3-1

$l_i : \sigma_i^2$, choose $\sigma_0^2 = \sigma_i^2$

compute $w_i = \frac{\sigma_0^2}{\sigma_i^2}$

do the adjustment

Hypothesis Test

$H_0: \sigma_0^2 \text{ actual} = \sigma_0^2 \text{ chosen}$

vs.

$H_1: \sigma_0^2 \text{ actual} \neq \sigma_0^2 \text{ chosen}$

$\hat{\sigma}_0^2 = \frac{v^T W v}{r}$

$\frac{\hat{\sigma}_0^2}{\sigma_0^2 \text{ chosen}}$ = test statistic $\sim \frac{\chi^2_r}{r}$

σ_0^2 chosen, assumed

σ_0^2 actual

$\hat{\sigma}_0^2$ estimated

3-2

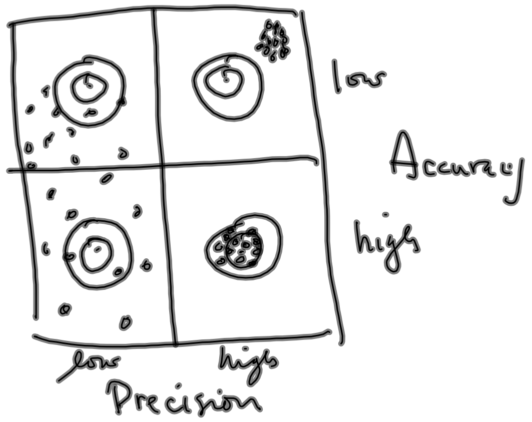
Precision : measure of dispersion or clustering

high prec. = tight cluster

low prec. = loose cluster

Accuracy

→ relation to true value



Solve LS problem: 3-3

1. minimize sum of squares of corrections to obs.
2. $\hat{l}$ satisfy the model

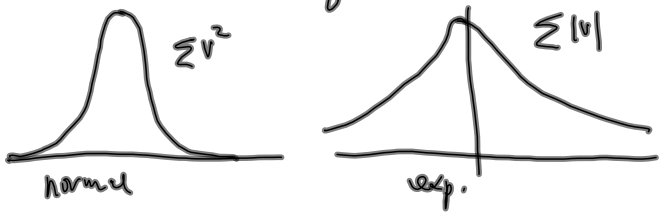
$\Phi = v_1^2 + v_2^2 + \cdots + v_n^2$, or

$w_1 v_1^2 + w_2 v_2^2 + \cdots w_n v_n^2$

$[v_1 \; v_2 \; v_3] \begin{bmatrix} v_1 \\ v_2 \\ v_3 \end{bmatrix}$ $\quad \Phi = V^T V, \; V^T W V$

Why Least Squares?
if obs/data are gaussian (normally distr.)
if choose Max. Likelihood

Then, $\Rightarrow$ Least Squares



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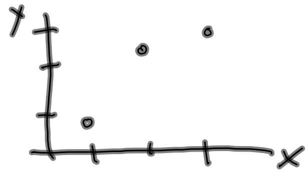

x	y
1	1.0
2	2.2
3	3.0

constant obs.

model 1 straight line through 3 pts.

$n = 3$
$n_0 = 2$
$r = 1$

pick $n_0 = 2$ parameters 3-4
slope m
intercept b

$\hat{y} = mx + b$

$\boxed{\text{indirect obs.}}$ * $\rightarrow$ exactly n_0 unknowns
observations only model GLS
write exactly n cond. eqn
each obs. is expressed as functions of those parameters

$\hat{y}_1 = m x_1 + b$
$\hat{y}_2 = m x_2 + b$
$\hat{y}_3 = m x_3 + b$

$y_1 + v_1 = m x_1 + b$
$y_2 + v_2 = m x_2 + b$
$y_3 + v_3 = m x_3 + b$

$v_1 = m x_1 + b - y_1$
$v_2 = m x_2 + b - y_2$
$v_3 = m x_3 + b - y_3$

$v_1 = m \cdot 1 + b - 1$
$v_2 = m \cdot 2 + b - 2.2$ $\leftarrow$
$v_3 = m \cdot 3 + b - 3.0$

$\Phi = v_1^2 + v_2^2 + v_3^2$

$\Phi = (m + b - 1)^2 + (2m + b - 2.2)^2 + (3m + b - 3.0)^2$

$\partial \Phi / \partial m = 0$
$\partial \Phi / \partial b = 0$

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