

# Homework #2

CS 539, Fall 2021

---

100 points total [6% of your final grade]

**Due:** September, 21, 2021 by 11:59pm

[no submission will be accepted after September 23, 2021 at 11:59pm]

**Delivery:** Submit via Canvas

---

For this assignment, you will:

(70 pts) Implement linear regression with gradient descent

(30 pts) Make predictions by using your implementation

## Part 1: Implement linear regression with gradient descent

In this problem, you will implement the linear regression algorithm in python3. We provide the following files:

- a) `linear_regression.py` - You will implement several functions. As we discussed in class, implement the functions by using **vectorization**. You may refer to matrix calculus here:

[https://en.wikipedia.org/wiki/Matrix\\_calculus](https://en.wikipedia.org/wiki/Matrix_calculus)

Do not change the input and the output of the functions.

- b) `test.py` - This file includes unit tests. Run this file by typing `'nosetests -v test.py'` in the terminal as you did in homework 1 in order to check whether all of the functions are properly implemented. No modification is required.

## Part 2: Make predictions by using your implementation

Given training and test sets, you will make predictions of test examples by using your linear regression implementation (`linear_regression.py`). We provide the following file:

- a) `application.py` – write your code in this file. Do not change `X` and `y`.

Please play with the parameters `alpha` and number of epochs to make sure your testing loss is smaller than  $1e-2$  (i.e., 0.01). Report your parameters, training loss and testing loss. In addition, based on your observations, report a relationship between `alpha` and number of epochs. Note that a single epoch means the single time you see all examples in the training set.

---

## What to turn in:

- Submit to Canvas your `linear_regression.py`, `application.py` and a pdf document for part 2.
- This is an individual assignment, but you may discuss general strategies and approaches with other members of the class (refer to the syllabus for details of the homework collaboration policy).