EXPERIMENT-8

Problem Statement: To implement linear and multiple regression on 'mtcars' dataset to estimate the value of 'mpg' variable, with best R2 and plot the original values in 'green' and predicted values in 'red'

Theoretical Background:

Regression analysis is a very widely used statistical tool to establish a relationship model between two variables. One of these variable is called predictor variable whose value is gathered through experiments. The other variable is called response variable whose value is derived from the predictor variable.

Im() function:

This function creates the relationship model between the predictor and the response variable.

Syntax

The basic syntax for Im() function in linear regression is -

Im(formula,data)

Following is the description of the parameters used -

- formula is a symbol presenting the relation between x and y.
- data is the vector on which the formula will be applied.

abline() function:

Itis used to add one or more straight lines to a graph. The abline() function can be used to add vertical, horizontal or regression lines to plot.

abline(a, b, h, v, col, lwd)

Parameters:

a, b: It specifies the intercept and the slope of the line

h: specifies y-value for horizontal line(s)

v: specifies x-value(s) for vertical line(s)

col: optional color parameter for the line

lwd: optional line width parameter for the line

pasteO() function:

The pasteO() is a built-in R function used to concatenate all elements without a separator. The pasteO() function accepts one or more R objects as arguments and optional collapse argument.

summary() function:

The summary() function is a generic function used to produce result summaries of the results of various model fitting functions.

mtext() function :

The mtext() function is used to write text in one of the four margins of the current figure region or one of the outer margins of the device region.

mtext(text, side, line)

- **text**: A character or an expression vector specifying the text to be written.
- side: on which side of the plot (1 = bottom, 2 = left, 3 = top, 4 = right)
- line: on which margin line starting at 0 counting outwards.

Simple Linear Regression on mtcars dataset

```
View(mtcars)
plot(mpg ~ wt, data= mtcars, col=2)
fit <-lm(mpg ~ wt, data= mtcars)</pre>
summary(fit)
##A residual is a measure of how far away a point is vertically
from the regression line.
##Simply, it is the error between a predicted value and the
observed actual value
##The intercept (often labeled the constant) is the expected mean
value of Y
##when all X=0. Start with a regression equation with one
predictor, X.
##If X sometimes equals 0, the intercept is simply the expected
mean value of Y at that value. ...
##It's the mean value of Y at the chosen value of X.
abline(fit,col=3,lwd=2) #We could add a line to our first plot to
show the predicted mpg:
bs<-round(coef(fit), 3)</pre>
print(bs)
lmlab <- paste0("mpg = ", bs[1], ifelse(sign(bs[2])==1, " + ", "</pre>
-"), abs(bs[2]), " wt ")
mtext(lmlab, 3, line=-2) #we add it to the plot using mtext
```

Output

```
Call:
lm(formula = mpg ~ wt, data = mtcars)

Residuals:
```

```
Min 1Q Median 3Q Max

-4.5432 -2.3647 -0.1252 1.4096 6.8727

Coefficients:

Estimate Std. Error t value Pr(>|t|)

(Intercept) 37.2851 1.8776 19.858 < 2e-16 ***

wt -5.3445 0.5591 -9.559 1.29e-10 ***

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Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

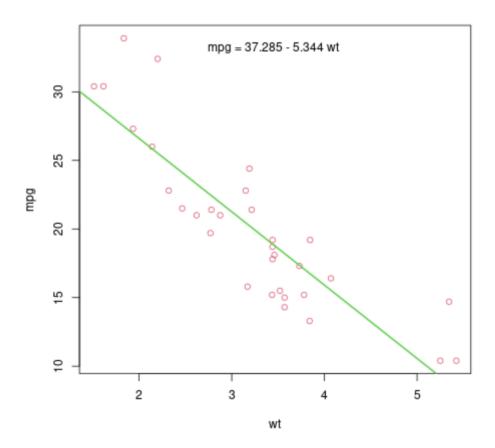
Residual standard error: 3.046 on 30 degrees of freedom

Multiple R-squared: 0.7528, Adjusted R-squared: 0.7446

F-statistic: 91.38 on 1 and 30 DF, p-value: 1.294e-10

(Intercept) wt

37.285 -5.344
```



Multiple Linear Regression on mtcars dataset

```
input <- mtcars[,c("mpg","disp","hp","wt")]
print(head(input)

model <-lm(mpg~disp+hp+wt, data= input)

# Show the model.
print(model)

# Get the Intercept and coefficients as vector elements.
cat("# # # # The Coefficient Values # # # ","\n")

a <-coef(model)[1]
print(a)

Xdisp <-coef(model)[2]
Xhp <-coef(model)[3]
Xwt <-coef(model)[4]

print(Xdisp)
print(Xhp)
print(Xwt)</pre>
```

Output

```
mpg disp hp wt
Mazda RX4
               21.0 160 110 2.620
Mazda RX4 Wag
               21.0 160 110 2.875
               22.8 108 93 2.320
Datsun 710
Hornet 4 Drive
               21.4 258 110 3.215
Hornet Sportabout 18.7 360 175 3.440
Valiant
         18.1 225 105 3.460
Call:
lm(formula = mpg ~ disp + hp + wt, data = input)
Coefficients:
(Intercept)
                 disp hp wt
 37.105505 -0.000937 -0.031157 -3.800891
# # # # The Coefficient Values # # #
(Intercept)
```

37.10551			
disp			
-0.0009370091			
hp			
-0.03115655			
wt			
-3.800891			