

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

$$f(x) = (2x - 1)^2 + 3 \quad (1.0.1)$$

2 SOLUTION

The given equation (1.0.1) can be written as

$$f(x) = 4x^2 - 4x + 4 \quad (2.0.1)$$

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

$$\frac{df(x)}{dx} = 0 \quad (2.0.2)$$

$$\Rightarrow 4(2x) - 4(1) + 0 = 0 \quad (2.0.3)$$

$$\Rightarrow 8x - 4 = 0 \quad (2.0.4)$$

$$\Rightarrow x = 0.5 \quad (2.0.5)$$

Now, to know that $x=0.5$ is maxima or minima, we calculate $f''(x)$

$$\frac{d^2 f(x)}{dx} = 8 \quad (2.0.6)$$

$$(2.0.7)$$

$\because \frac{d^2 f(x)}{dx} > 0$, therefore, we can conclude that $x=0.5$ is a minima.

Value of $f(x)$ at $x=0.5$ is

$$f(0.5) = 4(0.5)^2 - 4(0.5) + 4 \quad (2.0.8)$$

$$= 4(0.25) - 2 + 4 = 3 \quad (2.0.9)$$

Figure 1 shows plot of parabola obtained from python code:

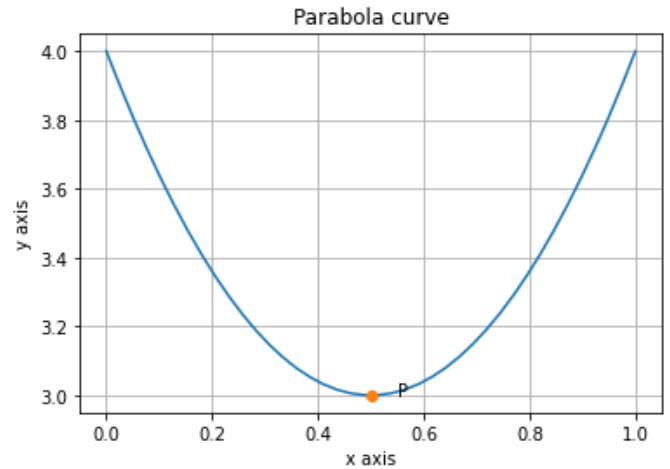


Fig. 1: Plot obtained from python code