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Machine learning Assignment.

Ans I $(x-\bar{x})(y-\bar{y})$	Month	(x) production $ million	$x-\bar{x}$	electric usage	$y-\bar{y}$	$(x-\bar{x})^2$
0.1372	JAN	4.51	-0.375	2.48	-0.365	0.1406
0.7845	FEB	3.58	-1.305	2.26	-0.585	1.703
0.2161	MAR	4.31	-0.575	2.47	-0.375	0.0306
-0.013	APR	5.06	0.175	2.77	-0.758	0.0306
0.108	MAY	5.64	0.755	2.99	0.1442	0.57
0.021	JUN	4.99	0.105	3.05	0.2042	0.011
0.1353	JUL	5.29	0.405	3.18	0.3342	0.164
0.58	AUG	5.83	0.945	3.41	0.6142	0.8930
-0.03	SEP	4.70	-0.185	3.03	0.1842	0.0340
-0.0003	OCT	5.61	0.725	3.26	0.4142	0.5256
-0.0026	NOV	4.90	0.015	2.67	-0.1758	0.0002
0.2163	DEC	4.20	-0.685	2.53	-0.3158	0.4692
2.4305		58.62		34.15		4.8723

For Regression line

$$m = \frac{\sum (x-\bar{x})(y-\bar{y})}{\sum (x-\bar{x})^2} = \frac{2.4305}{4.8723} = 0.4988$$

$\bar{x} = 4.885$

$\bar{y} = 2.845$

$\bar{y} = m\bar{x} + c$

$2.845 = 0.4988 \times 4.8723 + c$

$c = 0.4145$

$Y = 0.4988X + 0.4145$

(b) when $x = 6.25$ $y = ?$

$$y = 0.49985 \times 6.25 + 0.41145$$

$$y = 3.5385$$

Q2

x	y	$(x-\bar{x})$	$(y-\bar{y})$	$(x-\bar{x})(y-\bar{y})$	$(x-\bar{x})^2$
0	2	-2	-2	4	4
1	3	-1	-3	3	1
2	5	0	1	0	0
3	4	1	0	0	1
4	6	2	2	4	4
				11	10

$\bar{x} = 2$ $\bar{y} = 4$

$$m = \frac{11}{10} = 1.1$$

$\bar{y} = m\bar{x} + c$

$4 = 1.1 \times 2 + c$

$4 - 2.2 = c$

$c = 1.8$

$y = 1.1x + 1.8$

(b) If $x = 10$ $y = ?$

$y = 1.1 \times 10 + 1.8$

$y = 11 + 1.8$

$y = 12.8$

Q3 =

x	y	$(x-\bar{x})$	$(y-\bar{y})$
2005	12	-8030	-130
2006	19	-8029	-1
2007	29	-8028	0
2008	37	-8027	2
2009	45	-8026	2

$\bar{x} = \frac{10035}{5} = 2007$

$\bar{y} = \frac{142}{5} = 28.4$

$\bar{x} = 2007$

$\bar{y} = 28.4$

$(x-\bar{x})$	$(y-\bar{y})$	$(x-\bar{x})(y-\bar{y})$	$(x-\bar{x})^2$
-2	-16.4	32.8	4
-1	-9.4	9.4	1
0	0.6	0	0
1	8.6	8.6	1
2	16.6	33.2	4
		84	10

$m = \frac{84}{10} = 8.4$

$\bar{y} = m\bar{x} + c \quad / \quad 28.4 = 8.4 \times 2007 + c$

$c = -16830.4$

$y = 8.4x - 16830.4$

(b) if $x = 2012$ $y = ?$

$y = 8.4 \times 2012 - 16830.4$

$y = 70.4$

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Q4 Ans

Total = 19

predicted dogs = 17

Acheal dogs = 17 + 3 = 4

$$A = \frac{Tp}{TP+FP} = \frac{4}{17}$$ Ans

Q5 =

		Predicted NO	Predicted yes
	Achal NO	Tn = 50	Fp = 10
	Acahal yes	Fn = 5	Tp = 100

$$\text{Accuracy} = \frac{TP+TN}{\text{Total}} = \frac{100+50}{165} = \frac{150}{165}$$

