Gradient Descent

Created	@August 2, 2025
Edited	@August 2, 2025 9:43 PM
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Definition:

It is an optimization algorithm used for minimizing the loss function in various machine learning algorithms. It is used for updating the parameters of the learning model.

Model optimization:

Optimization refers to determining the best parameters for a model, such that the loss function of the model decreases, as a result of which the model can predict more accurately.

The algorithm we use is Gradient Descent.

w = w - L*dw

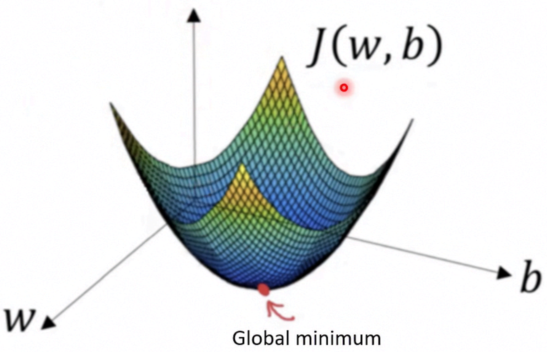
b = b - L*db

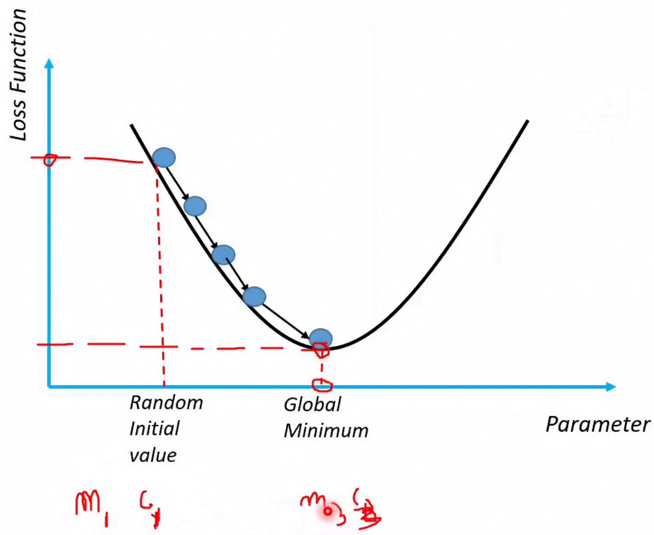
w --> weight
b --> bias
L --> Learning Rate

dw --> Partial Derivative of loss function with respect to m

db --> Partial Derivative of loss function with respect to c

Gradient Descent in 3 Dimension





Implementation:

$$m = m - LD_m$$

$$c = c - LDc$$

m --> slope
c --> intercept
L --> Learning Rate

D_m --> Partial Derivative of loss function with respect to m

D_c --> Partial Derivative of loss function with respect to c

Learning rate is the magnitude if the change of the arrow ⟶ from (m1, c1) to (m2, c2)

$$D_m = \frac{\partial(Cost\ Function)}{\partial m} = \frac{\partial}{\partial m}\left(\frac{1}{n}\sum_{i=0}^{n}\left(y_i - y_{i\,pred}\right)^2\right)$$

$$= \frac{1}{n}\frac{\partial}{\partial m}\left(\sum_{i=0}^{n}\left(y_i - (mx_i + c)\right)^2\right)$$

$$= \frac{1}{n}\frac{\partial}{\partial m}\left(\sum_{i=0}^{n}\left(y_i^2 + m^2x_i^2 + c^2 + 2mx_ic - 2y_imx_i - 2y_ic\right)\right)$$

$$= \frac{-2}{n}\sum_{i=0}^{n} x_i\left(y_i - (mx_i + c)\right)$$

$$= \frac{-2}{n}\sum_{i=0}^{n} x_i\left(y_i - y_{i\,pred}\right)$$

$$D_c = \frac{\partial(Cost\ Function)}{\partial c} = \frac{\partial}{\partial c}\left(\frac{1}{n}\sum_{i=0}^{n}\left(y_i - y_{i\,pred}\right)^2\right)$$

$$= \frac{1}{n}\frac{\partial}{\partial c}\left(\sum_{i=0}^{n}\left(y_i - (mx_i + c)\right)^2\right)$$

$$= \frac{1}{n}\frac{\partial}{\partial c}\left(\sum_{i=0}^{n}\left(y_i^2 + m^2x_i^2 + c^2 + 2mx_ic - 2y_imx_i - 2y_ic\right)\right)$$

$$= \frac{-2}{n}\sum_{i=0}^{n}\left(y_i - (mx_i + c)\right)$$

$$\frac{-2}{n}\sum_{i=0}^{n}\left(y_i - y_{i\,pred}\right)$$