

IE 7374 ST: Machine Learning in Engineering

HW-3

Rohit Bokade
NUID: 001280767

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1. (a) Class-conditional probability for each class $i \in \{0, 1\}$ is given as

$$p(x|y = i) = \frac{1}{(2\pi)^{d/2} |\Sigma_i|^{1/2}} \exp \left[-\frac{1}{2} (x - m_i)^T \Sigma_i^{-1} (x - m_i) \right]$$

where $m_0 = (1, 2)$, $m_1 = (6, 3)$, $\Sigma_0 = \Sigma_1 = \mathbb{I}_2$ and $P(Y = 0) = P(Y = 1) = 1/2$. Also, point x is said to be on the decision surface or boundary if $P(Y = 1|x) = P(Y = 0|x)$.

We can use Bayes' theorem to obtain the posterior $p(y|x) = \frac{p(x|y)p(y)}{p(x)}$ for both the classes and equate them to find the optimal decision boundary.

- 2.
- 3.
- 4.