EE7403 2023-2024 S2

2. (a) $p(e_i|x) = 1 - P(w_i|x) = \left(\sum_{j=1}^{c} P(w_j|x)\right) - p(w_i|x) = \sum_{\substack{j=1 \\ j\neq K}}^{c} P(w_j|x)$

(b) $\underset{w_i}{\arg\min}\ p(e_i|x)$

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

$= 1 - \underset{w_i}{\arg\max}\ P(w_i|x)$

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

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

$\therefore \underset{i}{\arg\max}\ g_i(x)$

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

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

$\therefore$ decide $w_i = \underset{w_i}{\arg\max}\ g_i(x)$

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

(c) X