L09

**CNN Architecture**

In this lab, I implemented a CNN to distinguish between images of Chihuahuas and muffins a popular and humorously difficult classification problem due to their visual similarity. The CNN consisted of three convolutional layers (though I attempted to add a fourth, followed by fully connected layers.

Compared to the traditional FNN , CNNs are uniquely suited for image data. While an FNN processes flattened pixel values without any spatial awareness CNN’s maintain spatial hierarchies by applying filters (that can learn features such as edges, shapes, and textures.

**Model Performance**

After I went in and filled in all the blanks for the training model, I adjusted the code to 15 epochs with an increased learning rate of 0.01. I saw an improvement in overall time. The model achieved over 90% accuracy on the validation set. Most confusion from the AI side occurred on images where muffins had chocolate chips positioned like eyes or where Chihuahuas had similar color tones and backgrounds as the muffins.

**Comparison with Traditional Neural Network**

Compared to the traditional FNN, the CNN model performed significantly better in terms of accuracy and robustness. The FNN struggled with high variance due to the loss of spatial information, and it overfit to the training data. Training time was slightly longer for the CNN due to its more complex architecture and increased number of parameters. However, this was a worthwhile tradeoff, as the CNN produced more reliable.

**Challenges and Solutions**

One major challenge I faced was modifying the model architecture to include deeper layers. I thought I could try adding new but I was unsuccessful, having to recalculating the input size of the first fully connected layer.

Another challenge was identifying a suitable learning rate. Initially, the model was not converging properly due to a high learning rate. After increasing it from 0.001 to 0.01, the model trained faster but a little jumpy.

**Real-World Applications**

Image classification using CNNs has vast real-world applications. Similar models can be applied to medical imaging and quality control in manufacturing, this lab served as a simplified example of how powerful CNNs can be.

**Ethical Considerations**

Privacy is my main concern, especially when deploying models that analyze personal or sensitive images. I think clear consent and secure data handling practices must be followed. It's essential to avoid over-reliance on AI decisions. Human oversight should always be present, especially in highstakes applications like medical diagnosis or legal decision making.

**Main References:**

* Goodfellow, I., Bengio, Y., & Courville, A. (2016). *Deep Learning*. MIT Press.
* Stanford University. (n.d.). *CS231n: Convolutional Neural Networks for Visual Recognition*.
* Chollet, F. (2017). *Deep Learning with Python*. Manning Publications.