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Machine Learning
Bayesian Classification & ML Basics

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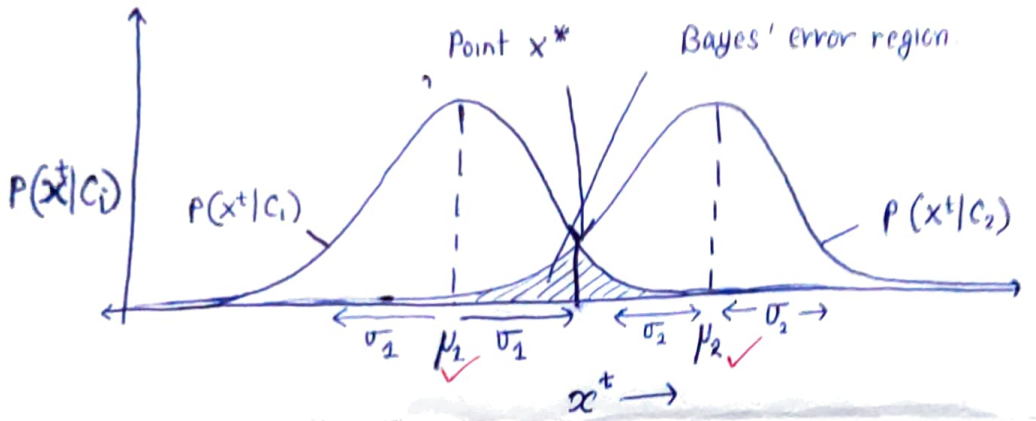
1 b) For $P(X|C_1) \sim N(\mu_1, \sigma_1^2)$ & $P(X|C_2) \sim N(\mu_2, \sigma_2^2)$



x^*, satisfies
$P(x^t|C_1) = P(x^t|C_2)$

x^t = instance t (w/ one attribute)
$P(x^t|C_i)$ = Likelihood / (Class-conditional) probability of x^t given class C_i

2) $P(LC) = 0.01$ ✓, $P(\overline{LC}) = 1 - P(LC) = 0.99$
$P(T|LC)$ 0.90, $P(\overline{T}|LC) = 1 - P(T|LC) = 0.1$
$P(\overline{T}|\overline{LC}) = 0.899$, $P(T|\overline{LC}) = 1 - P(\overline{T}|\overline{LC}) =$ ~~0.101~~ 0.101

A) Now $P(T) = \sum_{i=1}^{K} P(T|C_i) P(C_i)$ (Law of total probability)

Now, $C_1 = LC$, $C_2 = \overline{LC}$. (Not Lung Cancer).

$= P(T|C_1)P(LC) + P(T|\overline{LC})P(\overline{LC})$

$= 0.9 \times 0.01 + 0.101 \times 0.99$

$= \underline{0.10899}$ ✓

2) B) Now, $P(LC|T) = \frac{P(T|LC)P(LC)}{P(T)}$ (Bayes' Rule)

$\Rightarrow P(LC|T) = \frac{0.90 \times 0.01}{0.10899}$

$= \underline{0.08258}$

6

4)

T1 :

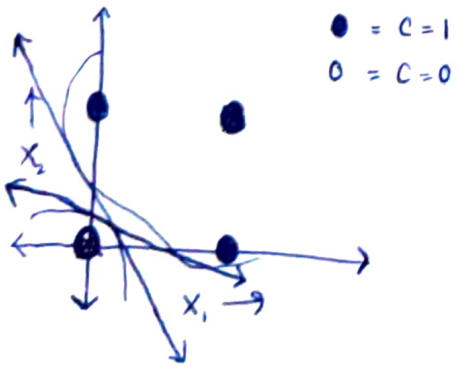
X_1	X_2	C
0	0	0
0	1	1
1	0	1
1	1	1

T2 :

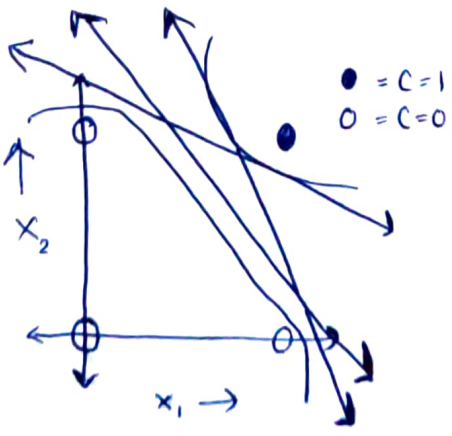
X_1	X_2	C
0	0	0
0	1	0
1	0	0
1	1	1

T3 :

X_1	X_2	C
0	0	0
0	1	1
1	0	1
1	1	0

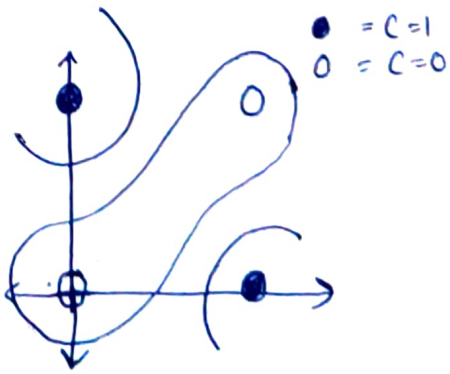


∞ lines through gap b/w decision regions ✓



∞ lines through gap b/w decision regions

3



No lines b/w gap b/w decision regions possible.