DD2358 - Project Abstract

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Abstract

Background

This project focuses on analyzing and optimizing the performance of a Python-based artificial neural network implementation designed for multi-class image classification tasks. The implementation, from `https://github.com/pmocz/artificialneuralnetwork-python`, trains neural networks to classify galaxy images derived from the Sloan Digital Sky Survey (SDSS) and Galaxy Zoo project datasets.

By profiling and characterizing the code's performance, this project seeks to identify bottlenecks in computation and memory access and search for optimizations such as data layout improvements, compiler-level optimizations using tools like Numba or Cython, and parallelization via multi-threading or GPU acceleration.

Project Timeline

- **Week 1**:
  - Familiarize with the baseline code.
  - Profile the code to identify key bottlenecks using tools such as `cProfile` or `line_profiler`.
- **Week 2**:
  - Implement data layout optimization to improve memory access patterns.
  - Document changes and evaluate initial performance improvements.
- **Week 3**:
  - Apply compiler or library optimizations (e.g., `Numba` or `Cython`).
  - Measure and analyze the performance gains.
- **Week 4**:
  - Parallelize compute-intensive operations using multi-threading or GPU acceleration (e.g., via `CUDA` or `OpenCL`).
  - Test correctness and document implementation details.
- **Week 5**:
  - Analyze the overall performance improvements across all optimizations.
  - Create performance plots and finalize the optimization report.
- **Week 6**:
  - Prepare and submit the final project report and abstract.
  - Develop slides and rehearse for the 15-minute presentation.