

HW 6 - SMAI ROLL_NUMBER - 20171213

Q3.

20171213

PSET-06 - Q-3

(a) $P(w_1) = 7/14 = 0.5$, $P(w_2) = 7/14 = 0.5$

(b) $\mu_{w_1} = \frac{(0,0) + (0,1) + (2,0) + (3,2) + (3,3) + (2,2) + (2,0)}{7}$
 $= (12/7, 8/7) = (1.714, 1.143)$

& $\mu_{w_2} = \frac{(7,7) + (8,6) + (9,7) + (8,10) + (7,10) + (8,9) + (7,11)}{7}$
 $= (7.714, 8.571)$

$\Sigma_1 = \begin{bmatrix} 1.571 & 0.881 \\ 0.881 & 1.476 \end{bmatrix}$, $\Sigma_2 = \begin{bmatrix} 0.571 & -0.645 \\ -0.645 & 3.62 \end{bmatrix}$

(c) equation for decision boundary

$P(w_1) P(x|w_1) = P(w_2) P(x|w_2)$
 $\Rightarrow \frac{1}{2} \times \frac{1}{(\sqrt{2\pi})^2 |\Sigma_1|^{1/2}} e^{-\frac{1}{2}(x-\mu_1)^T \Sigma_1^{-1} (x-\mu_1)} = \frac{1}{2} \times \frac{1}{(\sqrt{2\pi})^2 |\Sigma_2|^{1/2}} e^{-\frac{1}{2}(x-\mu_2)^T \Sigma_2^{-1} (x-\mu_2)}$
 $\Rightarrow \frac{1}{2} (x-\mu_2)^T \Sigma_2^{-1} (x-\mu_2) - \frac{1}{2} (x-\mu_1)^T \Sigma_1^{-1} (x-\mu_1) = \ln \left| \frac{\Sigma_1}{\Sigma_2} \right|^{1/2}$

\Rightarrow Putting values,

$x^2 - 2.14y^2 + 3.05xy - 9.16x + 45.7y - 205 = 0$

(As $h = -\frac{3.05}{2}$, $a=1$, $b=-2.14 \Rightarrow h^2 - ab > 0$)

\therefore hyperbola

