Let $(x_1, x_2 \cdots x_n)$ be sample of size n

Mean $\to \theta_1$ Var $\to \theta_2$

$$L(\theta_1, \theta_2) = \prod_{i=1}^{n} \frac{1}{\sqrt{2\pi\theta_2}} e^{-(x_i-\theta_1)^2/2\theta_2}$$

take log

$$\log L(\theta_1, \theta_2) = -\frac{n}{2} \log(2\pi\theta_2) - \frac{1}{2\theta_1} \sum_{i=1}^{n} (x_i - \theta_1)^2$$

for θ_1 diff $\log(L(\theta_1, \theta_2))$ wrt θ_1 and set it to 0

$$\frac{\partial \log(L)}{\partial \theta_2} = \frac{1}{\theta_2} \sum_{i=1}^{n} (x_i - \theta_1) = 0$$

$$\theta_1 = \frac{1}{n} \sum_{i=1}^{n} x_i$$

MLE of S_1 is sample mea
for θ_2 diff wrt θ_2 and put zero.

$$\theta_2 = \frac{1}{n} \sum_{i=m}^{n} (x_i - \theta_1)^2$$

(2) Binomial Distribution
m = no. of trails
$\theta = (0,1)$ prob of succss
$$L_\theta = \prod_{i=1}^{n} f(x_i, n, \theta$$

PMF

$$f(x, n, \theta) = {}^{n}C_{x}\, \theta^{n} (1-\theta)^{m-n}$$

$$L(\theta) = \prod_{i=1}^{m} ({}^{n}C_{x_i}) \cdot \theta^{x_i} (1-\theta)^{m-x_i}$$

take log

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$$\frac{\partial \log(\ell)}{d\theta} = \frac{1}{\theta}\sum_{i=1}^{n} x_i - \frac{1}{1-\theta}\sum_{i=1}^{m}(m - x_i) = 0$$

$$= \frac{1}{\theta}\sum_{i=1}^{n} x_i - \frac{1}{1-\theta}\sum_{i=1}^{m}(m - x_i)$$

Multiply by $\theta(1-\theta)$

$$\Rightarrow (1-\theta)\sum_{i=1}^{n} x_i = \theta\sum_{i=1}^{m}(m - x_i$$

$$\Rightarrow \boxed{\theta = \sum_{i=1}^{m} x_i \Big/ m}$$

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PARAMETER ESTIMATION
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