Summary Report on CNN Model Training and Inference

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Introduction

In this submission, I implemented a Convolutional Neural Network (CNN) to predict numerical labels for a given dataset of handwritten digits (sum of all 4 digits). The data was loaded from preprocessed NumPy arrays and split into training and test sets. The CNN was trained on the normalized training data using the Adam optimizer and mean squared error (MSE) as the loss function.

Approach and Implementation

The model architecture consists of a convolutional layer with a 3×3 kernel and ReLU activation function, followed by a fully connected output layer. The dataset was normalized by dividing pixel values by 255 to ensure consistent input ranges. The training process was monitored for 50 epochs, with both training and validation losses being logged. The model was saved in HDF5 format for later inference.

Results and Observations

The training loss started at a high value of 348.44 and decreased significantly over the epochs, reaching a final value of 4.83. The validation loss showed a similar trend, decreasing from 345.43 to 25.10. The mean absolute error (MAE) on the training set was approximately 1.00. In the inference phase,

the model's predictions were close to the true labels for most test images, as demonstrated by the provided images.

Conclusion

The model achieved effective learning with a significant decrease in loss and reasonable accuracy during inference. Future work could include experimenting with deeper architectures, data augmentation, and hyperparameter tuning to further enhance performance.