Assignment #2: SVM and Softmax Classifier
Due: Friday, March 19th, 2021 at 11:59 PM (EST)

Description
In this homework you will create SVM and Softmax classifiers in Python using the Numpy package. You need to understand how SVM and Sofmax classifiers work, including backpropagation and how gradient decent is performed, in order to complete this homework successfully. The goals of this homework are:

- To understand the steps to train/test the classifier for image classification.
- To use the validation dataset to tune up hyper parameters.
- To implement and understand SVM classifier.
- To implement and understand Softmax classifier.

Instructions
*** Important *** In order to complete this lab, you will need to install additional packages. The packages are: NumPy, SciPy, MatPlotLib, Tensorflow, and Keras. This can be done using the package manager built into PyCharm (tested with Windows and Linux). As some of the packages in this list depend on other packages in this list, it is recommended that you install them in the given order.

All steps for the programming portion of this assignment are listed in the python files. A description of each file is included below. You will have to modify all three files.

- runSvmSoftmax.py: This is the main file that you will execute. It will be used to read and process the CIFAR10 dataset, initialize classifiers, train, and also tune up hyperparameters. The first time you run this code, it will download the CIFAR10 dataset.
- svm.py: SVM class that contains 5 functions: initialize, train, predict, calculate loss, and calculate accuracy.
- softmax.py: Softmax class that has the same structure as in svm.py.

Notes:

- Each file has comments that will walk you through the implementation. Furthermore, they have explanations in each block of code that you have to fill in.
- The points available for each block of code is in the comment with the instructions.
- Comment your code.
- Don't put any print function in your answer.
- *** Do NOT edit any of the code outside of the TODO blocks. ***

There is also a written portion of this assignment. In a report, you will need to complete two tasks.

- First, you will need to include a copy of the output of runSvmSoftmax.py.
- Second, you will need to complete the calculations in CSE691_Assignment2_Gradient_S21.pdf. Show your work. Modern word processors such as Microsoft Word and LibreOffice Writer, and markup languages like LaTeX can be used to format mathematics if you wish to type this section. Otherwise, include an image or scan of your work in the report pdf.

Assignment #1: Python and NumPy Exercises
Due: Friday, March 19th, 2021 at 11:59 PM (EST)

Submission

Your submission ZIP archive will contain 3 python files named: '**runSvmSoftmax.py**', '**svm.py**', and '**softmax.py**'. (Do not change the names of the python files!) Your submission will also include 1 report named '**report.pdf**'.

- Zip file named via the following convention:
  - <SU-EMAIL>_<FIRST-Name>_AS2.zip
  - Ex. dprider_Daniel_AS2.zip
- In the report, paste a copy of the output from runSvmSoftmax.py as well as your answer from the gradient calculations.
- Upload the zip file to blackboard before 11:59PM (EST Time) 03/19/2021