Project 1 Report: CIFAR-10 Classification with Custom ResNet

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Abstract

This project addresses the CIFAR-10 image classification challenge using a custom ResNet architecture under the 5-million-parameter constraint. We propose a [brief description of approach], achieving [X

1 Introduction

The CIFAR-10 dataset is a standard benchmark for image classification, consisting of 60K images spread across 10 classes. We aim to design a custom ResNet architecture with fewer than 5 million parameters, trained from scratch to achieve high accuracy on this dataset.

2 Methodology

2.1 Data Preprocessing and Augmentation

We use standard data normalization, random cropping, and horizontal flipping to increase effective training data size.

2.2 Model Architecture

Our proposed network modifies the standard ResNet block to reduce parameter count while maintaining representational power. The final layer configuration is shown in Table 1.

2.3 Training Configuration

We train using stochastic gradient descent (SGD) with momentum, a batch size of 128, and an initial learning rate of 0.1 with a cosine annealing scheduler.

Table 1: Key Architecture Details and Parameter Counts

Layer	Output Size	# Params
Conv1	32×32	XXX
ResBlock1	16×16	XXX
ResBlock2	8×8	XXX
...	...	...
FC	10	XXX

3 Experiments and Results

3.1 Ablation Studies (Optional)

4 Discussion

Our experiments show that data augmentation and a well-tuned learning rate schedule are critical to achieving high accuracy within the parameter limit. We found that deeper networks risk exceeding 5 million parameters, while shallower networks underfit.

5 Conclusion

We demonstrated a custom ResNet for CIFAR-10 that respects the 5-million-parameter cap while maintaining competitive accuracy. Future work could explore novel regularization strategies or advanced optimization techniques.

6 References