Assignment: MNIST Classification using Least Squares

November 1, 2024

Objective

In this assignment, you will classify the MNIST dataset using a least squares approach. The key challenge is to restrict yourself to only the `np.linalg.lstsq` function for solving the least squares problem.

Assignment Tasks

1. **Data Loading**: Load and split the MNIST dataset.
2. **Data Preprocessing**: Normalize the data and manually convert labels to one-hot encoding.
3. **Least Squares Model**: Implement the least squares classifier using only `np.linalg.lstsq` to solve for the weight matrix.
4. **Prediction and Evaluation**: Predict labels and manually calculate accuracy for training and test sets.
5. **Visualization**: Display some images with accurately predicted class.
6. **Optional Visualization**: Display some misclassified images.

Questions

1. **Why might the least squares classifier perform worse than more sophisticated models on MNIST?**

Submission Instructions

1. Make a Jupyter Notebook (`.ipynb`) file containing your code for the assignment.
2. Convert the Jupyter Notebook (`.ipynb`) file to a PDF or HTML file and upload it.
3. Include a brief report as a separate PDF document that contains:
   - Training and test accuracy results.
   - Discussion of misclassified examples (if optional visualization was completed).
   - Answers to the questions above.
4. Name your files as `LAAIML24_RollNo_MNIST_Assignment`.
5. Submit both files in a single compressed ZIP folder with the same naming format.