Homework 6 (20 Points)

Due: 2023/12/5

Submission Guidlines

1. You need to write your homework in *Rmd/* ipynb/ Rnotebook.
2. Please submit two files: one script file and one generated *pdf file.

In this assignment, you will explore neural network from scratch and neural network in machine learning framework with a toy dataset.

1. First simulate 1000 pairs of (x_1, x_2): x_1 and x_2 are independently drawn from a uniform distribution in [0,1]. Let $y = x_1^2 + x_2^2 + \epsilon_i$, where ϵ_i is the error term and $\epsilon_i \sim N(0, 0.1^2)$.
2. Write your code to construct a two-layer neural network for predicting Y using X (you can customize the activation function and the number of hidden variables). And solve it using gradient descent. Please implement **two** function, one for feed forward, and the other for back propagation.
3. Visualize the performance of your model: you may plot the error plots as a function of iteration times, or the comparison between Y and $\hat{Y}$
4. Rewrite the code for part 2 using any existing machine learning framework and play with auto differentiation. (Here you don't need to write everything from scratch, just use built-in libraries from PyTorch, Keras, or other frameworks.) Visualize your results (use the same plot in part 3)