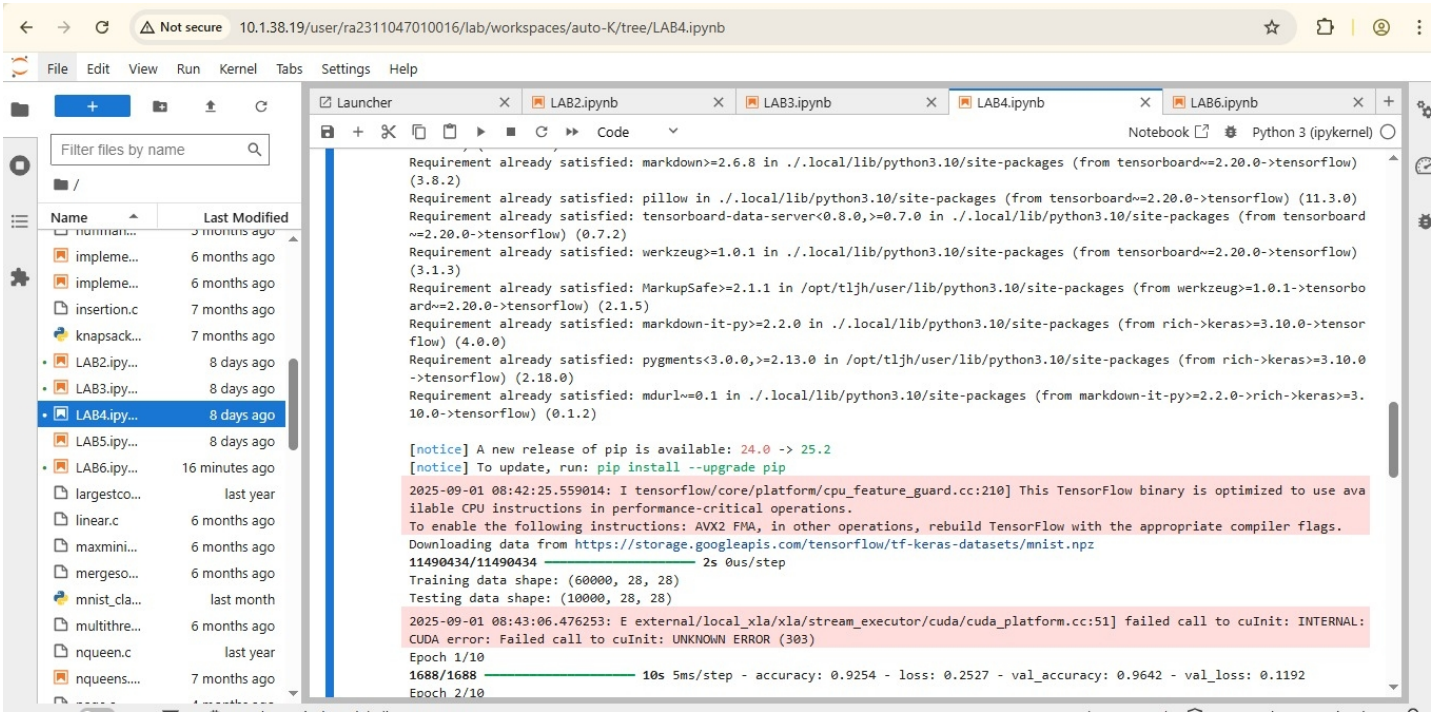
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[notice] A new release of pip is available: 24.0 -> 25.2
[notice] To update, run: pip install --upgrade pip
2025-09-01 08:42:25.559014: I tensorflow/core/platform/cpu_feature_guard.cc:210] This TensorFlow binary is optimized to use available CPU instructions in performance-critical operations.
To enable the following instructions: AVX2 FMA, in other operations, rebuild TensorFlow with the appropriate compiler flags.
