**PGP in AI/ML**

**Regression - Assignment 2**

***Total Marks: 12 Submission Date: 2359hrs on 20-11-2019***

1. Every object in the world has some stress related to it. Residual stresses are the ones which occur on a material even if it isn’t loaded with anything. These stresses are derived by photo elasticity. To measure the stress on the material, we need to dig into the object. At certain depth, there is minimum and maximum pressure getting applied. The following table shows the same.

|  |  |
| --- | --- |
| Drilling depth[mm] | Min Pressure [MPa] |
| 0.5 | 79.4 |
| 1 | 46.33 |
| 1.5 | 44.43 |
| 2 | 44.85 |
| 2.5 | 48.54 |
| 3 | 49.64 |
| 3.5 | 52.44 |
| 4 | 53 |
| 4.5 | 54.1 |

Fit best regression model on the given training data by minimising the corresponding error function. You should solve this minimization problem by finding the stationery point of error function( or by equating first derivative of the function to zero). Please solve this programmatically as well as analytically. [2 Marks]

Also predict the Min pressure which will be required at 3.8 mm depth. [2 Marks]

b\_0 = 57.55722222222223

b\_1 = -2.01266666666667

Min pressure= 57.55722222222223+ -2.01266666666667\*3.8= 49.912

1. Is the function Y= 6x²+9x convex?

What are the maxima and minima of this function? [4 Marks]

If the second derivative of the above function is greater than 0 then we will say that the function is convex in nature.

F’(x)=12x

F’’(x)=12

As the second derivative is greater than 0 we say that this function is convex

Now for finding minima of a function take the first derivative and equate it to 0

F’(x)=12x+9=0

So now x can take the values -3/4.

Second derivative of the function is 12 which is always positive irrespective of value of x. Plus we have already proved that this is a convex function. In convex function the local minima is equal to global minima.

As 2nd derivative of the function is positive we say that at x=-3/4 this function achieves minimum.

Considering the maximum of a function we have not defined a range of the convex function.

When a convex function doesn’t have a range, its maximum is said to be infinity.

3) Consider the following training set of m=4 training examples:

|  |  |
| --- | --- |
| x | y |
| 1 | 0.5 |
| 2 | 1 |
| 4 | 2 |
| 0 | 0 |

Consider the linear regression model hθ(x) = θ0+ θ1x. What are the values of θ0 and θ1 that you would expect to obtain upon running gradient descent on this model? (Linear regression will be able to fit this data perfectly.Solve this problem analytically only using gradient descent.) [4 Marks]

Answer: θ0 = 0,θ1 = 0.5

Submissions:

Solutions or answers to all questions (excepting programming problems) should be submitted in a word document named ‘Roll\_No.doc’ (Roll\_No is your identity number of this programme).

All python code should be submitted in a Jupyter notebook named "Roll\_No.ipynb".