STATISTICAL PATTERN RECOGNITION (FALL 2021)
HOMEWORK#2: LOGISTIC REGRESSION & SOFTMAX

Due date: 7th Dec 2021

In order to do this homework, you have to go through logistic regression & softmax theories and concepts.

- Logistic Regression

  Dataset : Iris https://archive.ics.uci.edu/ml/datasets/Iris

  - Binary Classification
    - The Iris dataset consists of 4 features and 3 classes. Use only the first and second features (remove the third and fourth columns) and also delete the instances of the 'Iris-versicolor' class to reduce the data to 2 classes with 2 features.
    - Consider the first 80% of the data in each class for train and the rest 20% for test
    - Report the training and testing errors, and the equation of the decision boundary.
    - Also, plot the decision boundary along with the samples of the two classes with different colors all in one plot.
  - Multiclass Classification
    - As mentioned in previous part the Iris dataset consists of 4 features and 3 classes. Use all features and classes for this part of homework. In before, you used logistic regression for binary classification. In this part you should use whole iris dataset for multiclass classification (one-vs.-one and one-vs.-all) by logistic regression.
    - Consider the first 80% of the data in each class for train and the rest 20% for test.
    - Train multiclass classification (one-vs.-one and one-vs.-all) by logistic regression and report train and test accuracy for both of method.
    - Plot cost function for enough iteration for one-vs.-all method and report convergence iteration in this method.

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- Softmax

  Then using softmax regression and compare them.
  - Train multiclass classification by softmax regression and report train and test accuracy.
  - What method (one-vs.-one, one-vs.-all or softmax) has worked best?

Notes:

- ✓ Pay extra attention to the due date. It will not extend.
- ✓ Be advised that submissions after the deadline would not grade.
- ✓ Prepare your full report in PDF format and include the figures and results.
- ✓ Do not use sklearn or any similar library for regression and logistic regression and write your own code.
- ✓ Submit your assignment using a zipped file with the name of "StdNum_FirstName_LastName.zip"
- ✓ Feel free to use your preferred programming languages.
- ✓ Feel free for using sklearn in python for load iris or split train and test dataset.
- ✓ Using other students' codes or the codes available on the internet will lead to zero grades.