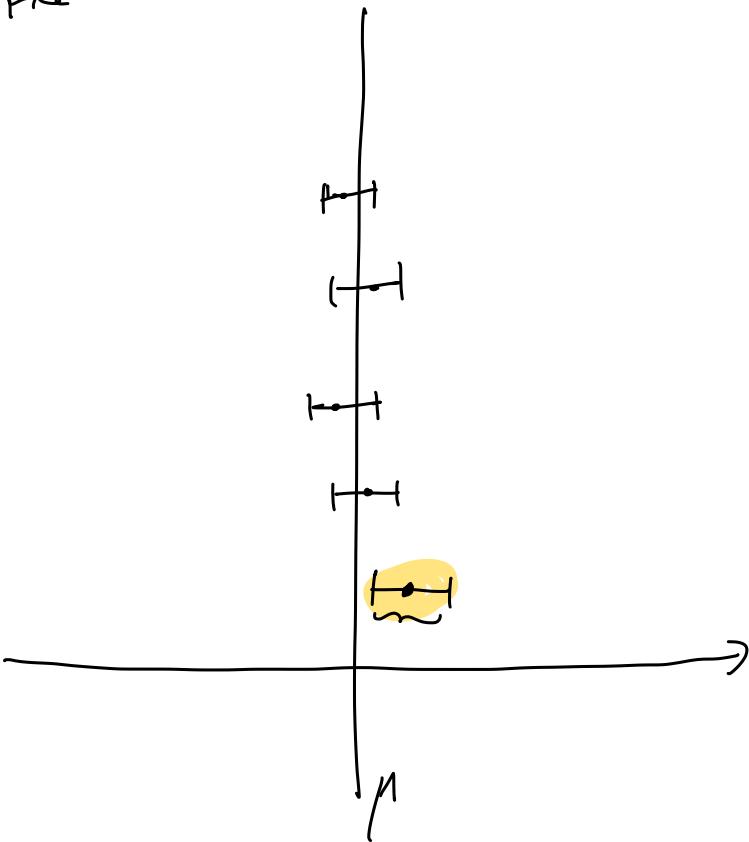
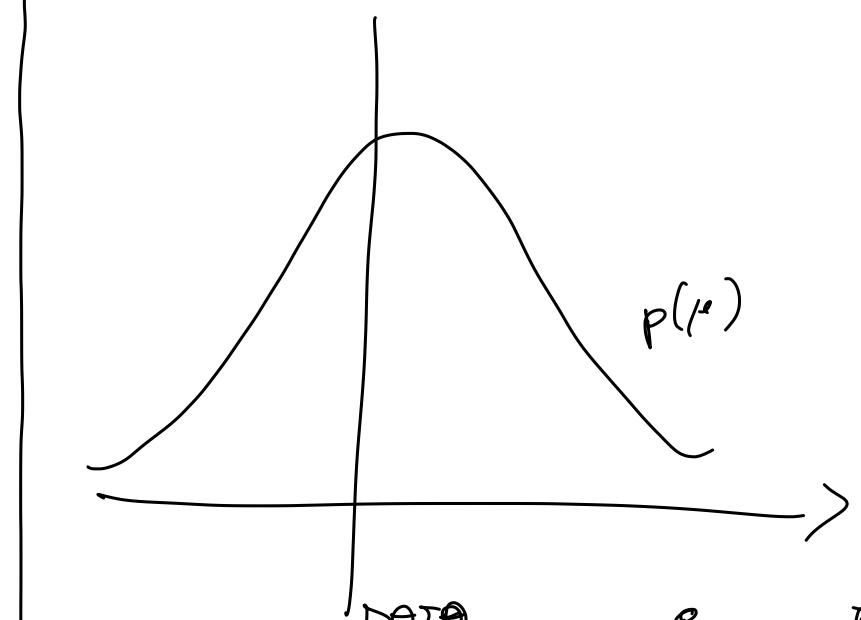


FREQU.



