

Lab 06 - Chihuahua or Muffin Workshop

What we learned about image classification with CNN

This exercise, in my opinion, is one of the most important since it puts into perspective the similarities between two totally different types of objects if we think of it as a human, but when we see it in rotated images, with similar colors and textures, it can be easy to confuse the object. In many of the images, even for the human eye, it was difficult to identify at first glance if it was a Muffin or a Chihuahua.

This practice was based on the construction and training of a convolutional neural network (CNN) to classify Chihuahuas and muffins, a functional and easy-to-understand application about image classification. We used PyTorch and CNN for image classification tasks.

Convolutional Neural Network was built with three convolutional layers for feature extraction, which used (Conv2d, ReLU, MaxPool2D) followed by fully connected layers for classification.

Important Concepts

Image Classification: We use deep learning, to classify images

Convolutional Neural Networks convolutional layers are very important and what happens at each layer where patterns like edges and textures are detected.

Model Evaluation evaluate model performance such as accuracy and loss

Challenges Encountered and Solutions

Training Instability: Initially, the loss did not decrease as expected. The problem was identified as inadequate learning rates. Tuning the learning rate and using the Adam optimizer resolved this.

Overfitting: During training, the model performed well on the training data but poorly on the validation data. Adding dropout and data augmentation layers significantly improved the model performance on unseen data.

Hardware Limitations: Training the model on large datasets was computationally expensive. Using CUDA for GPU acceleration improved training speed.

Insights Gained

The Power of CNNs: CNNs' ability to automatically extract meaningful features from images is what makes them so effective for image classification tasks.

Importance of Data Preprocessing: The role of data augmentation and normalization in improving model robustness was clarified. Machine learning models require continuous tuning for optimal performance.

In Conclusion

We learned how machine learning and image classification are reliable and can solve image classification problems. Chihuahuas and Muffins showed us the complexity of training models to distinguish fine details in images.

CNN taught me how convolutional layers work to extract patterns and how fully connected layers combine these features for classification.