DS 501: STATISTICAL AND MATHEMATICAL METHODS FOR DATA SCIENCE
QUIZ 4
December 05, 2019.

Problem

$f(\mathbf{w}) = -w_0^2 + w_1^3 + w_2^2$
Given the initial point (-1,1,2), show one iteration of gradient descent when learning rate is set to 0.5

Solution

$$\mathbf{w}^t \leftarrow \mathbf{w}^{t-1} + \eta \nabla_{\mathbf{w}} f(\mathbf{w}^{t-1})$$

Here t denotes the iteration number.

$$\nabla_{\mathbf{w}} f(\mathbf{w}) = \begin{bmatrix} -2w_0 \\ 3w_1^2 \\ 2w_2^2 \end{bmatrix}$$

The final solution is then (considering that we have the initial point at iteration zero):

$$\mathbf{w}^1 \leftarrow \begin{bmatrix} -1 \\ 1 \\ 2 \end{bmatrix} + 0.5 \begin{bmatrix} -2(-1) \\ 3(1) \\ 2(2) \end{bmatrix}$$

So the new weights are given by:

$$\begin{bmatrix} 0 \\ \frac{5}{2} \\ 4 \end{bmatrix}$$