PMR – Gaussian classifier with $\Sigma_1 = \Sigma_2 = \Sigma$ 23/10/09

$$\log p(x|C_i)\,p(C_i)$$

$$= -\frac{1}{2}(x-\mu_i)^T \Sigma^{-1}(x-\mu_i) - \frac{1}{2}\log|\Sigma| + \log p(C_i) - \frac{D}{2}\log 2\pi$$

$$\log \frac{p(x|C_1)\,p(C_1)}{p(x|C_2)\,p(C_2)} = \Delta(x)$$

$$\Delta(x) = \frac{1}{2}(x-\mu_2)^T \Sigma^{-1}(x-\mu_2) - \frac{1}{2}(x-\mu_1)^T \Sigma^{-1}(x-\mu_1) + \log \frac{p(C_1)}{p(C_2)}$$

$$= (\mu_1-\mu_2)^T \Sigma^{-1} x + \frac{1}{2}\mu_2^T \Sigma^{-1}\mu_2 - \frac{1}{2}\mu_1^T \Sigma^{-1}\mu_1 + \log \frac{p(C_1)}{p(C_2)}$$

as quadratic term $x^T \Sigma^{-1} x$ cancel.

Note that $\Delta(x)$ is a linear function of $\underline{x}$.