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ML LAB WEEK 14

Introduction

The goal of this lab was to build and test a Convolutional Neural Network (CNN) that can look at pictures of hand signs and decide whether they show rock, paper, or scissors. We used the Rock–Paper–Scissors dataset from Kaggle.First, we prepared the images using PyTorch's ImageFolder. Then, we created our own CNN model from scratch. After that, we trained the model using the labeled images and checked how well it performed on a separate test set.

Overall, the lab helped us learn the full deep-learning process: getting data ready, building a model, training it, checking accuracy, and trying out predictions on new images.

Model Architecture

The CNN model has three main convolution blocks and then a fully connected (linear) classifier at the end.
Each block has:

- a 3×3 convolution layer with padding 1 so the size stays the same
- a ReLU activation
- a 2×2 Max Pooling layer that cuts the image size in half

The model starts with 3 input channels (because images are RGB).
As the network goes deeper, it learns more features by increasing the number of channels to 16, then 32, and then 64.After the last pooling layer, the feature map has size 64 × 16 × 16. This is flattened into a long vector and sent into the fully connected part of the network.

The classifier has:

- a dense layer with 128 neurons
- a ReLU activation
- a dropout layer (0.5) to reduce overfitting
- a final output layer with 3 neurons for the three classes: rock, paper, and scissors

Training and Performance

The model was trained using the Adam optimizer with a learning rate of 0.001, because it trains quickly and adapts well. We used CrossEntropyLoss, which is the usual loss function for multi-class problems.

Training was done for 10 epochs with a batch size of 32, and it was run on CPU. During training, the loss steadily dropped from 0.6836 to 0.0166, showing that the model was learning well without any instability.

After training, the model was tested on the 20% test set and achieved 98.86% accuracy, proving that it can correctly classify rock, paper, and scissors images with high reliability.

Conclusion and analysis

The CNN model performed very well, reaching 98.86% test accuracy. This shows that the network learned useful features and could correctly classify new images. The training loss decreased smoothly, meaning the model trained properly, and there were no signs of overfitting or underfitting.

To make the model even better, two improvements could be tried:

- Data augmentation (rotations, flips, brightness changes) to increase variety and improve robustness.
- A deeper CNN with more layers to learn more complex patterns.

These upgrades could help push the accuracy even closer to 100%.