Downloading data from https://storage.googleapis.com/tensorflow/tf-keras-datasets/mnist.npz
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Training data shape: (60000, 28, 28)
Testing data shape: (10000, 28, 28)
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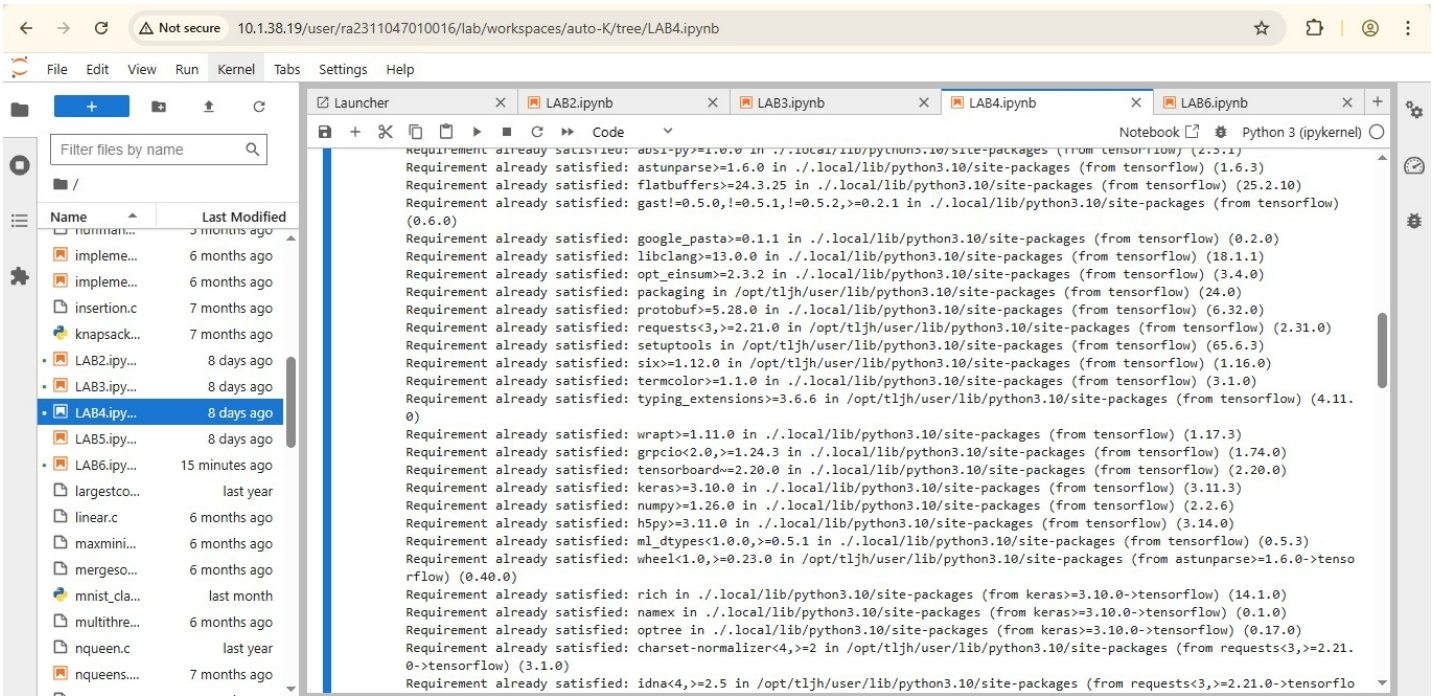
Epoch 1/10
1688/1688 10s 5ms/step - accuracy: 0.9254 - loss: 0.2527 - val_accuracy: 0.9642 - val_loss: 0.1192
Epoch 2/10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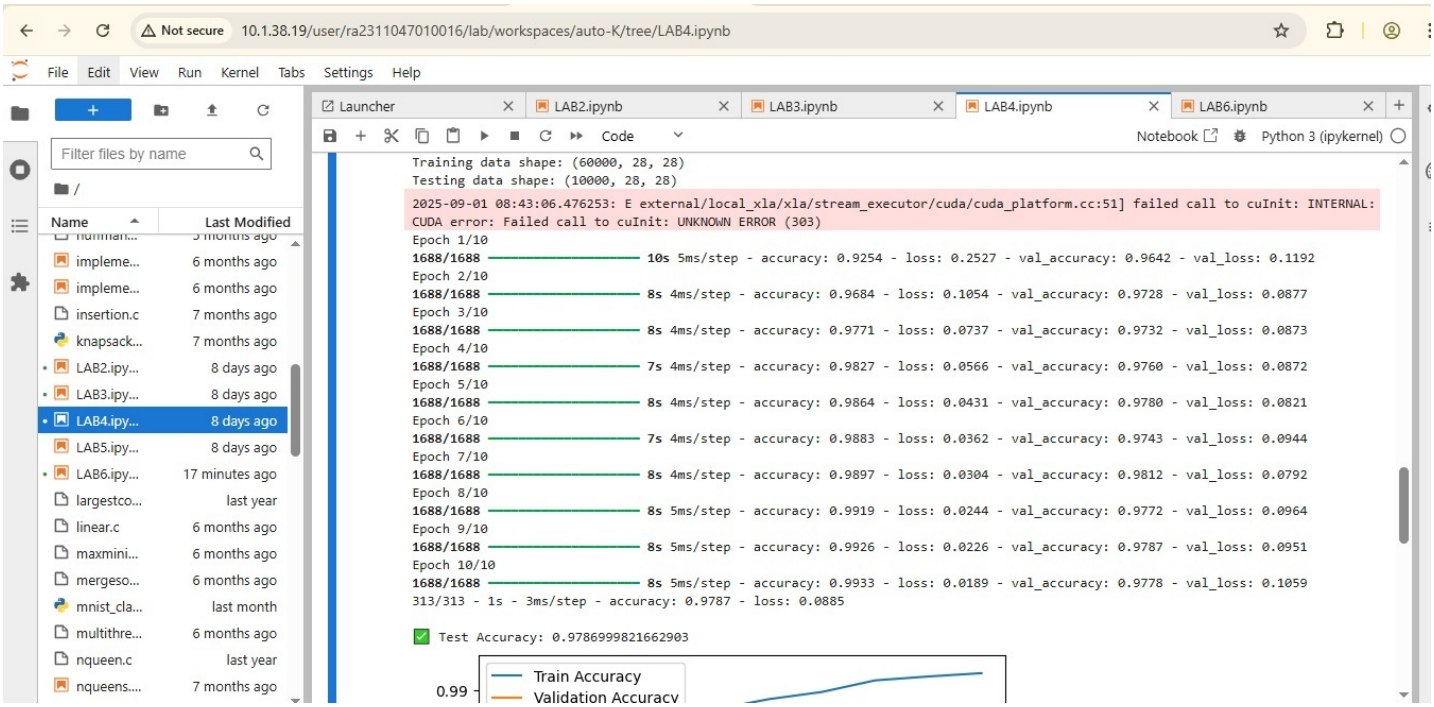
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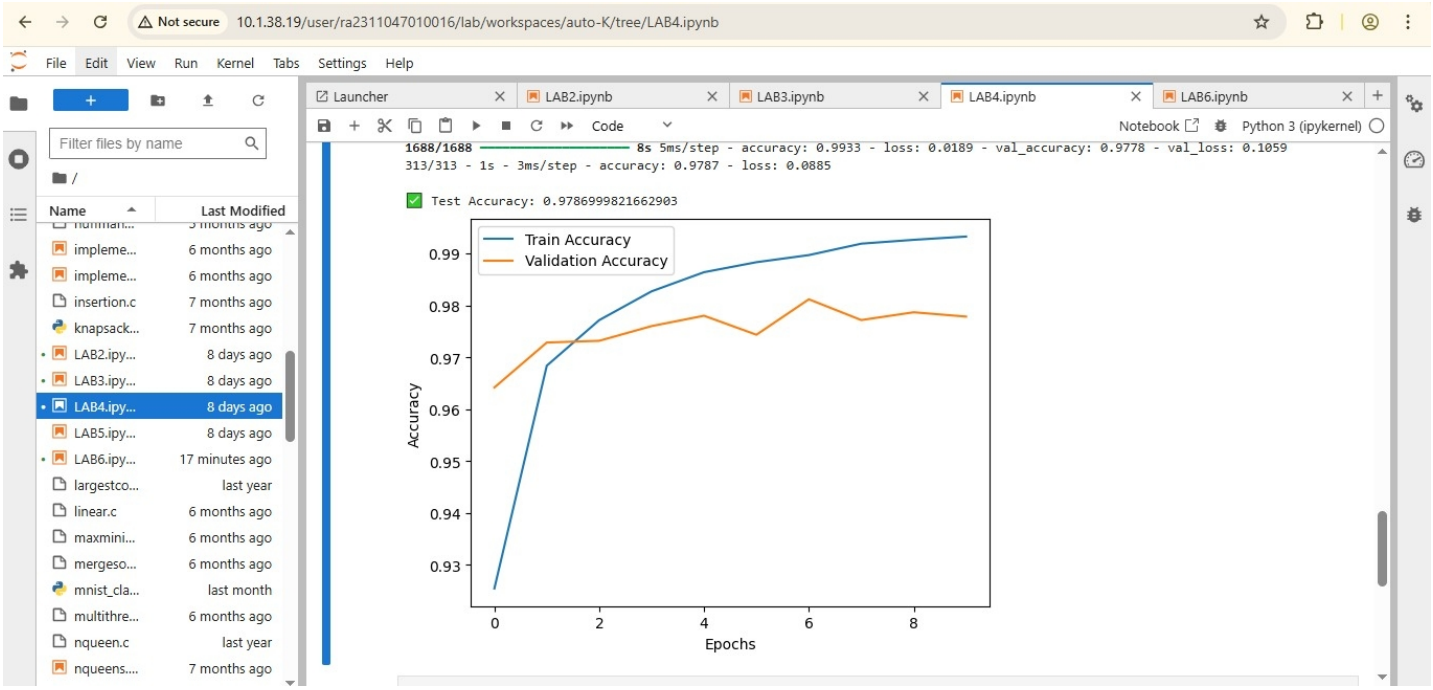
