DD2434 Practical 3

$$N(x|\mu,\Sigma) = \frac{1}{(2\pi)^{\frac{D}{2}}|\Sigma|^{\frac{1}{2}}} e^{-\frac{1}{2}\underbrace{(x-\mu)^T\Sigma^{-1}(x-\mu)}}$$

$$(x-\mu)^T\Sigma^{-1}(x-\mu)$$

① Σ = diagonal matrix

$$\Sigma = \begin{bmatrix} \Sigma_1 & & \emptyset \\ & \Sigma_2 & \\ \emptyset & \ddots & \Sigma_d \end{bmatrix} \Rightarrow \Sigma^{-1} = \begin{bmatrix} \frac{1}{\Sigma_1} & & \emptyset \\ & \frac{1}{\Sigma_2} & \\ \emptyset & \ddots & \frac{1}{\Sigma_d} \end{bmatrix}$$

$$(x-\mu)^T\Sigma^{-1}(x-\mu) = [(x_1-\mu_1), \ldots, (x_D-\mu_D)]\begin{bmatrix} \frac{1}{\Sigma_1} & & \\ & \ddots & \\ & & \frac{1}{\Sigma_D} \end{bmatrix}\begin{bmatrix} x_1-\mu_1 \\ \vdots \\ x_D-\mu_D \end{bmatrix} =$$

$$= (x_1-\mu_1)\cdot\frac{1}{\Sigma_1}\cdot(x_1-\mu_1) + \ldots + (x_D-\mu_D)\cdot\frac{1}{\Sigma_D}(x_D-\mu_D) =$$

$$= \sum_i^D \underbrace{\frac{1}{\Sigma_i}(x_i-\mu_i)^2}_{A}$$

A – alway positive

- small value $(x_i-\mu_i) \rightarrow$ close to mean
- Σ_i – scales this value

$\Rightarrow \Sigma_i$ – big $\Rightarrow$ uncertain about this dimenson $\rightarrow$ large deviation from mean doesn't matter

Σ_i – small $\Rightarrow$ certain about this dimension $\Rightarrow$ large deviation from mean matters a lot