Godavari College of Engineering, Jalgaon

Subject Name: Machine Learning

Practical No: 01 Date:

Title: Regression Analysis and Plot interpretation.

Aim: Study and implementation of Regression Analysis and plot interpretation.

Theory:

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.

In Linear Regression these two variables are related through an equation, where exponent (power) of both these variables is 1. Mathematically a linear relationship represents a straight line when plotted as a graph. A non-linear relationship where the exponent of any variable is not equal to 1 creates a curve.
The general mathematical equation for a linear regression is-

$$y=ax+b$$

Following is the description of the parameters used −

- **y** is the response variable.
- **x** is the predictor variable.
- **a** and **b** are constants which are called the coefficients.

Steps to Establish a Regression:

A simple example of regression is predicting weight of a person when his height is known. To do this we need to have the relationship between height and weight of a person.

The steps to create the relationship is-

- Carry out the experiment of gathering a sample of observed values of height and corresponding weight.
- Create a relationship model using the **lm()** functions in R.
- Find the coefficients from the model created and create the mathematical equation using these

- Get a summary of the relationship model to know the average error in prediction. Also called **residuals**.
- To predict the weight of new persons, use the **predict()** function in R.

lm() Function

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

Syntax:

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

lm(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.

Predict() Function

The basic syntax for predict() in linear regression is-

predict(object, newdata)

Following is the description of the parameters used-

- **object** is the formula which is already created using the lm() function.
- **newdata** is the vector containing the new value for predictor variable.

Source Code:

```
# Values of height
151, 174, 138, 186, 128, 136, 179, 163, 152, 131

# Values of weight.

63, 81, 56, 91, 47, 57, 76, 72, 62, 48


#Apply the lm() function

relation ← lm(y~x)
print(relation)

#get the summary of relatonship
print(summary(relation))
```

#Find weight of person with height 170
a ← data.frame(x=170)
result ← predict(relation, a)
print(result)

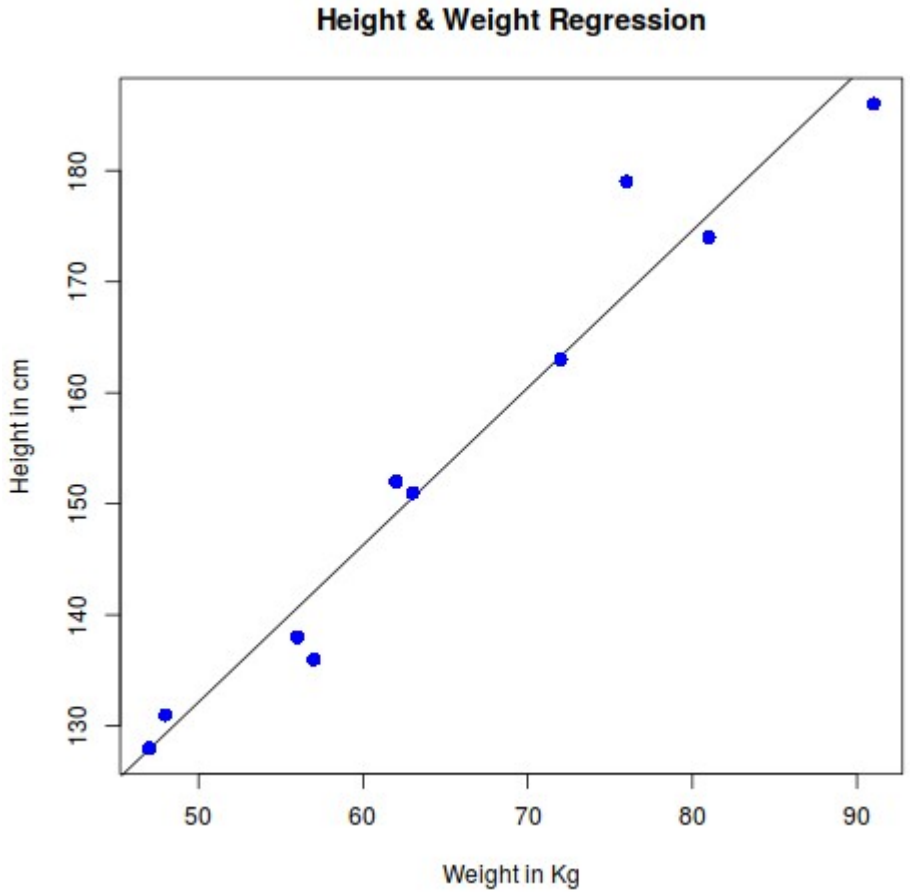
#Give the chart file a name
png(file = “linearregression.png”)

#Plot the Chart
plot(y,x,col = “blue”, main=”Height & Weight Regression”,
abline(lm(x~y)), cex = 1.3, pch = 16, xlab = “Weight in kg”, ylab = “Height in cm”)

#Save the file
dev.off()

Output:

```
> x <- c(151,174,138,186,128,136,179,163,152,131)
> y <- c(63,81,56,91,47,57,76,72,62,48)
> relation <- lm(y~x)
> print(relation)

Call:
lm(formula = y ~ x)

Coefficients:
(Intercept)            x
   -38.4551       0.6746

> print(summary(relation))

Call:
lm(formula = y ~ x)

Residuals:
    Min      1Q  Median      3Q     Max
-6.3002 -1.6629  0.0412  1.8944  3.9775

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept) -38.45509    8.04901  -4.778  0.00139 **
x             0.67461    0.05191  12.997 1.16e-06 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 3.253 on 8 degrees of freedom
Multiple R-squared:  0.9548,    Adjusted R-squared:  0.9491
F-statistic: 168.9 on 1 and 8 DF,  p-value: 1.164e-06

> #find weight of a person with height 170.
> result <- predict(relation, a)
> print(result)
       1
76.22869
> # Give the chart file a name.
> png(file = "linearregression.png")
> # Plot the chart.
> plot(y,x,col = "blue",main = "Height & Weight Regression", abline(lm(x~y)),cex=1.3,pch=16,xlab="Weight in Kg",ylab="Height in cm")
> # Save the file.
> dev.off()
png
  2
```


Height & Weight Regression
Height in cm
130
140
150
160
170
180
50
60
70
80
90
Weight in Kg

Conclusion: