

University of Tripoli Faculty of Engineering

EEE 569: Introduction to deep learning

Assignment 1 Part (C)

Reem Ben Guma

Introduction:

This part of the homework focuses on leveraging deep learning techniques with the MNIST dataset. It involves building, experimenting with, and comparing models based on fully connected neural networks and convolutional neural networks to understand their design and performance.

Task 1- Full MNIST:

load the full high-resolution MNIST dataset. Modify the code to train a Multilayer Perceptron (MLP) on this dataset. Aim to achieve optimal performance by adjusting hyperparameters such as network depth and activation functions. Document all your experiments and results.

Model 1:

Architecture:

- Dense(image_height* image_width, 128)
- ReLU,
- Dense (128, 10),
- SoftMax,
- CE

Weights initialization: Xavier

Learning rate: 0.0001

Batch size: 4

Epochs: 50

Accuracy: 91.63%

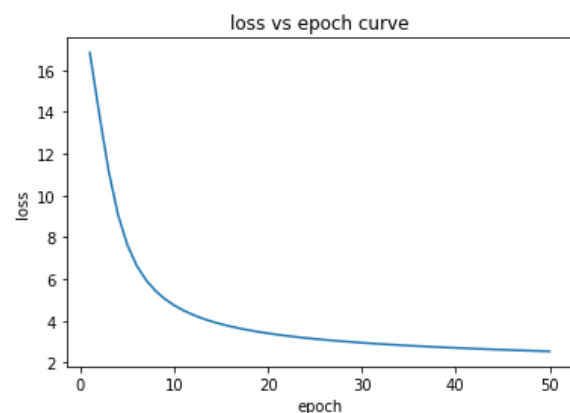


Figure 1: Training loss curve for Model 1.

Model 2:

Architecture:

- Dense(image_height* image_width, 256)
- ReLU,
- Dense (256, 64),
- ReLU,
- Dense (64, 32),
- ReLU,
- Dense (32, 10),
- SoftMax,
- CE

Weights initialization: Xavier

Learning rate: 0.00005

Batch size: 16

Epochs: 50

Accuracy: 86.63%

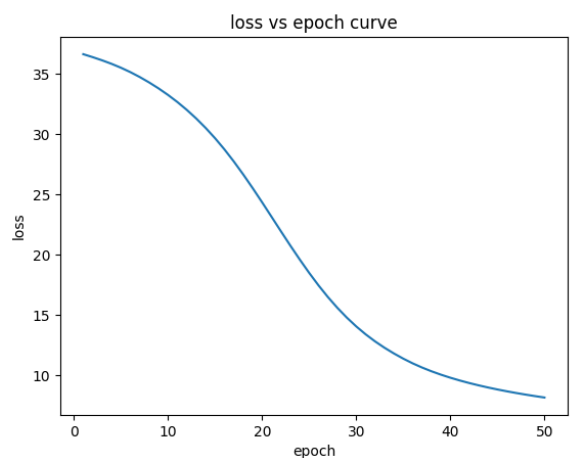


Figure 2: Training loss curve for Model 2.

Model 3:

Architecture:

- Dense(image_height* image_width, 512)
- ReLU,
- Dense (512, 256),
- ReLU,
- Dense (256, 128),
- ReLU,
- Dense (128, 10),
- SoftMax,
- CE

Weights initialization: Xavier

Learning rate: 0.0001

Batch size: 8

Epochs: 50

Accuracy: 93.67%

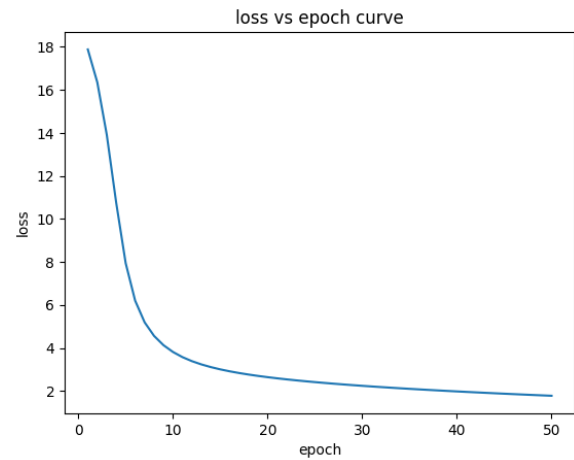


Figure 3: Training loss curve for Model 3.

Model 4:

Architecture:

- Dense(image_height* image_width, 512)
- ReLU,
- Dense (512, 256),
- ReLU
- Dense (256, 128),
- ReLU,
- Dense (128, 64),
- ReLU,
- Dense (64, 10),
- SoftMax,
- CE

Weights initialization: Xavier

Learning rate: 0.001

Batch size: 32

Epochs: 20

Accuracy: 93.97%

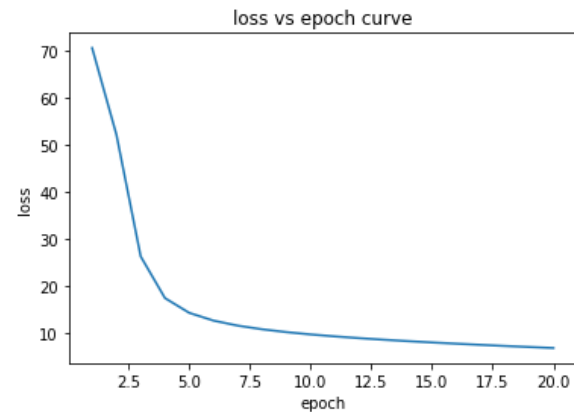


Figure 4: Training loss curve for Model 4.

Model 5:

Architecture:

- Dense(image_height* image_width, 128)
- ReLU,
- Dense (128, 64),
- ReLU
- Dense (64, 16),
- ReLU,
- Dense (16, 10),
- SoftMax,
- CE

Weights initialization: Hu

Learning rate: 0.01

Batch size: 32

Epochs: 50

Accuracy: 97.68%

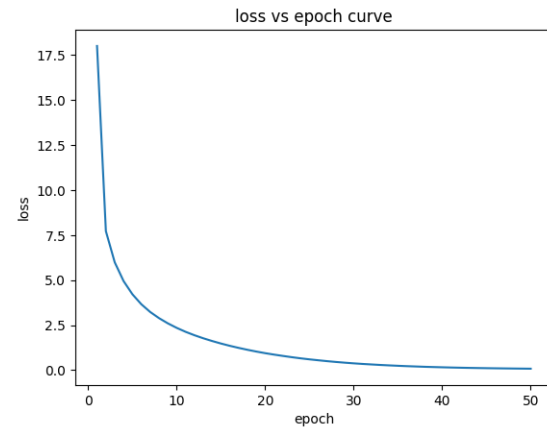


Figure 5: Training loss curve for Model 5.