Reflective Journal- Lab 06: Chihuahua or Muffin Workshop

1. **Introduction**:
    - **Overview**: Lab 06 tasked us with completing a walk-through notebook that builds a neural network classification model, with the goal of training the model to correctly guess chihuahua or muffin based on a set of images. The notebook, *workshop_1.ipynb,* from the GitHub repository: (https://github.com/patitimoner/workshop-chihuahua-vs-muffin.git), is mostly guided in structure but has several challenges for the reader to input their own code. Following along, we learn how to build a neural network, how to load the data, how to train the classification model on the data, and how to visualize the results.
    - **Purpose**: This reflective journal will be covering the main objectives and techniques of the workshop, insights gleaned, as well as discussing parameters that were tweaked to increase the accuracy and decrease the false positive outcomes of the model's guesses.
2. **Steps Taken**:
    - **Building the Neural Network**: We construct a 2- class muffin-vs-chihuahua classifier using PyTorch's neural network module. The model has 4 hidden layers and will have 2 output neurons corresponding to the two classes: muffin or chihuahua.
    - **Data and Data Loading**: This part of the notebook explores the data visually, and highlights that the data is split into 80% training and 20% testing sets.

- **Convert Image Data**: All the images must be converted to tensor objects, using a “dataloader”. After the image data is converted, we create datasets by passing the transforms into the ImageFolder constructor. Lastly, form dataloaders from the datasets.
- **Train the classification model and evaluate outcomes**: The dataset is run through multiple epochs for best performance and finally the model’s predictions are visualized for easy examination.

3. **Key Concepts**:
    - **Image Classification**: “Image classification categorizes and assigns class labels to groups of pixels or vectors within an image dependent on particular rules.” [1]
    - **Convolutional Neural Networks**: A framework modelled after the human brain’s firing of synapses between neurons. “CNN layers can be of four main types: Convolution Layer, ReLu Layer, Pooling Layer, and Fully-Connected Layer.” [1]
    - **Transfer Learning:** “A machine learning technique where a model trained on one task is re-purposed on a second related task” [2]
4. **Challenges Encountered**:
    - **Coding comprehension**: At times I struggled with understanding some of the terms used and had to reference Google Gemini alongside the workshop for help.

- **New frameworks and functions**: This was my first time working with Pytorch and the functions and modules were all new to me, I again utilized Gemini to assist in translating blocks of unfamiliar code.

5. **Insights Gained**:
    - **Parameter Tuning**: I made a couple of parameter changes to try to improve the model's performance, first I had initially set the input width and height to 224 but later tried both 256x256 and 299x299, to see if the model's performance was improved, then doubled the number of epochs from 3 to 6; these changes were met with mixed results- the accuracy improved and error rate decreased, however I noticed that some images had an unfavorable uptick in false positive predictions. Future work would be to change other parameters to correct the false positive problem.
6. **Potential Real-World Applications**:
    - **Use Cases for Image Classification**: Gaudenz Boesch for viso.ai lists several use cases for image classification: Automated inspection and quality control, object recognition in driverless cars, classification of skin cancer with AI vision, face recognition in security, traffic monitoring and congestion detection, retail customer segmentation, and land use mapping. [1]
7. **Conclusion**: The chihuahua vs muffin workshop deepened my understanding of convolution neural networks and their powerful role in image classification. The notebook's visualizations made understanding the data exponentially easier and helped to materialize concepts like CNN layers.

8. **References**:

1.) Boesch, Gaudenz. 2023, December 20. "*A Complete Guide to Image Classification in 2024*". viso.ai. https://viso.ai/computer-vision/image-classification/

2.) Brownlee, Jason. 2019, September 16. "*A Gentle Introduction to Transfer Learning for Deep Learning*". Machine Learning Mastery. https://machinelearningmastery.com/transfer-learning-for-deep-learning/