BLM462E / BLM535 Homework#1

Gradient Descent for Linear Regression with multiple variable

Deadline: March 19, 2020 Thursday

Mathematical part: You will use Mean Square Error (MSE) as a cost function.

$$MSE = \frac{1}{m}\sum_{i=1}^{m}\left(\theta^T . x^{(i)} - y^{(i)}\right)^2$$

1. You should compute the gradient of the cost function with regards to each model parameter θ_j. Assume that $x_0^{(i)} = 1$

$$\frac{\partial}{\partial \theta_j} MSE(\theta_j) = ??$$

2. Instead of computing these gradients individually, compute the gradient vector

$$\nabla_\theta MSE(\theta) = \begin{bmatrix} \frac{\partial}{\partial \theta_0} MSE(\theta_0) \\ \frac{\partial}{\partial \theta_1} MSE(\theta_1) \\ \dots \\ \frac{\partial}{\partial \theta_n} MSE(\theta_n) \end{bmatrix} = ????$$

Gradient descent:

$$\theta^{next\ step} = \theta - \eta \nabla_\theta MSE(\theta)$$

Implementation part: In this homework, you are expected to apply gradient descent for linear regression on Boston Housing dataset (load_boston()) using scikit-learn.

a. Normalize your input values
b. Implement gradient descent in Python using the following cost function (Mean Square Error)
c. Test with the different learning rates ($\eta = 0.02, 0.1, 0.5$)
d. For each η value, plot a graph of cost function versus number of iterations.

For each approach, you must use the mean squared error as regression metric (mean_squared_error in Scikit-learn Library)

You are required to write a detailed report that includes your results and discussions. You should cite your references. Please zip and submit all your files (report and jupyter notebook files).
You may discuss an assignment and the general approach to a problem with your instructor, TA, or your classmates. However, the final submitted work should be totally ***yours***.

Good Luck

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