$$= 0.90$$

$$\text{Precision} = \frac{Tp}{TP+FP} = \frac{100}{100+10} = \frac{100}{110} = 0.90$$

$$\text{Recal} = \frac{TP}{TP+FN} = \frac{100}{100+5} = \frac{100}{105} = 0.95$$

$$\text{F score} = \frac{2Pr}{P+r} = \frac{2 \times \frac{100}{110} \times \frac{100}{105}}{\frac{100}{110} + \frac{100}{105}}$$

$$= \frac{2 \times 10000}{110 \times 105} \times \frac{105 \times 110}{100 \times 105 + 110 \times 100} = \frac{200}{215} = 0.93$$ Ans

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Q6 Ans

Ulum is painting and 4%.

$P(E_1)P(\overline{E_1}) = \frac{15\times4}{30\times100} = \frac{3}{5\times30}$

similarly 5 4@% $= \frac{5\times6}{30\times100} = \frac{3}{10\times30}$

10 4$\frac{3}{3}$% $= \frac{10\times3}{30\times100} = \frac{3}{10\times30}$

So $= \frac{\frac{3}{5\times30}}{\frac{1}{30}\left(\frac{3}{5}+\frac{3}{10}+\frac{3}{10}\right)} = \frac{\frac{3}{5}}{\frac{3}{5}+\frac{3}{5}} = \frac{1}{2}$ or 50% Ans

Q8

	F1	F2	class	
{	1	1	A	} Ulum F1 = 10
	2	3	A	} F2 = 7
	2	4	A	
	5	3	A	D(x, i) = 10.81 (N8)
	8	6	B	D(x, ii) = 8.94 (N7)
	8	8	B	D(x, iii) = 8.54 (N6)
	9	6	B	D(x, iv) = 6.40 (N5)
	11	7	B	D(x, v) = 2.23 (N4)
	(10)	(7)		D(x, vi) = 2.23 (N3) B
				D(x, vii) = 1.414 (N2) B
				D(x, viii) = 1 (N1) B

So (F1=10, F2=7) is of Class 'B'

Imp Q. what is outliers & its effect

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Ans 9

Ingredient	Sweet	Crunch	Food Type
Grapes	8	5	Fruit
Green bean	3	7	Vegetable
Nuts	3	6	Protein
Orange	7	3	Fruit
Tomato	(6)	(4)	

$D(x_i, x) = 2.23$ Fruit (N2) ✓
$D(x_i, ii) = 4.24$ Veg (N4) (let K = 3)
$D(x_i, iii) = 3.6$ protein (N3) ✓
$D(x_i, iv) = 1.414$ fruit (N1) ✓

So tomato is a 'fruit'

Ans 8

$D(x_i, i) = \sqrt{(120-125)^2} = 5$ (N2) ✓ NO
$D(x_i, ii) = \sqrt{(120-100)^2} = 20$ (N3) ✓ NO
$D(x_i, iii) = \sqrt{(120-70)^2} = 50$ (N8)
$D(x_i, iv) = \sqrt{(120-120)^2} = 0$ (N1) ✓ No
$D(x_i, v) = \sqrt{(120-95)^2} = 25$ (N4)

let K = 3

$D(x_i, vi) = \sqrt{(120-60)^2} = 60$ (N9)
$D(x_i, vii) = \sqrt{(120-220)^2} = 100$ (N10)
$D(x_i, viii) = \sqrt{(120-85)^2} = 35$ (N6)
$D(x_i, ix) = \sqrt{(120-75)^2} = 45$ (N7)
$D(x_i, x) = \sqrt{(120-90)^2} = 30$ (N5)

So value of Evade is 'NO'.

