

Answer:

$$\begin{aligned} p(y = 1 \mid x; \phi, \mu_0, \mu_1, \Sigma) &= p(x \mid y = 1, \phi, \mu_0, \mu_1, \Sigma) \frac{p(y = 1)}{p(x \mid \phi, \mu_0, \mu_1, \Sigma)} \\ &= \frac{\phi f_{y=1}(x)}{\phi f_{y=1}(x) + (1 - \phi) f_{y=0}(x)} \\ &= \frac{1}{1 + \frac{1-\phi}{\phi} \exp\left(-\frac{1}{2}(x - \mu_1)^T \Sigma^{-1}(x - \mu_1) + \frac{1}{2}(x - \mu_0)^T \Sigma^{-1}(x - \mu_0)\right)} \\ &= \frac{1}{1 + \frac{1-\phi}{\phi} \exp\left(-(\mu_0 - \mu_1)^T \Sigma^{-1}x - \frac{1}{2}(\mu_1^T \Sigma^{-1} \mu_1 - \mu_0^T \Sigma^{-1} \mu_0)\right)} \\ &= \frac{1}{1 + \exp(-(\theta^T x + \theta_0))}, \end{aligned}$$