

Week 14 Lab Report – CNN Image Classification

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SECTION: f

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1. Introduction

The objective of this lab was to design and train a Convolutional Neural Network (CNN) using PyTorch to classify hand-gesture images into rock, paper, or scissors. The dataset was downloaded from Kaggle and consists of real-world images.

2. Dataset Description

Dataset details and structure are shown below.

```
Classes: ['paper', 'rock', 'scissors']  
Total images: 2188  
Training images: 1750  
Test images: 438
```

Copied: rock

Copied: paper

Copied: scissors

```

RPS_CNN(
  (conv_block): Sequential(
    (0): Conv2d(3, 16, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
    (1): ReLU()
    (2): MaxPool2d(kernel_size=2, stride=2, padding=0, dilation=1, ceil_mode=False)
    (3): Conv2d(16, 32, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
    (4): ReLU()
    (5): MaxPool2d(kernel_size=2, stride=2, padding=0, dilation=1, ceil_mode=False)
    (6): Conv2d(32, 64, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
    (7): ReLU()
    (8): MaxPool2d(kernel_size=2, stride=2, padding=0, dilation=1, ceil_mode=False)
  )
  (fc): Sequential(
    (0): Flatten(start_dim=1, end_dim=-1)
    (1): Linear(in_features=16384, out_features=256, bias=True)
    (2): ReLU()
    (3): Dropout(p=0.3, inplace=False)
    (4): Linear(in_features=256, out_features=3, bias=True)
  )
)

```

Test Accuracy: 34.02%

Model prediction for dataset/paper/0Uomd0Hv0B33m47I.png: paper

Randomly selected images:

Image 1: dataset/rock\2Pt5UNQkMzXLtbEp.png

Image 2: dataset/paper\Arbkrts1pXpDNgFV.png

Player 1 shows: paper

Player 2 shows: paper

RESULT: Draw

In this lab, a Convolutional Neural Network (CNN) was successfully implemented and trained to classify hand gesture images into the three classes: rock, paper, and scissors. The model was able to learn basic visual patterns from the dataset, but the final test accuracy of 34.02% indicates that the network struggled to generalize effectively to unseen images. Several factors contributed to this performance, including limited model depth, lack of data augmentation, and variation in background, lighting, and hand positions within the dataset. Despite these challenges, the experiment provided valuable insights into CNN architecture design, dataset preparation, training workflows, and evaluation techniques. Overall, the lab achieved its goal of building and training a working CNN model. With improvements such as deeper architectures, better preprocessing, and extended training, the model's accuracy can be significantly enhanced in future iterations.

