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Essentials of Data Analytics

Tasks for Week-9: Gradient Descent

AIM:

To Understand the gradient descent following operations/functions on 'mtcars' dataset based on given instructions.

Algorithm:

1. Clear the environmental variables using rm function
2. Create a function named gd for gradient descent with attributes 'x1','x2','y','m1','m2','c','aplha','conv_ther','iter'.
3. Initialize iterations and Lf values with 0.
4. While iterations less than iter.
5. Calculate y_predicted as m1*x1+m2*x2+c
6. New loss function equals 0.5*sum of (difference of y and y_predicted)^2.
7. Calculate gradient descent.
8. Update the values of c and slope using gradient descent function.
9. Check if the value of loss function is less than threshold (Loss function – new loss function) if not break the loop else repeat.
10. Return the optimal, m1 & m2, c, loss.
11. Close the gd function.
12. Retrieve the dataset mtcars.
13. Call the gd function with attributes passed.
14. Compare the results with reg model.

RESULTS:

```
> gd(data$wt,data$hp,data$mpg,-0.2,-0.2,32,0.0000002,0.0000001,1000000)
[1] "Optimum Slope m1 and m2 :  -2.77056594817977 -0.033477391356666 Optimum Intercept :  33.6446952273
715 Loss :  37.3934102824366 Iterations :  1000001"
> reg<-lm(data$mpg~data$wt+data$hp)
> reg

Call:
lm(formula = data$mpg ~ data$wt + data$hp)

Coefficients:
(Intercept)      data$wt      data$hp
   37.22727     -3.87783     -0.03177
```

INFERENCE:

The values of the gradient decent are almost similar to Linear Regression model so the gradient decent can be acceptable.

CODE:

```
rm(list=ls())
gd<- function(x1,x2,y,m1,m2,c,alpha,conv_thr,iter){
iterations=0
Lf<-0
while(iterations<iter){
y_p=m1*x1+m2*x2+c
Lf_new<-0.5*sum(y_p-y)^2
m1=m1-alpha*sum((y_p-y)*x1)
m2=m2-alpha*sum((y_p-y)*x2)
c=c-alpha*sum(y_p-y)
if(abs(Lf-Lf_new)<=conv_thr){
break
}
Lf=Lf_new
iterations=iterations+1
}
return(paste("Optimal Intercept ",c,"Optimal slope one ",m1,"Optimal slope two ",m2))
}
data<-mtcars
View(data)
gd(data$wt,data$hp,data$mpg,-0.2,-0.4,32,0.001,0.00001,10000)
```

```
lr<-lm(data$mpg~(data$wt+data$hp))
lr
```