EE7403 2023-2024 S2

2. (a) $p(e_i|x) = 1 - p(w_i|x)$ $\quad p(w_i|x) = \frac{p(x|w_i)\,p(w_i)}{p(x)}$ $\quad p(x) = \sum_{i=1}^{c} p(x|w_i)$

$$\therefore p(e_i|x) = 1 - \frac{p(x|w_i)\,p(w_i)}{\sum_{i=1}^{c} p(x|x_i)}$$

(b) $\underset{w_i}{\text{argmin}}\; p(e_i|x)$

$= \underset{w_i}{\text{arg min}}\,[1 - p(w_i|x)]$

$= 1 - \underset{w_i}{\text{argmax}}\; p(w_i|x)$

set the discriminant function $g_i(x) = \ln[p(w_i|x)]$

since $\ln x$ is monotonously increasing when x increases

$\therefore \underset{i}{\text{argmax}}\; g_i(x)$

$g_i(x) = \ln[p(w_i|x)] = \ln\left[\frac{p(x|w_i)\,p(w_i)}{p(x)}\right]$

as $p(x)$ is a constant $\Rightarrow g_i(x) = \ln p(x|w_i) + \ln p(w_i)$

$\therefore$ decide $w_i = \underset{w_i}{\text{argmax}}\; g_i(x)$

or decide $w_i = \underset{w_i}{\text{argmax}}\,[p(x|w_i)\,p(w_i)]$

(c) X