CSE353 Assignment 4 - Linear Regression, Logistic Regression, Stochastic Gradient Descent, Binary Classification

Due Nov 16 2021 5:00PM

TA: Md Moniruzzaman
Email: md.moniruzzaman@stonybrook.edu
Time: Thursday, during 10:00 AM - 12:00 PM
Zoom: https://stonybrook.zoom.us/j/5318718293?pwd=U2tMQWRYWW1KNW5jdW1mUlNPNytQZz09

One data set is provided in 'X.txt' and 'Y.txt', where matrix X (40*3) contains 40 training samples of dimension 3 and Y (40*1) is a column vector containing ground truth binary labels.

1. Linear Regression

(a) Implement your Linear Regression algorithm on this dataset and obtain your $w_{LinearRegression}$.

(b) Apply your $w_{LinearRegression}$ to the dataset for binary classification and compute your error rate;

(c) Using $w_{LinearRegression}$ as the initialization on w_{PLA} to train your perceptron learning algorithm, report your observation compared to other initializations like $w_{PLA} = \mathbf{0}$. You can compare the iteration times and error rates, and draw the decision boundaries along with the input data.

2. Logistic Regression

(a) Implement your Logistic Regression algorithm on this dataset and obtain your $w_{LogisticRegression}$.

(b) Apply your $w_{LogisticRegression}$ to the dataset for binary classification and compute your error rate;

(c) If using $w_{LinearRegression}$ as the initialization in the logistic regression, what do you observe compared to an initialization with the zero vector?

(d) If using different learning rates in the logistic regression, what do you observe?

3. SGD Logistic Regression

(a) Implement your Logistic Regression algorithm with Stochastic Gradient Descent (SGD) on this dataset and obtain your $w_{LogisticRegressionSGD}$. Compared with the logistic regression without SGD, what do you observe in terms of computational cost?

(b) Apply your $w_{LogisticRegressionSGD}$ to the dataset for binary classification and compute your error rate;

(c) Changing the number of samples used in the stochastic gradient computing, what do you observe?

Upload your codes with enough comments so TA can understand them in an easy way and a brief report to Blackboard by the due date & time, including

a) Introduction. Brief summary of what you think the assignment is about,

b) Method. Brief outline of your (algorithmic) approach,

c) Experiments. Tables and/or pictures of intermediate and final results that convince us that the program does what you think it does.

d) Discussions and Conclusions. Any design decisions you had to make and your experimental observations. What do you observe about the behavior of your program when you run it? Does it seem to work the way you think it should? Play around a little with different setting to see what happens. Note, your open-ended exploration is highly valued.