

## MACHINE LEARNING

### CLASS ACTIVITY:

Q.2 Solve the following problems based on regression.

a) From the following data find the regression equations and further estimated if  $x = 16$  find  $y$ . If  $y = 18$  find  $x$ .

$x$	$y$	$x - \bar{x}$	$y - \bar{y}$	$(x - \bar{x})^2$	$(x - \bar{x})(y - \bar{y})$
3	12	-5	-3	25	15
4	11	-4	-4	16	16
6	15	-2	0	4	0
10	16	2	1	4	2
12	19	4	4	16	16
13	17	5	2	25	10
				$\Sigma = 90$	$\Sigma = 59$

$$\bar{x} = 8 \quad \bar{y} = 15$$

$$m = \frac{\sum (x - \bar{x})(y - \bar{y})}{\sum (x - \bar{x})^2} = \frac{59}{90} = 0.655$$

$$y = mx + c \quad \dots \text{Line Equation}$$

$$15 = (0.655)(8) + c$$

$$\therefore c = 15 - (0.655)(8)$$

$$\therefore c = 15 - 5.24$$

$$\therefore c = 9.76$$

$$\text{Regression Eq.} \Rightarrow y = 0.655x + 9.76$$

Case 1:  $x = 16$  and find  $y$ .

$$y = mx + c$$

$$= (0.655)(16) + 9.76$$

$$y = 20.24$$

Case 2:  $y = 18$  and find  $x$ .

$$y = mx + c$$

$$18 = (0.655)x + 9.76$$

$$8.24 = (0.655)x$$

$$x = 12.58$$

b) Following data represents the marks in Algebra ( $x$ ) and Geometry ( $y$ ). It is collected from a group of 10 students. Find regression equation and estimate if  $x = 78$  and predict  $x$  if  $y = 94$ .

$x$	$y$	$(x - \bar{x})$	$(y - \bar{y})$	$(x - \bar{x})^2$	$(x - \bar{x})(y - \bar{y})$
75	82	-5.3	0.1	28.09	-0.53
80	78	-0.3	-3.9	0.09	1.17
93	86	9.7	4.1	161.29	52.07
65	72	-15.3	-9.9	234.09	151.47
87	91	6.7	9.1	76.49	60.97
71	80	-9.3	-1.9	86.49	17.67
98	95	17.7	13.1	313.29	231.87
68	72	-12.3	-9.9	151.29	121.77
89	89	8.7	7.1	75.69	61.77
77	74	-3.3	-7.1	10.89	26.07

$$\bar{x} = 80.3 \quad \bar{y} = 81.9$$

$$m = \frac{\sum (x - \bar{x})(y - \bar{y})}{\sum (x - \bar{x})^2}$$

$$= \frac{1106.1}{1106.1}$$

$$= \frac{724.3}{1106.1} = 0.654$$

$$\leftarrow y = mx + c$$

$$c = y - mx$$

$$= 81.9 - (0.654) 80.3$$

$$= 29.7052$$

$$= 29.3838$$

$$\text{Regression Eq} \Rightarrow y = 0.654x + 29.3838$$

Case 1:

estimate  $y$ ;  $x = 78$

$$y = (0.654)(78) + 29.3838$$

$$= 51.012 + 29.3838$$

$$= 80.395$$

Case 2:  $y = 94$  find  $x$ .

$$94 = (0.654)x + 29.3838$$

$$x = 98.802$$

(Q.3) Write a short note on regression based on following points.

Definition : i) Regression analysis is a statistical method of analysis which is used to understand the relationship between two or more variables of interest.

ii) It defines a relationship between a dependent variable and one or more independent variables often known as predictors.

### Linear Regression:

- i) Linear regression is a technique of predictive modelling which helps in investigating a linear relationship between a dependent and one or more independent variables.
- ii) Linear regression can create a predictive model on apparently random data, showing trends in data.

### Equation of Linear Regression:

$$y = mx + c$$

where  $y$  = dependent variable

$m$  = slope of relationship

$x$  = independent variable

$c$  = intercept of dependent variable

Application area where linear regression can be used

a) Evaluate trends and estimate forecasts

If a company's sale is have increased steadily over few months, by conducting a linear analysis on sales, the company could format forecast sales in future months.

b) Risk analysis by credit card company.

The analyzing the past records, the company can analyzing safe  $\rightarrow$  cibil score range to make sure no customer can access their services that are potential to be defaulter.