Lec. 10

Visualize, Simplify, Consider extreme cases, commonalities vs. differences, rewriting, etc.

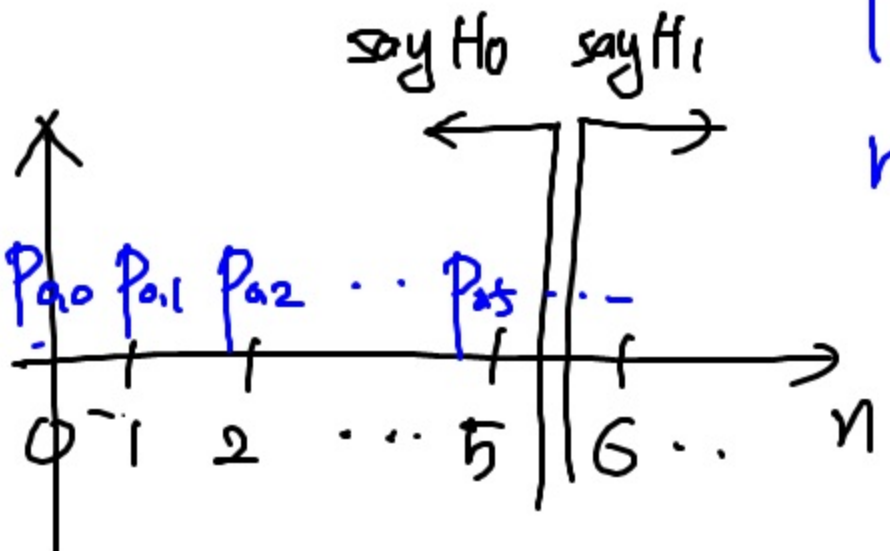
Review

The Neyman-Pearson criterion	The 2nd "사모님 problem"	The N-P Lemma
$\max_{\delta} P_D$ s.t. $P_F \le \alpha$	돈 α 조원어치를 L개의 은행에 정기예금으로 넣어 1년 후 찾을 때, 수익 maximization s.t. 각 은행 upper limit.	Find η, γ s.t. $\delta(y_l) = \begin{cases} 1, & \frac{p_{1,l}}{p_{0,l}} > \eta \\ \gamma, & \text{—} = \eta \\ 0, & \text{—} < \eta \end{cases}$ and $P_F = \alpha$
Find the most powerful detector with level α		The most p.d. w/ size α.

p.2

Binary → MAP, General, minimax, N-P

Bayesian → detectors are all (randomized) likelihood ratio tests.



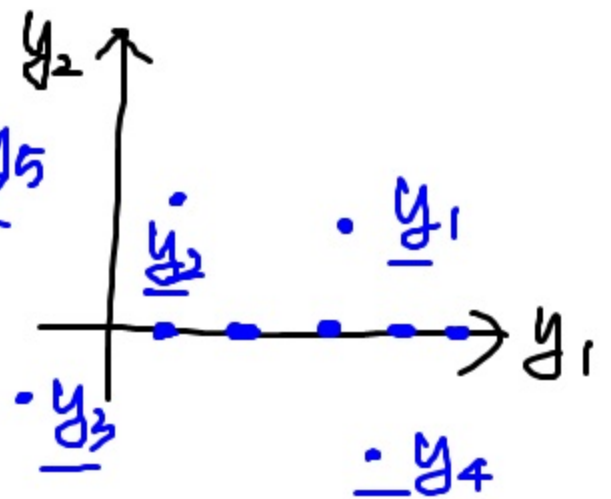
observation : scalar discrete ①
vector discrete ②
vector continuous ③

