Project Proposal: Handwritten Digit Recognition with LeNet5 Model in PyTorch

1   Introduction

Handwritten digit recognition is a fundamental problem in the field of computer vision and machine learning. In this project, we propose to implement the LeNet5 model using PyTorch to recognize handwritten digits from the MNIST dataset. The goal is to build an accurate digit recognition system that can classify digits with high accuracy.

2   Project Flow

2.1   The MNIST Handwritten Digit Recognition Problem

- Introduce the MNIST dataset and its significance in the field of machine learning.

- Explain the problem of handwritten digit recognition and its applications.

2.2   Loading the MNIST Dataset in PyTorch

- Provide instructions for downloading and loading the MNIST dataset using PyTorch's DataLoader.

- Preprocess the dataset, including normalization and data augmentation techniques.

2.3   Baseline Model with Multilayer Perceptrons

- Implement a baseline model using a simple Multilayer Perceptron (MLP).

- Train and evaluate the model's performance on the MNIST dataset.

2.4   Simple Convolutional Neural Network for MNIST

- Introduce the concept of Convolutional Neural Networks (CNNs) and their advantages in image recognition tasks.

- Implement a simple CNN architecture using PyTorch for handwritten digit recognition.

- Train and evaluate the CNN model's performance on the MNIST dataset.

2.5   LeNet5 for MNIST

- Introduce the LeNet5 architecture, one of the pioneering CNN models for image classification.

- Implement the LeNet5 model architecture using PyTorch for recognizing handwritten digits.

- Train and evaluate the LeNet5 model's performance on the MNIST dataset.

3 Expected Deliverables

- Implementation of various models for handwritten digit recognition, including MLP, CNN, and LeNet5.

- Evaluation reports comparing the performance of different models in terms of accuracy and computational efficiency.

- Visualizations of model predictions and evaluation metrics.

- Documentation detailing the methodology, implementation details, and findings of the project.

4 Project Timeline (8 weeks)

- Week 1-2: Data loading and preprocessing

- Week 3-4: Implementation and training of baseline MLP model

- Week 5-6: Implementation and training of simple CNN model

- Week 7-8: Implementation and training of LeNet5 model, final evaluation and documentation
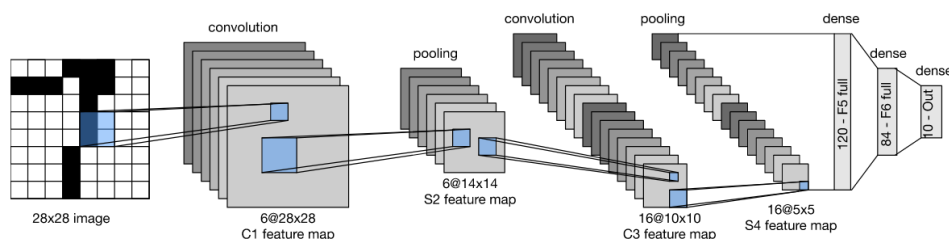
5 Architecture Diagram

Figure 1: Architecture diagram illustrating the LeNet5 model for handwritten digit recognition

6 Conclusion

The proposed project aims to implement and evaluate different models for handwritten digit recognition using the MNIST dataset. By comparing the performance of baseline models with advanced CNN architectures like LeNet5, we aim to provide insights into the effectiveness of different approaches for this task. We believe that the successful implementation of these models will contribute to the advancement of digit recognition systems and offer valuable insights for further research in this area.