

Assignment 4

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Gradient Descent

Abstract—This document contains the solution to find the maximum / minimum value of given function by gradient descent method

Download all python codes from

<https://github.com/rubeenaafreen20/EE5600AI-ML/tree/master/Assignment4/Code>

Download latex-tikz codes from

<https://github.com/rubeenaafreen20/EE5600AI-ML/tree/master/Assignment4>

1 PROBLEM

Find the maximum and minimum values, if any, of the following function

$$f(x) = 9x^2 + 12x + 2 \quad (1.0.1)$$

2 SOLUTION

At the point where maxima / minima occurs, slope is zero. Therefore, we differentiate $f(x)$ w.r.t x

$$\frac{df(x)}{dx} = 0 \quad (2.0.1)$$

$$\Rightarrow 9(2x) + 12(1) + 2 = 0 \quad (2.0.2)$$

$$\Rightarrow 18x + 12 = 0 \quad (2.0.3)$$

$$\Rightarrow x = -\frac{2}{3} \quad (2.0.4)$$

Now, to know whether $x = -\frac{2}{3}$ is maxima or minima, we calculate $f''(x)$

$$\frac{d^2f(x)}{dx} = 18 \quad (2.0.5)$$

$\therefore \frac{d^2f(x)}{dx} > 0$, therefore, we can conclude that $x = -\frac{2}{3}$ is a minima.

Value of $f(x)$ at $x = -\frac{2}{3}$ is

$$f\left(-\frac{2}{3}\right) = 9\left(-\frac{2}{3}\right)^2 + 12\left(-\frac{2}{3}\right) + 2 \quad (2.0.6)$$

$$= 4 - 8 + 2 = -2 \quad (2.0.7)$$

Figure 1 shows plot of parabola obtained from python code:

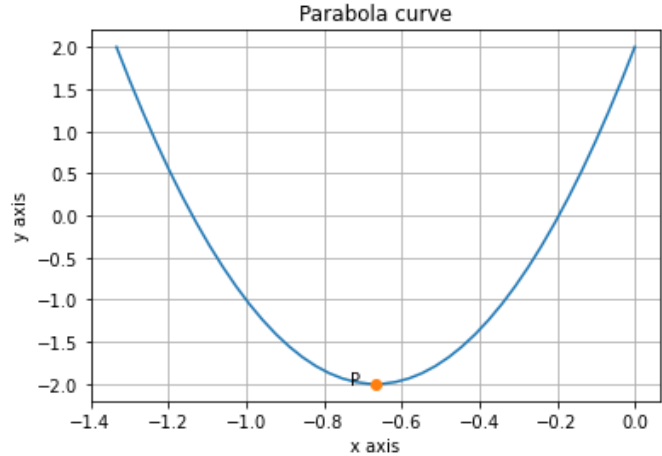


Fig. 1: Plot obtained from python code