Homework 4
IST 597
Physics-Informed Machine Learning

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Question 1

Implement the forward operations of a 3 hidden-layer neural network with 10 neurons in each layer to learn the function $sin(2\pi xy) + 2xy^2$ where x , y are between 0 and 1. Use numpy alone. In this question - I do not expect a trained network - just the forward operations.

Ans:

Code: hw4.ipynb

Question 2

Implement forward and reverse mode AD from scratch to compute gradients. Verify that they provide the same gradients and perform timing assessments (you may need to collect timings for multiple calculations and average).

Ans:

Code: hw4.ipynb

Experiment: 1000 calculations

Average Times

Reverse Mode AD: 0.000149 seconds
Forward Model AD: 0.013176 seconds

Question 3

Use stochastic gradient descent to train your neural network using forward and reverse mode AD. Compare results.

Ans:

Code: hw4.ipynb

Training Times

Reverse Mode AD: 4.608514 seconds
Forward Model AD: 637.784775 seconds

Test Losses

Reverse Mode AD: 0.012305
Forward Model AD: 0.078139