**Reflective Journal**

**Convolutional Neural Networks (CNNs) and the MNIST Dataset**

**Learning Insights**

In this lab, I deepened my understanding of Convolutional Neural Networks (CNNs) and their role in deep learning, focusing on how they enhance image classification by learning positional patterns of features. The concept of convolutional layers applying filters to detect edges, textures, and patterns was reinforced through practical implementation.

CNNs offer advantages over traditional networks by reducing the number of parameters, thereby improving efficiency. I recognized the importance of max pooling for retaining essential features while reducing dimensionality. Given CNNs' proven effectiveness in image classification tasks, I anticipated high accuracy on the MNIST dataset. The pre-split training and testing sets, along with normalization, ensured faster and more effective training. I also appreciated CNNs' ability to automatically learn features without manual extraction.

While implementing the CNN architecture, I focused on how each layer contributed to feature extraction and classification. Although I didn’t experiment with various configurations, I understood that adjusting parameters like kernel sizes, strides, and padding could affect model performance.

**Challenges and Growth**

I continued exploring the challenge of overfitting by implementing dropout layers and adjusting the learning rate for better generalization. Additionally, I became interested in the interpretability of CNNs, exploring tools to understand the network’s decision-making process. I also revisited backpropagation and gradient descent, reinforcing my understanding of their roles in CNNs. Moreover, I recognized the importance of activation functions like ReLU in enabling CNNs to learn complex patterns.

**Personal Development**

This lab boosted my confidence in working with deep learning models. I particularly valued the hands-on experience with CNNs. In a previous assignment, I explored transfer learning using pre-trained models like VGG16, demonstrating how leveraging such models can save time and improve performance.

Beyond accuracy, I focused on refining my approach to model evaluation, considering metrics such as precision, recall, and F1-score. I also recognized the importance of data preprocessing in optimizing deep learning models. Techniques like batch normalization and dropout layers proved essential in improving training stability and model generalization.

CNNs have immense potential in fields beyond digit classification, such as medical imaging, facial recognition, and autonomous vehicles. My interest in AI applications is growing, and I look forward to working with more complex datasets, exploring techniques like Recurrent Neural Networks (RNNs) or transformers for tasks like video analysis and natural language processing.

**Conclusion**

This lab was a valuable exercise that strengthened my theoretical knowledge and practical experience with CNNs. It deepened my interest in exploring deep learning applications in more complex domains, such as medical imaging and environmental monitoring, where CNNs can be integrated with other architectures to solve advanced problems.