# assn2.2

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October 2019

1.

$$P(X_i = x_{ij}|Y = y_k) = P(< X_1, X_2, ..., X_n > |Y = y_k)$$

$$= P(X_1|Y = y_k) * P(X_2|Y = y_k) * ... * P(X_n|Y = y_k)$$

$$= \prod_{i=1}^{n} P(X_n|Y = y_k)$$

$$= \prod_{i=1}^{n} \frac{1}{\sigma\sqrt{2\pi}} exp \frac{-(x_i - \mu)^2}{2\sigma^2}$$

$$= \prod_{i=1}^{n} (\frac{1}{\sigma\sqrt{2\pi}}) \prod_{i=1}^{n} (exp \frac{-(x_i - \mu)^2}{2\sigma^2})$$

$$= (\frac{1}{\sigma\sqrt{2\pi}})^n \prod_{i=1}^{n} (exp \frac{-(x_i - \mu)^2}{2\sigma^2})$$

$$= (\frac{1}{\sigma\sqrt{2\pi}})^n (exp \sum_{i=1}^{n} \frac{-(x_i - \mu)^2}{2\sigma^2})$$

$$L(P(X_n|Y = y_k)) = log((\frac{1}{\sigma\sqrt{2\pi}})^n (exp \sum_{i=1}^{n} \frac{-(x_i - \mu)^2}{2\sigma^2}))$$

$$= (nlog(\frac{1}{\sigma\sqrt{2\pi}}) log(exp \sum_{i=1}^{n} \frac{-(x_i - \mu)^2}{2\sigma^2}))$$

$$= (n(log(1) - log(\sigma\sqrt{2\pi}))log(exp\sum_{i=1}^{n}\frac{-(x_i-\mu)^2}{2\sigma^2}))$$

$$= (n(-log(\sigma) + log(\sqrt{2\pi})))log(exp\sum_{i=1}^{n}\frac{-(x_i-\mu)^2}{2\sigma^2}))$$

$$= (-log(\sigma)n + log(\sqrt{2\pi})n)log(exp\sum_{i=1}^{n}\frac{-(x_i-\mu)^2}{2\sigma^2}))$$

$$= (-log(\sigma)n + log(\sqrt{2\pi})n)(\sum_{i=1}^{n}\frac{-(x_i-\mu)^2}{2\sigma^2}))$$

$$\frac{dL(P(X_n|Y=y_k))}{d\mu} = (-log(\sigma)n + log(\sqrt{2\pi})n)(\sum_{i=1}^{n}\frac{-(x_i-\mu)^2}{2\sigma^2})) = 0$$

$$= \sum_{i=1}^{n}\frac{2((x_i-\mu))}{2\sigma^2} = 0$$

$$= \sum_{i=1}^{n}\frac{(x_i-\mu)}{\sigma^2} = 0$$