Assignment-6

Q1 sample $\Rightarrow (x_1 \dots x_n)$

$\mu = \theta_1$

$\sigma^2 = \theta_2$

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$$L(x_1 \dots x_n) = \prod_i^n (f(x_i))$$

$$= \left(\frac{1}{\sqrt{2\pi\sigma^2}}\right)^n e^{\left(\frac{\Sigma(x_i-\mu)^2}{-2\sigma^2}\right)}$$

$$n\ln\left(\frac{1}{\sqrt{2\pi\theta_2}}\right) + \ln\left(e^{\frac{\Sigma(x_i-\theta_1)^2}{-2\theta_2}}\right)$$

$$= n\ln\left(\frac{1}{\sqrt{2\pi\theta_2}}\right) + \frac{\Sigma(x_i-\theta_1)^2}{-2\theta_2}$$

diff w.r.t θ_1

$$= \frac{\partial}{\partial\theta_1}\left(n\ln\left(\frac{1}{\sqrt{2\pi\theta_2}}\right) + \frac{\Sigma(x_i-\theta_1)^2}{-2\theta_2}\right) = 0$$

$$= 0 - \frac{1}{2\theta_2}\Sigma\frac{\partial(x_i-\theta_1)}{\partial\theta_1} = 0$$

$$\Sigma(x_i-\theta_1) = 0$$

$$\Sigma x_i - (\theta_1)(n) = 0$$

$$\boxed{\frac{\Sigma x_i}{n} = \theta_1}$$

diff wrt θ_2

$$\frac{\partial}{\partial\theta_2}\left(n\ln\left(\frac{1}{\sqrt{2\pi\theta_2}}\right) + \frac{\Sigma(x_i-\theta_1)^2}{-2\theta_2}\right) = 0$$

$$\frac{-n}{2\theta_2} + \frac{\Sigma(x_i-\theta_1)^2}{2}\left(\frac{1}{\theta_2^2}\right) = 0$$

$$\frac{\Sigma(x_i-\theta_1)^2}{\cancel{2}}\left(\frac{1}{\theta_2^{\cancel{2}}}\right) = \frac{n}{\cancel{2}\cancel{\theta}_2}$$

$$\boxed{\frac{\Sigma(x_i-\theta_1)^2}{n} = \theta_2}$$

Q2. sample $(x_i --- x_n)$

$B(m, \theta) \longrightarrow$ Bernoulli dist.

$\theta \in (0,1)$

$$P(X_i = x_i) = \theta^{x_i} (1-\theta)^{1-x_i}$$

$$L = \prod_1^n \theta^{x_i} (1-\theta_i)^{1-x_i}$$

$$= \theta^{\Sigma x_i} . (1-\theta)^{n-\Sigma x_i}$$

taking log

$$\Sigma x_i \ln(\theta) + (n - \Sigma x_i)(\ln(1-\theta))$$

diff w.r.t θ

$$\frac{\Sigma x_i}{\theta} + \frac{n - \Sigma x_i}{1-\theta}(-1) = 0$$

$$(\Sigma x_i)(1-\theta) = \theta(n - \Sigma x_i)$$

$$\Sigma x_i - \cancel{\theta \Sigma x_i} = \theta n - \cancel{\theta \Sigma x_i}$$

$$\boxed{\theta = \frac{\Sigma x_i}{n}} \longrightarrow$$ mean Is the MSE for given problem