.11 Log likelyhood function (1.54)

$$\ln p(x|\mu,\sigma^2) = -\frac{1}{2\sigma^2}\sum_{n=1}^{N}(x_n-\mu)^2 - \frac{N}{2}\ln\sigma^2 - \frac{N}{2}\ln(2\pi)$$

$$\frac{\partial \ln p(x|\mu,\sigma^2)}{\partial \mu} = -\frac{1}{2\sigma^2}\cdot 2\sum_{n=1}^{N}(x_n-\mu) = 0$$

$$\Rightarrow \sum_{n=1}^{N} x_n = N\mu$$

$$\Rightarrow \mu_{ML} = \frac{1}{N}\sum_{n=1}^{N} x_n$$

$$\frac{\partial \ln p(x|\mu_{ML},\sigma^2)}{\partial \sigma^2} = -\frac{N}{2}\frac{1}{\sigma^2} + \frac{1}{2(\sigma^2)^2}\Sigma(x-\mu_{ML})^2 = 0$$

$$\Rightarrow \sigma^2_{ML} = \frac{\Sigma(x-\mu_{ML})^2}{N}$$