$$f(x) = \prod_i \left( \frac{1}{\sigma_i \sqrt{2\pi}} e^{-\frac{(x-\mu_i)^2}{2\sigma_i^2}} \right)$$

$$= \prod_i \left( \frac{1}{\sqrt{2\pi\sigma_i^2}} e^{-\frac{(x-\mu_i)^2}{2\sigma_i^2}} \right)$$

$$log\left(f(x)\right) = log\left( \prod_i \frac{1}{\sqrt{2\pi\sigma_i^2}} \right) - \frac{(x-\mu_i)^2}{2\sigma_i^2}$$

$$= -\frac{1}{2}\left( nlog(2\pi) + \sum_i log(\sigma_i^2) \right) - \sum_i \frac{(x-\mu_i)^2}{2\sigma_i^2}$$

$$= -\frac{1}{2} G_{const} - \sum_i \frac{(x-\mu_i)^2}{2\sigma_i^2}$$

$$= -\frac{1}{2} G_{const} - \frac{1}{2} \sum_i \frac{(x-\mu_i)^2}{\sigma_i^2}$$

$$G_{const} = nlog(2\pi) + \sum_i log(\sigma_i^2)$$

$$E = \sum_{n=1}^{n} ||g\left(x_n\right) - d\left(x_n\right)||$$

$$d\left(x_n\right) = \left(d_1\left(x_n\right), ..., d_K\left(x_n\right)\right)^t$$

$$g\left(x_n\right) = \left(g_1\left(x_n\right), ..., g_K\left(x_n\right)\right)^t$$

$$KN$$