Assignment 1: Gradient Decent / Linear Regression

Deep Networks for Machine Learning — Spring 2019

Brief

• Due date: 07 March, 2019 11:59 PM
• Implement linear regression
• Required files: Submit your ipython notebook along with a Report.pdf in a single zip file with name IDnumber_A01.zip.
• Submission: iLearn

Overview

The goal of this assignment is to implement the gradient decent algorithm for a linear neuron discussed in class. Note that, with a squared loss objective function, this is essentially the same as doing linear regression on your data.
The datasets we are going to use is a scaled down versions of boston house price.
It has been provided along with this pdf on iLearn. You can load the dataset with following command:

In [ ]:

```
import pickle
(x_train, y_train), (x_test, y_test)= pickle.load( open( "dataset.pkl", "rb" ) )
#You can load the second dataset in similar fashion
(x_train, y_train), (x_test, y_test)= pickle.load( open( "dataset2.pkl", "rb" ) )
```

The goal of this assignment is to develop your understanding of a basic Machine Learning model and learn some basic concepts such as how datasets are visualised and misc. We think that it is necessary to not only understand the mathematics behind the models but also to know how to convert that knowledge into code that can work.

Details

• Theoratical:

• Answer the following question: For a 3 dimensional dataset, What is the minimum number of points that are required to fit a hyperplane? (3 Points)

• Read the following paper "Deep Learning" (http://www.cnbc.cmu.edu/~plaut/IntroPDP/papers/LeCunBengioHinton15Nat.deepLearning.pdf). It is an exciting paper published in Nature and written by three pioneers of the deep learning — Yann LeCun, Yoshua Bengio and Geoffrey Hinton. The tripod of deep learning if you will :). The objective of this reading is to get you guys excited about deep learning and what can be / has been achieved with it. Write a summary of this paper, and let us know what it is that you find most exciting about deep learning and why? Your summary should not exceed 300 words.

• Question 1: Write a summary (7 Points)

• Question 2: What is the difference between deep and shallow learning. Explain with concrete example(s) when shallow learning is suitable as compared to deep learning and vise versa. (3 Points)

• Implementation:

• Implement gradient decent algorithm to learn parameters of a linear neuron using squared error objective function. The weights will be the coefficients of a linear regression model along with the bias. (10 Points)

• Visualize the learned model (plot both datasets seprately along with learnt line). (3 Points)

• Report the coefficient of the model along with the bias. (1 Point)

• Report model's performance using Mean Squared Error. (3 Points)

Honor code

• Honor code of AUS will be followed.
• Always give reference for code or ideas.
• Do not copy code from the web or from any other person.

Submission

• Please note that the zip file must be named in following manner IDnumber_A01.zip (e.g. g00012345_A01.zip).
• No late submissions will be accepted.