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19BCE1311

CSE3506 – ESSENTIALS OF DATA ANALYTICS
LAB-9

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Tasks for Week-9: Gradient Descent

Aim: To obtain the value of a and b for y= ax + b using gradient descent method.

Algorithm:

Step 1: Initialize the weights (a & b) with random values and calculate the loss function.

Step 2: Calculate the gradient. This helps us move the values of a & b in the direction in which loss function is minimized.

Step 3: Adjust the weights with the gradients to reach the optimal values where loss function is minimized.

Step 4: Use the new weights for prediction and to calculate the new loss function.

Step 5: Repeat steps 2 and 3 till further adjustments to weights don't significantly reduce the Error.

STATISTICS:

Values using Gradient Descent:

FIELD	VALUE
Optimum Slope	-5.33401243341807
Optimum Intercept	37.2487084651956
Number of iterations	580
Loss function	0.00411973531571587

Values using Linear Regression:

FIELD	VALUE
Intercept	37.285
Slope	-5.344

RESULT:

We can observe that slope and intercept obtained using gradient descent method is almost equal to the values obtained using Linear Regression. Therefore, we have successfully calculated the values of m and c for y= mx + c.

INFERENCE:

Hence, we have obtained the optimal value of the weights m and c.

Program:

```
rm(list=ls())
gd<-function(x,y,m,c,alpha,conv_thr,iter){
  iterations=0
  Lf=0
  while(iterations<=iter){
    y_pred=m*x+c
    Lf_new=0.5*(sum(y_pred-y)^2)
    m=m-alpha*sum((y_pred-y)*x)
    c=c-alpha*sum(y_pred-y)
    if(abs(Lf-Lf_new)<conv_thr){
      break;
    }
    Lf=Lf_new
    iterations=iterations+1
  }
  return(paste('Optimum Slope',m,"Optimum Intercept",c,"Number of
iterations",iterations,"Loss function",Lf))
}
data<-mtcars
gd(data$wt,data$mpg,32,-0.2,0.005,0.0001,10000)
reg<-lm(data$mpg~data$wt)
reg
```