$-16.38x_1 - 11x_2 = 0$ | $16.38x + 11x_2 = 0$

$-11x_1 - 7.38x_2 = 0$ | $11x_1 + 7.38x_2 = 0$

DIP

Date 23/9

$$MF(x,y) = 1 - e^{-\frac{D^2(u,v)}{2\sigma^2}}$$

Date (M.L)
28/9/

Solving PCA numerical

1. Get the Data.
2. Calculate the mean and subtract the mean from data.
3. compute the covariance matrix.
4. Calculate eigen values & eigen vectors.
5. Derive the new data.

x	y	$(x-\bar{x})$	$(y-\bar{y})$	$(x-\bar{x})(y-\bar{y})$	$(x-\bar{x})^2$	$(y-\bar{y})^2$
4	11	-4	0	0	16	0
8	4	0	-7	0	0	49
13	15	5	4	20	25	16
7	14	-1	3	-3	1	9
		0	0	17	42	74

$\bar{x} = 8$ $\bar{y} = 11$

$\frac{17}{4} = 4.25$ $\frac{42}{4} = 10.5$ $\frac{74}{4} = 18.5$

$$\begin{bmatrix} cov(x,x) & cov(x,y) \\ cov(x,y) & cov(y,y) \end{bmatrix} = \begin{bmatrix} 10.5 & 4.25 \\ 4.25 & 18.5 \end{bmatrix}$$

eigen values.

$$\begin{bmatrix} 10.5-\lambda & 4.25 \\ 4.25 & 18.5-\lambda \end{bmatrix} = 0$$

$$(10.5-\lambda)(18.5-\lambda) - (4.25)^2 = 0$$

$$\lambda^2 - (18.5+10.5)\lambda + 18.5 \times 10.5 = (4.25)^2$$

$$\lambda^2 - 29\lambda + 176.875 = 0$$

$$\lambda_1 = 20.33$$

$$\lambda_2 = 8.66$$

$$CV = \lambda_1 V$$

$$\begin{bmatrix} 10.5 & 4.25 \\ 4.25 & 18.5 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = 20.33 \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

$$10.5x_1 + 4.25x_2 = 20.33x_1$$

$$4.25x_1 + 18.5x_2 = 20.33x_2$$

$$4.25x_2 - 9.83x_1 = 0 \quad / \quad 4.25x_1 - 1.83x_2 = 0$$

$$x_2 = \frac{9.83x_1}{4.25}$$

$$x_1 = \frac{1.83}{4.25} x$$

$x_1 = \frac{4.25}{9.83} x_2$ let $x_2 = 1$

$x_1 = 0.43$

$x_2 = \frac{4.25}{1.83} \times 0.43$ $\therefore \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} 0.43 \\ 1 \end{bmatrix}$

$x_2 = 0.99 \simeq 1$

Now $\begin{bmatrix} \frac{0.43}{\sqrt{(0.43)^2+(1)^2}} \\ \frac{1}{\sqrt{(0.43)^2+(1)^2}} \end{bmatrix} = \begin{bmatrix} 0.39 \\ 0.91 \end{bmatrix}$

$$\begin{bmatrix} 10.5 & 4.25 \\ 4.25 & 18.5 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = 8.66 \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

$10.5 x_1 + 4.25 x_2 = 8.66 x_1$

$4.25 x_2 = -1.84 x_1$ let $x_1 = 1$

$x_2 = \frac{-1.84}{4.25}$

$x_2 = -0.432$ $\begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} -0.432 \\ 1 \end{bmatrix}$

$$f = e_1^T \begin{bmatrix} (x-\bar{x}) \\ y-\bar{y} \end{bmatrix}$$

$$f = [0.39 \quad 0.91] \begin{bmatrix} -4 & 0 & 5 & -1 \\ 0 & -7 & 4 & 3 \end{bmatrix}$$

(PC1)

$$f = \begin{bmatrix} -1.56 & -6.37 & 5.59 & -0.73 \end{bmatrix}$$

(principal component) →