

Risk in Decision Making

$$P(\omega_1 | x) = 0.51 \quad (\text{2 class w/ equal priors})$$

Classes: $\{\omega_1, \omega_2, \dots, \omega_c\}$

actions: $\{\alpha_1, \alpha_2, \dots, \alpha_e\}$

cost: $\{\lambda_{11}, \lambda_{21}, \dots, \lambda_{ec}\}$

cost function: $\lambda(\alpha_i | \omega_j)$

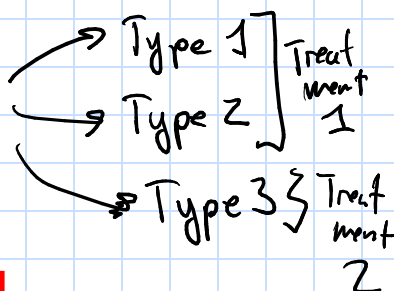
* It does not need to equal c.

For every action there is a cost function.
→ cost of taking action i given

that the state-of-nature is ω_j

→ healthy

→ disease



$\omega_1 \rightarrow \text{healthy}$

$\omega_2 \rightarrow T1$

$\omega_3 \rightarrow T2$

$\omega_4 \rightarrow T3$

$\alpha_1 \rightarrow \text{nothing}$

$\alpha_2 \rightarrow \text{Treatment 1}$

$\alpha_3 \rightarrow \text{Treatment 2}$

Conditional Risk

→ # of classes

$$R(\alpha_i | x) = \sum_{j=1}^c \underbrace{\lambda(\alpha_i | \omega_j) P(\omega_j | x)}_{\text{posterior}}$$

$$|p(\omega_j) p(x | \omega_j)|$$

$$\hat{y} = \omega^T x$$

$$\alpha^* = \arg \min_{\alpha_i} R(\alpha_i | x)$$

We need to build up a cost matrix

$$[\lambda] = \begin{matrix} & \text{Predicted} \\ \begin{matrix} \omega_1 \\ \omega_2 \end{matrix} & \begin{bmatrix} \lambda_{11} & \lambda_{12} \\ \lambda_{21} & \lambda_{22} \end{bmatrix} \end{matrix} \begin{matrix} \\ \end{matrix} \text{True} \begin{matrix} \omega_1 \\ \omega_2 \end{matrix}$$

$$[\lambda] = \begin{matrix} & \text{cancer} & \text{healthy} \\ \begin{matrix} \text{cancer} \\ \text{healthy} \end{matrix} & \begin{bmatrix} 1/2 & 1000 \\ 10 & 0 \end{bmatrix} \end{matrix}$$