Fall 2022

CSE432/532 Machine Learning Basics

HW 1

General Instructions:

1. This homework includes two parts, the hand-written assignment, and the coding assignment.
2. For the hand-written part, please submit a ".pdf" file to the canvas. For the coding assignment, please finish it in the colab and submit the ".ipynb" file.
3. Please submit the homework by next Friday (Sep 16, 23:59PM).

Hand-written part:

A. Please calculate the answer for each question if applicable:

1. $\vec{a} = [1,3,2,-3]$, $\vec{b} = [-2,1,-1,2]$ what is $\vec{b} \cdot \vec{a}$?

2. $\vec{a} = [1,3,2,-3]$, $\vec{b} = [-2,1,-1,2]$ what is $\vec{b}^T \cdot \vec{a}$?

3. $A = \begin{bmatrix} 1 & 1 & 0 \\ 0 & 2 & -1 \end{bmatrix}$, $\vec{a} = [1,3]$ what is $\vec{a} \cdot A$? And what is $A \cdot \vec{a}$?

4. $A = \begin{bmatrix} 1 & 1 & 0 \\ 0 & 2 & -1 \end{bmatrix}$, $\vec{a} = [1,3,1]$ what is $\vec{a} \cdot A$? And what is $A \cdot \vec{a}^T$?

5. $A = \begin{bmatrix} 1 & 1 & 0 \\ 0 & 2 & -1 \end{bmatrix}$, $B = \begin{bmatrix} 3 & 2 \\ 5 & 1 \\ 2 & -4 \end{bmatrix}$. What is $A \cdot B$? What is $B \cdot A$?

6. $= \begin{bmatrix} 1 & 1 & 0 \\ 0 & 2 & -1 \end{bmatrix}$, $B = \begin{bmatrix} 3 & 2 \\ 5 & 1 \\ 2 & -4 \\ 2 & 1 \end{bmatrix}$. What is $A \cdot B$? What is $B \cdot A$?

B. Please calculate the first order derivative with respect to x of the following equation:

$$y = \cos((3 * x^2 - 5 * x)^3)$$

Coding part:

1. Write the Python code to solve the question 1~6 in the hand-written part A (using numpy). You can also use this result to check your solution.

2. Please implement the ".dot()" function by yourself by only using the "for" or "while" loop.
    a) You should create (or define) a function (such as DotMulti()).
    b) This function should have two arguments, a and b
    c) Your program should check the argument to figure out whether it is vector or matrix.
    d) Your program should determine whether the dimension of the two arguments meet the requirement for multiplication or not. If the dimensions of the two operands are not valid, you should return error information.
    e) The two arguments, could be the type of List or a Numpy array. Please make sure you will return the result with the correct type.
    f) You should not use the existing function "np.dot()".
    g) You need to test this function using the question 1~6 in the hand-written part A. Display the result to show they are the same as what you get by using the "np.dot()"

3. Write Python code to visualize:
    a. the original equation in the handwritten part B.

$$y = \cos((3 * x^2 - 5 * x)^3)$$

    b. The first order derivative with respect to x

    Please plot the two curves in the same figure. You should use different colors to indicate different equations. Please display the curve for $-3 \leq x \leq 3$