PA 2 - Feed Forward Neural Networks

Due Feb 24 11:59 PM

Overview

In this assignment you will implement a basic feed-forward neural network from scratch and train it to recognize handwritten digits from the classical MNIST dataset. All graded taskes are maked with TODO comments in PA2_starter.ipynb

Learning Goals

- Implement basic feed forward neural network (structure, forward and backwards passes, etc.)

- Implement utlity functions e.g. loss functions, accuracy, etc.

- Train a basic FFNN to classify image classifiers.

- Create a custom model to improve performance.

Allowed Libraries

- No machine learning packages e.g. Sci-kit Learn, Pytorch, etc. for FFNN implementation.

Deliverables

- Submit PA2 starter.ipynb with all TODOs completed.

- Do not rename the notebook (the autograder expects this filename).

Point Distribution (100 points)

Part 1: Value Nodes and Computational Graph (0 points)

Part 2: Operations — Forward and Backward (15 points)

Part 3: Softmax and Building the MLP (30 points)

Part 4: Loss Functions (5 points)

Part 5: Backpropagation (0 points)

Part 6: Training on MNIST (50 points)

Part 7: (Extra credit) Softmax and Building the MLP (20 points)

Notes

- Some functions are already provided (e.g. the main backwards pass, create_value, etc.)

- The baseline model takes around 10 minutes to run. (2 minutes per epoch)

- Limit the size of your custom model as training may take a while.

Submission Checklist

- All TODOs are implemented.

- Notebook runs end-to-end without errors.

- You did not change function signatures.

Tips

- Submit each part as you go as previous functions are used in latter parts.

- Don't wait till the last minute, training the model takes time!