Hypothesis testing $\longrightarrow$ "lady testing tea"

Guassian C.F. Gauss b. 1777 phd 1799

$\propto e^{-\frac{(x-\mu)^2}{2\sigma^2}}$ 1801 ceres

$\downarrow$

Laplace $\propto e^{-\frac{|x-\mu|}{\sigma}}$

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least squares — $\sum (\text{observed} - \text{want})^2 \rightarrow$ minimize

$\downarrow$

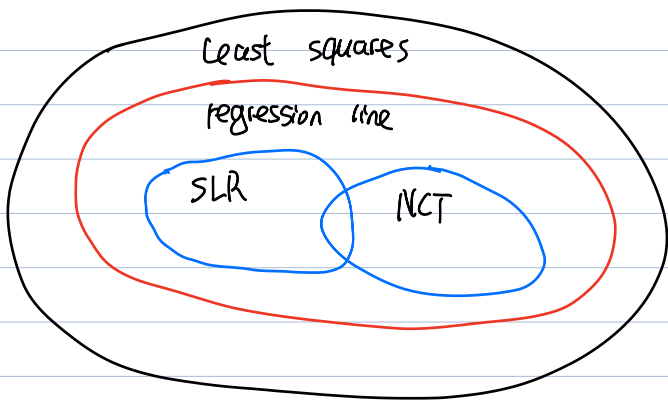
$\sum |\text{observed} - \text{want}| \rightarrow$ minimize

Lasso

Sparcits constraint : ℓ_0 norm

ℓ_p norm $\left(\sum |a_k|^p\right)^{\frac{1}{p}}$ norm $p \geq 1$

$p=0$ # of nonzero



Three models

1) $Y_i = a x_i + b + \varepsilon_i$ "$\varepsilon_i = Y_i - a x_i - b$"

Nothing is random

2) $Y_i = a x_i + b + \varepsilon_i$ ε_i — i.i.d $N(0, \sigma^2)$ SLR

x_i non-random

3) $Y_i \overset{d}{=} \mu_Y + \rho \frac{\sigma_Y}{\sigma_X}(X_i - \mu_X) + \sigma_Y (1-\rho^2)^{\frac{1}{2}} \varepsilon_i$ $\quad$ ε_i – i.i.d. $N(0,1)$

if $(X,Y) \sim N(\mu_X, \mu_Y, \sigma_X^2, \sigma_Y^2, \rho)$ $\quad$ $\rho = \frac{\mathbb{E}(X-\mu_X)(Y-\mu_Y)}{\sigma_X \sigma_Y}$

can replace μ_Y with $\bar{Y}$

if (X,Y) is Guassian
then $Y|X \sim N(\underline{\mu_Y + \rho \frac{\sigma_Y}{\sigma_X}(X-\mu_X)}, \sigma_Y^2 (1-\rho^2))$

in particular, $\mathbb{E}(Y|X) =$ ↓

↓

best mean-square estimator of Y given X

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"Gauss-Markov thm"