VIT®

Vellore Institute of Technology

(Deemed to be University under section 3 of UGC Act, 1956)

Essentials of Data Analytics - (CSE3506)

Faculty – Lakshmi Pathi Jakkamputi **Sir**

Lab-9

Harshanth k Prakash

19BCE1293

L21-22 **Slot**

Tasks for Week-9: Gradient Descent

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

AIM

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

Algorithm

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

Result

Dataset: mtcars

	mpg	cyl	disp	hp	drat	wt	qsec	vs	am	gear	carb
Mazda RX4	21.0	6	160.0	110	3.90	2.620	16.46	0	1	4	4
Mazda RX4 Wag	21.0	6	160.0	110	3.90	2.875	17.02	0	1	4	4
Datsun 710	22.8	4	108.0	93	3.85	2.320	18.61	1	1	4	1
Hornet 4 Drive	21.4	6	258.0	110	3.08	3.215	19.44	1	0	3	1
Hornet Sportabout	18.7	8	360.0	175	3.15	3.440	17.02	0	0	3	2
Valiant	18.1	6	225.0	105	2.76	3.460	20.22	1	0	3	1
Duster 360	14.3	8	360.0	245	3.21	3.570	15.84	0	0	3	4
Merc 240D	24.4	4	146.7	62	3.69	3.190	20.00	1	0	4	2
Merc 230	22.8	4	140.8	95	3.92	3.150	22.90	1	0	4	2
Merc 280	19.2	6	167.6	123	3.92	3.440	18.30	1	0	4	4
Merc 280C	17.8	6	167.6	123	3.92	3.440	18.90	1	0	4	4
Merc 450SE	16.4	8	275.8	180	3.07	4.070	17.40	0	0	3	3
Merc 450SL	17.3	8	275.8	180	3.07	3.730	17.60	0	0	3	3

```
> gd(data1$wt, data1$mpg, -0.2, 32, 0.001, 0.00001, 2000)
[1] "Optimal intercept: 37.237325707781 Optimal slope: -5.3307433132084 Loss function 0.0135830640690634"
> reg <- lm(data1$mpg~data1$wt)
> reg

Call:
lm(formula = data1$mpg ~ data1$wt)

Coefficients:
(Intercept)     data1$wt
     37.285       -5.344

> |
```

Inference

Using the gradient descent

- Slope: -5.3307433132084
- Intercept: 37.237325707781
- Loss function: 0.0135830640690634

Using Regression model

- Slope: -5.344
- Intercept: 37.285

Program

```
rm(list = ls())
gd <- function(x, y, m, c, alpha, conv_thr, iter) {
  plot(x, y, col = "blue", pch = 20)
  iterations <- 0
  Lf <- 0
  while(iterations <= iter) {
    y_p = m*x+c
    Lf_new <- sum(y_p-y)^2
    m = m-alpha*sum((y_p-y)*x)
    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:", m,'Loss function',Lf))
}

data1 <- mtcars
View(data1)
gd(data1$wt, data1$mpg, -0.2, 32, 0.001, 0.00001, 1000)
reg <- lm(data1$mpg~data1$wt)
reg
```