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CSE-2

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Machine Learning

Assignment-3

① Target Classes (Job offer) - Yes / No

$N(A)$ = Number of occurrences of A

for Job offer,

$$N(\text{Yes}) = 7 \quad \& \quad N(\text{No}) = 3$$

$$\therefore P(\text{Yes}) = \frac{7}{7+3} = \frac{7}{10} \quad \& \quad P(\text{No}) = \frac{3}{7+3} = \frac{3}{10} \rightarrow \textcircled{\text{I}}$$

[Probability of Yes]

[Probability of No]

Lookup tables -

for CGPA: It is a continuous variable.

\therefore Apply Gaussian Naive Bayes (considering distribution as Gaussian)

$$\text{mean, } \mu = \frac{\sum_{i=1}^n (\text{CGPA})_i}{n}$$

[n = No. of instances in dataset of particular class label]

$$\mu(\text{CGPA})_{\text{yes}} = \frac{61.7}{107}$$

\Rightarrow

$$\mu_{\text{yes}} = 8.81$$

$\rightarrow \textcircled{\text{II}}$

for CGPA

Standard deviation,

$$\sigma = \sqrt{\frac{\sum_{i=1}^n (x_i - \mu)^2}{n-1}}$$

$$\begin{aligned} \sigma(\text{CGPA})_{\text{yes}} &= \sqrt{\frac{(9.5-8.81)^2 + (8.2-8.81)^2 + (8.4-8.81)^2 + (9.1-8.81)^2 + (9.6-8.81)^2 + (8.6-8.81)^2 + (8.3-8.81)^2}{7-1}} \\ &= \frac{2.0287}{6} = 0.3381 \rightarrow \textcircled{\text{III}} \end{aligned}$$

Similarly,

$$\mu(\text{CGPA})_{\text{No}} = \frac{24.4}{3} = 8.13$$

$\rightarrow \textcircled{\text{IV}}$

$$\begin{aligned} \sigma(\text{CGPA})_{\text{No}} &= \sqrt{\frac{(9.3-8.13)^2 + (7.6-8.13)^2 + (7.5-8.13)^2}{3-1}} \\ &= \frac{2.0467}{2} = 1.02335 \rightarrow \textcircled{\text{V}} \end{aligned}$$

(1)

CGPA

	μ	σ
Yes	8.81	$0.3381 \approx 0.34$
No	8.13	1.02

Interactiveness (categorical variable)

	Yes	No \rightarrow Job offer labels
Yes	5/7	1/3
No	2/7	2/3

Interactiveness labels

Test Data: (8.5, Yes)

for CGPA:

$$P(\text{CGPA}=8.5 | \text{Job offer}="Yes") = \frac{1}{0.34 \times \sqrt{2\pi}} e^{-\frac{(8.5-8.81)^2}{2 \times 0.34^2}} = 0.7745$$

Probability density function for Normal distribution.

$$f(x) = \frac{1}{\sigma \sqrt{2\pi}} e^{-\frac{(x-\mu)^2}{2\sigma^2}}$$

$$P(\text{CGPA}=8.5 | \text{Job offer}="No") = \frac{1}{0.34 \times \sqrt{2\pi}} e^{-\frac{(8.5-8.13)^2}{2 \times (0.34)^2}} = 0.6492$$

$$P(\text{Yes} | \text{Test data}) = P(\text{Yes}) * P(\text{CGPA}=8.5 | \text{Job offer}="Yes") * P(\text{Interactiveness}="Yes" | \text{Job offer}="Yes")$$

$$= \frac{7}{10} \times 0.7745 \times \frac{5}{7} = 0.3872$$

$$P(\text{No} | \text{Test data}) = P(\text{No}) * P(\text{CGPA}=8.5 | \text{Job offer}="No") * P(\text{Interactiveness}="No" | \text{Job offer}="No")$$

$$= \frac{3}{10} * 0.6492 * \frac{1}{3} = 0.06492$$

Clearly $P(\text{Yes} | \text{Test data}) > P(\text{No} | \text{Test data})$

\therefore Test data is considered as Job offer = "Yes" class label.

For (CGPA=8.5 & Interactiveness="Yes") \Rightarrow Job Offer="Yes"

Prediction = Yes for job offer Ans,