Task-6

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Q1. Calculate/ derive the gradients used to update the parameters in cost function
optimization for simple linear regression.

Ans: Then equation of simple linear regression is

$$\mathbf{y^{\wedge} = mx+c}$$

Where, $y^{\wedge}$ = target/predicted value/target variable
m = slope of the line
x = predictor/feature/independent variable
c= intercept

The cost function or loss function is the difference between actual prediction(y) and model's predicted value(y^).

$$\mathbf{E = 1/n*\sum(y-y^{\wedge})^2}$$

Maths behind gradient descent

Let, Y=actual value b=bias wi=weight or coefficient
X_i= feature
$Y=b+w_1x_1+w_2x_2+\ldots\ldots + w_nx_n$
Math behind Gradient Descent

W=(w0,w1,w2,w3,……wn)
C(w,b)= Cost function involving parameters W and b
dw=d(w,b)/dw[Partial differentiation of cost function wrt weights]
db=d(w,b)/dw[Partial differentiation of cost function wrt bias]
Update parameters w and b.
W=w-(a*dw)
B=b-(a*db)
Cost function
$J(\Theta_0, \Theta_1)= 1/2m \sum_{i=1} [h_0(x_i)-y_i]^2$
Gradient Descent

$\Theta_j = \Theta_j - \alpha d/d\Theta_j J(\Theta_0, \Theta i)$

Q2. What does the sign of gradient say about the relationship between the parameters and
cost function?

Ans: The gradient descent is a powerful optimization algorithm capable of finding optimal solutions to a wide range of problems. The concept of gradient descent is to tweak parameters in order to minimize the cost function.

- When the sign of gradient is positive then the step will decrease
- When the sign of gradient is negative then the step will increase

Q3. Why is Mean squared error taken as the cost function for regression problems?

Ans: Mean Squared Error is used to check how close predictions made by the model are to actual values. It calculates the error as actual prediction and squared the difference to eliminate the negative values. The lower the MSE, the closer is the prediction to actual. In the Regression model a lower MSE indicates a better fit.

Q4. What is the effect of learning rate on optimization, discuss all the cases.

Ans:

The learning rate plays an important role for the optimization.

If the learning rate is too small then the algorithm will have to go through many iterations and will eventually take a long time to reach the minimum.

If the learning rate is too high then the algorithm might fail to reach the minimum.