Epoch 2/10
1688/1688 8s 4ms/step - accuracy: 0.9684 - loss: 0.1054 - val_accuracy: 0.9728 - val_loss: 0.0877
Epoch 3/10
1688/1688 8s 4ms/step - accuracy: 0.9771 - loss: 0.0737 - val_accuracy: 0.9732 - val_loss: 0.0873
Epoch 4/10
1688/1688 7s 4ms/step - accuracy: 0.9827 - loss: 0.0566 - val_accuracy: 0.9760 - val_loss: 0.0872
Epoch 5/10
1688/1688 8s 4ms/step - accuracy: 0.9864 - loss: 0.0431 - val_accuracy: 0.9780 - val_loss: 0.0821
Epoch 6/10
1688/1688 7s 4ms/step - accuracy: 0.9883 - loss: 0.0362 - val_accuracy: 0.9743 - val_loss: 0.0944
Epoch 7/10
1688/1688 8s 4ms/step - accuracy: 0.9897 - loss: 0.0304 - val_accuracy: 0.9812 - val_loss: 0.0792
Epoch 8/10
1688/1688 8s 5ms/step - accuracy: 0.9919 - loss: 0.0244 - val_accuracy: 0.9772 - val_loss: 0.0964
Epoch 9/10
1688/1688 8s 5ms/step - accuracy: 0.9926 - loss: 0.0226 - val_accuracy: 0.9787 - val_loss: 0.0951
Epoch 10/10
1688/1688 8s 5ms/step - accuracy: 0.9933 - loss: 0.0189 - val_accuracy: 0.9778 - val_loss: 0.1059
313/313 - 1s - 3ms/step - accuracy: 0.9787 - loss: 0.0885
Test Accuracy: 0.9786999821662903
0.99
Train Accuracy
Validation Accuracy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