

## **Introduction**

The purpose of this document is to report on the learning experience, actions taken, and personal impact experienced while completing the assigned labs. The labs that this report is based on involved running, understanding, and editing Python code for creating and training basic convolutional neural networks(CNNs) and residual layers within neural networks.

## **Description of Experience**

Completing these labs was an enriching journey through the practical implementation of Convolutional Neural Networks (CNNs) using PyTorch. From loading real-world datasets to defining intricate model architectures, each lab provided invaluable hands-on experience in the entire deep learning workflow. We gained insights into preprocessing image data, designing 3\*network layers, setting hyperparameters, and analyzing training/validation results. The comparison between models with and without residual connections was particularly enlightening, shedding light on the crucial role of architecture choices in model convergence and accuracy. Overall, these exercises improve our understanding of CNN fundamentals and their application in real-world image classification tasks.

## **Personal Reflection**

The first lab with CNNs and a sample dataset started off smoothly, making it easy to begin. However, as the labs progressed, the tasks became more challenging, especially when it came to designing the network, which was confusing. The second lab was harder because it involved writing complex code that took a lot of time to get the challenge code and it was not sure if the code was correct, even though it ran successfully. The final lab was the most difficult, as it required comparing different layers of the network to see their performance after just one training session, but the challenge coding for this part turned out to be simpler than expected. Working through these labs helped in understanding how neural networks function. A more gradual introduction to the more complex parts of the coding would have made learning easier, allowing a thorough understanding of each concept before moving on to more difficult tasks. Engaging with these challenges was key to deepening knowledge of neural networks and preparing for more advanced future projects.

## **Discussion**

During these labs we learned and developed a couple different skills. The first one I want to talk about is Text Data Preprocessing Techniques, which are techniques that are crucial for preparing text data for deep learning models, improving their efficiency and effectiveness. Future applications could include sentiment analysis, document classification, and text generation tasks. Another skill we learned was Convolutional Neural Networks (CNNs) for Image Classification. We gained experience in building and training CNNs using frameworks like TensorFlow or PyTorch. Future applications could involve image recognition, object detection, and image segmentation in various domains such as healthcare, autonomous vehicles, and security. One final skill we learned is Transfer Learning which is particularly useful when working with limited data and can significantly improve model performance. Future applications could include building specialized models for specific domains like medical imaging, satellite image analysis, or industrial quality control.

## **Conclusion**

These labs demonstrated how to build, train, and test CNNs using PyTorch as well as the use of residual layers within such networks. Although we have worked with CNNs before, these labs strengthened our understanding of how they work and how they are constructed. Additionally, we were introduced to the concept of residual layers which can be used to improve the performance of CNNs and other neural networks. The challenges and activities helped to solidify the information from the labs by testing our knowledge and allowing us to practice using the techniques shown in the labs. CNNs are an important and widespread technology so the skills and knowledge gained from these labs will very likely benefit our pursuits with AI.

## **References**

AWS MLU - "Applications of Deep Learning to Text and Image Data," module 3 labs 2, 3, & 4.