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CS412 Machine Learning - 2023
HW3-Gradient Descent
50pts

50pts - We are trying to minimize a function F(x) = x2 - 10x +5   with respect to its parameter x.
In other words we want to find the x for which f(x) is minimum.

Starting from the point x=10 use steepest descent algorithm for TWO steps to find the local minimum of the function around this point. You should use a "step size" of a = 0.1 in update, as: x =x – a x ∇

We will use a subscript to indicate the subsequent values of x, starting from x0.

Worksheet:

F(x0) = 5   : Just to note at what F value we start (5pts)

Explanation: This answer is obtained by plugging in the initial value of × (×0 = 10) into the function F(x) = ×^2 - 10x + 5. So, F(x0) = (10)^2 - 10(10) + 5 = 5.

∇F= 2x-10   : Compute the gradient (10pts)
Explanation: The gradient of the function F(x) is computed. Since F(x) = x^2 - 10x + 5, we have ∇F = (dF/dx) = 2x - 10.
Note: Even though F is a function of a single variable, you can still write/think of the gradient as a vector of size one.

∇F | x0 = 10   : This is the gradient evaluated at x0 (10pts)
explanation : gradient. The gradient of F(x) is 2x - 10, which means
that it is a linear function that increases as x increases. At ×=10, the gradient is VF | x0 = 2(10) - 10 = 10.
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x1= 9   :Update x0 to find x1 (5pts)

explanation: x1 = x0 - α ∇F| x0 and In this case, we're given that α = 0.1, x0 = 10, and we've already computed ∇F| x0 = 10. Substituting these values, we get:

x1 = 10 - 0.1 * 10 = 9

F(x1) = -4   : just checking to see if we are indeed minimizing

Explanation:
to find the corresponding value of F(x1), we plug in x1 = 9 into the function F(x) = x^2 - 10x + 5:
F(x1) = (9)^2 - 10(9) + 5 = -4
So, F(x1) is -4 because that's the value of the function when evaluated at x1 = 9.

Now do the 2nd step similarly and write your results below (no partial so be careful please): :20pts

ANSWER: x2 (x after 2 steps of gradient descent)= 8.2   f(x2) = -9.76

Submission: Write the ANSWER line as inline submission to homework and attach the filled page as a pdf document to Sucourse.