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

Average Times

Forward Model AD: 0.00632 seconds
Reverse Mode AD: 0.000158 seconds

Question 3

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

Ans:

Code: hw4.ipynb

Test Loss

Forward Model AD: 0.0555
Reverse Mode AD: 0.0914