CSCI 4961/6961: Homework 5

Assigned Wednesday December 2 2020. Due by 11:59pm Wednesday December 9 2020.

Create a Jupyter notebook for this assignment, and use Python 3. Write documented, readable and clear code (e.g. use reasonable variable names). Submit this notebook along with a pdf in which the answers to each question are legible, and clearly labeled. You will be graded primarily based on the solutions and answers in the pdf, but the notebook must be runnable. Name the files RPIid\_pr1.ipynb and RPIid\_pr1.pdf, where RPIid is your six letter RPI id.

In this homework, you will compare, empirically, gradient descent and steepest descent, on a multiclass classification problem using the Chinese MNIST dataset. Specifically, you will fit amulticlass logistic regression model to solve the problem of recognizing which of 15 digits a given image contains.

1. Download the file  
   <https://github.com/Libsmj/CSCI-4961-GoemansWilliamson/blob/main/dataset.ipynb>  
   rename it to RPIid\_ pr1.ipynb, and use it as the starting point of your solution. The code should download.  
   Answer the following problems in your pdf in full sentences and provide the plots asked for in the pdf. The TA will not look in your Python code for answers that are not present in the pdf.  
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2. [For CSCI6961 students.] For the Goemans-Williamson Maxcut Approximation Algorithm, we required that our graph G has non-negative edge weights. This was so that the inequality

would not be reversed. Prove the inequality for a graph with negative edge weights is  
where  
Hint: can be rewritten as

by splitting W into its positive and negative weights