abstract
concrete

① $\{y_1, y_2, \cdots, y_L\}$

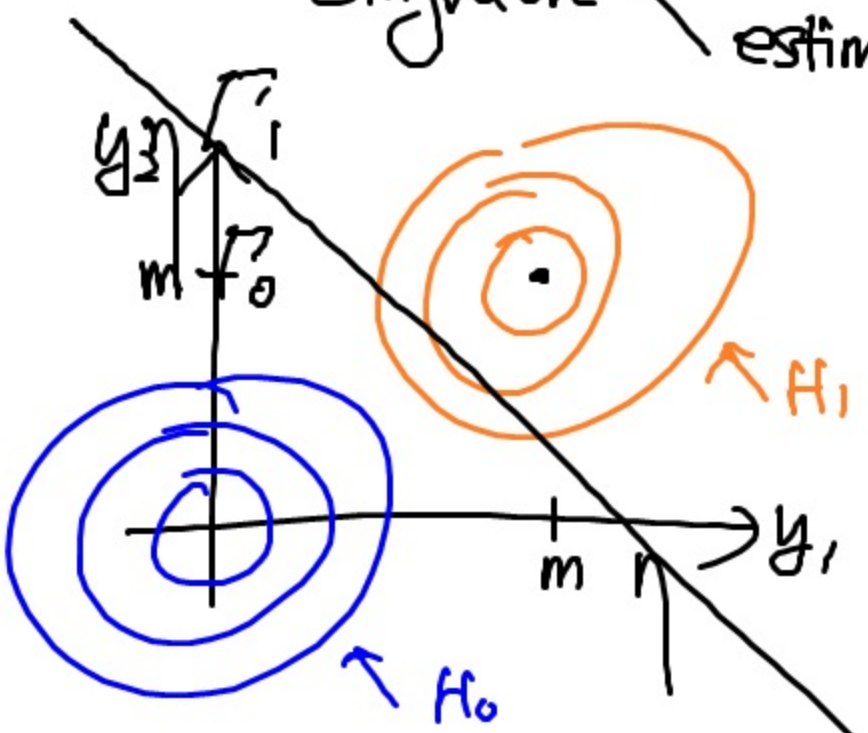
② $\{\underline{y}_1, \underline{y}_2, \cdots, \underline{y}_L\}$

③ ...



p-4

singular { detection
estimation.



$$f_{\underline{N}}(\underline{n}) = \frac{1}{(\sqrt{2\pi\sigma^2})^n} \exp\left(-\frac{\|\underline{n}\|^2}{2\sigma^2}\right)$$

i.i.d. r.v.s

gaussian

$$\underline{y}^T \underline{1} \gtrless \eta \quad \cdots$$

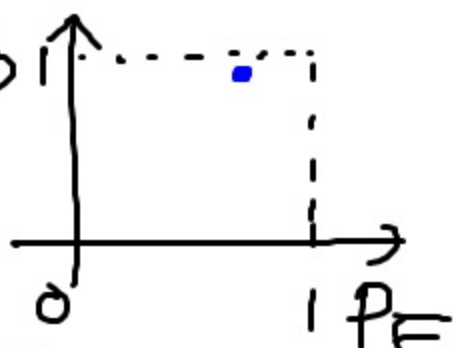
$$y_1 + y_2 = \eta .$$

p.5

ROC (receiver operating characteristic)

(i) Given a detector, what is the ROC?

binary



If r. parameter, $C_{\hat{\theta},\theta}$, π_0, then

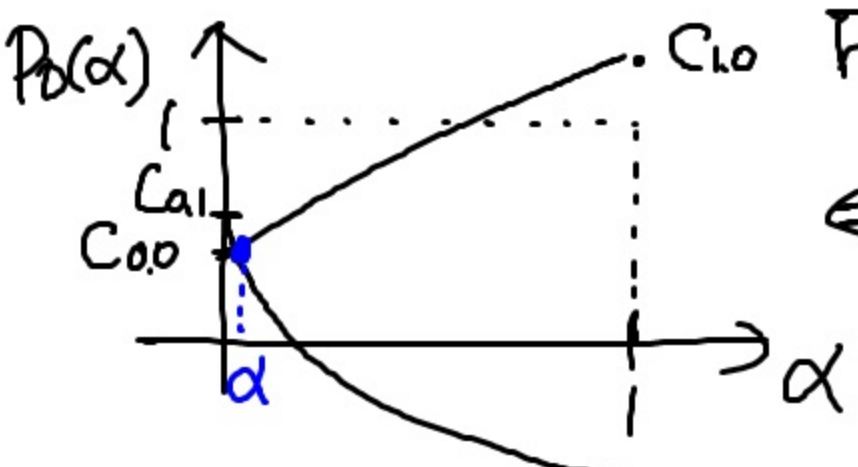
$$r(\delta,\pi_0) = E[C_{\hat{\theta},\theta}] = (C_{0,0}(1-P_F) + C_{1,0}P_F)\pi_0 + (C_{0,1}(1-P_D) + C_{1,1}P_D)(1-\pi_0)$$

p6.

$$r(\delta_{NF}(\alpha); \theta=0) = C_{0,0}(1-\alpha) + C_{1,0}\alpha \quad \cdots (*)$$

$$r(\delta_{NF(\alpha)}; \theta=1) = C_{0,1}\left(1-P_D(\alpha)\right) + C_{1,1}P_D(\alpha) \quad (**)$$

Find α such that $(*) = (**)$.



Find x s.t. $f(x)=g(x)$.

$\Leftrightarrow$ $y=f(x)$ 와 $y=g(x)$ 의 교점 ....