**Reflective Journal Requirements**

**Summary of Key Learnings:**  
This lab, “Building and Training a Neural Network in PyTorch,” focused on the key concepts involved in creating and training a neural network model for classification tasks. It covered how to design a basic neural network architecture with multiple layers, including applying Xavier initialization for weight distribution, using ReLU as the activation function, and incorporating dropout layers to prevent overfitting. The lab also walked through essential steps such as data preprocessing, loss function selection, and training the model using optimizers like SGD and Adam.

**Insights & Understanding:**  
Through this lab, I gained a better understanding of how neural networks are structured and trained. I learned that initialization techniques like Xavier initialization are crucial in ensuring the network converges effectively. Dropout layers were particularly eye-opening because they offer a simple but powerful way to regularize the model and prevent overfitting, which I hadn't fully appreciated before. I also realized that fine-tuning hyperparameters, including learning rates and batch sizes, can have a significant impact on model performance, sometimes in unexpected ways.

**Challenges Encountered:**  
During the lab, one of the main challenges was mastering PyTorch's DataLoader for handling data batches. Converting NumPy arrays into PyTorch tensors and ensuring that the data was correctly fed into the model for training proved tricky at first. There was also the issue of model performance not improving as quickly as expected. After troubleshooting, I adjusted the learning rate and optimizer settings, which led to better results. Overall, the experience highlighted the importance of carefully tuning and testing different parameters in neural network models.

**Application & Relevance:**  
This lab reinforced the importance of neural networks in machine learning and their applications in tasks like image recognition, classification, and beyond. The skills gained here will be directly applicable in future AI projects where neural networks are used, particularly in situations where I need to classify large and complex datasets. Whether it's working on data in computer vision or natural language processing, the concepts covered in this lab provide a foundational understanding for building and optimizing neural networks.

**Code and Experimentation:**  
In this lab, I experimented with different neural network architectures and hyperparameters. I started with a basic model with two hidden layers but later expanded it to three to see how more complexity affected performance. I also adjusted the learning rate using the Adam optimizer, noting that a lower learning rate led to more stable training, although it took longer to converge. Additionally, I experimented with the dropout rate, and after observing overfitting with a higher dropout value, I adjusted it to find a balance that improved generalization without slowing down training.

Work Cited

# Houston Community College. (2025). Application of Deep Learning to Text and Image Data

Module 1, Lab 3: Building an End-to-End Neural Network Solution

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