Spring 2020 Introduction to Deep Learning

Homework Assignment 2

Due dates: March 11th

Problem 1 (Practice of scalar-based backpropagation). You are required to calculate the gradients of $f(\mathbf{x}, \mathbf{w}) = \dfrac{1}{2 + sin^2(x_1 w_1) + \cos(x_2 w_2)}$ with respect to x_i and w_i.

(a) Use computational graph for calculation
(b) Based on(a), write a program to implement the computational graph and verify your answer in (a).

Note: You are free to choose the inputs of your computational graph.

Problem 2 (Practice of vector-based backpropagation). You are required to calculate the gradients of $f(x, w) = \|\sigma(\mathbf{W}\mathbf{x})\|^2$ with respect to x_i and $W_{i,j}$. Here $\|\cdot\|^2$ is the calculation of L2 loss, $\mathbf{W}$ is 3-by-3 matrix and $\mathbf{x}$ is 3-by-1 vector, and $\sigma(\cdot)$ is sigmoid function that performs **element-wise** sigmoid operation.

(a) Use computational graph for calculation
(b) Based on(a), write a program to implement the computational graph and verify your answer in (a). *You can use vectorized approach to simply your codes*.

Note: You are free to choose the inputs of your computational graph.