BAYESIAN



$$p(\mu | D_m) = \frac{p(D_m | \mu) p(\mu)}{\underline{p(D_m)}}$$

$$D_n = \{x_1, \dots, x_n\} \quad x_i \rightarrow \mathcal{M}, \mathcal{G}^2$$

↓ **i.i.o!**

$$\bar{x} = \frac{1}{n} \sum_{i=1}^n x_i \quad E\{\bar{x}\} = E\left\{ \frac{1}{n} \sum_{i=1}^n x_i \right\}$$

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

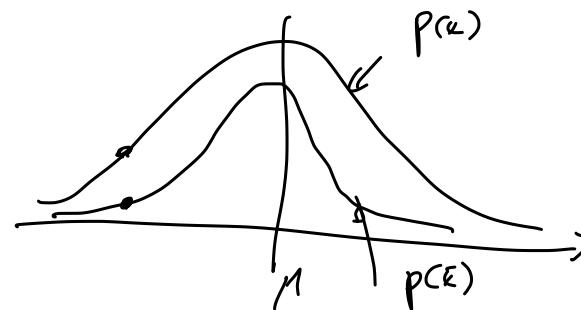
INDEPENDENCY

$$\mu = E\{x\}$$

$$= \frac{1}{n} \sum_{i=1}^n \mu = \mu$$

IDENTICALLY
DISCREPANCY

$$G_{\bar{x}}^2 = \frac{\sigma_x^2}{n}$$



$$\left| P \left\{ | \bar{x} - \mu | \geq \varepsilon \right\} \right| \leq e^{-2m\varepsilon^2}$$

= S

Hoeffding Bound

$\bar{x} \in [0, 1]$

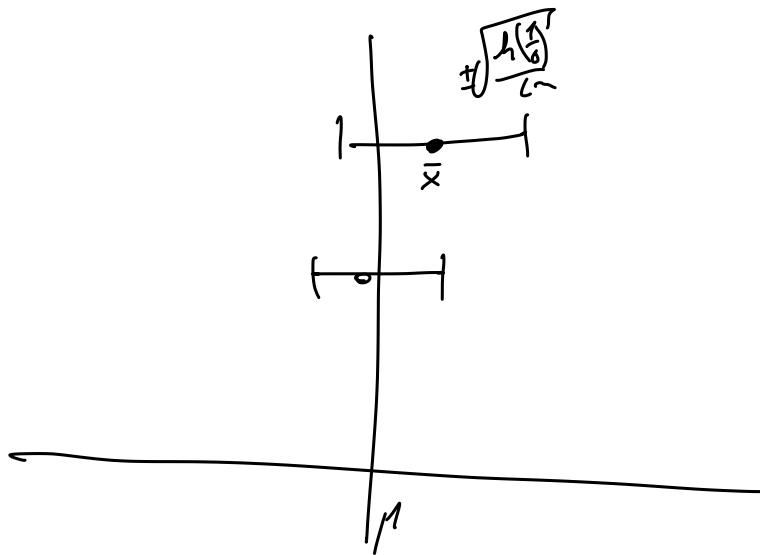


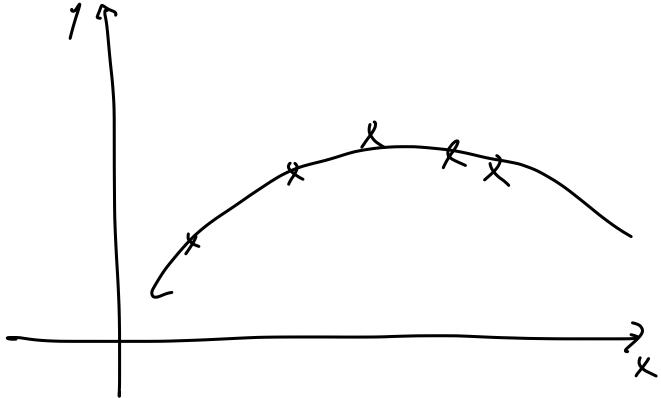
$$\varepsilon = \sqrt{\frac{\ln(\frac{1}{\delta})}{2m}}$$

$$|\mu - \bar{x}| \leq \sqrt{\frac{\ln(\frac{1}{\delta})}{2m}}$$

$(1-\delta)$

↑





$$D_m = \{(x_1, y_1), \dots, (x_n, y_n)\}$$

i.i.d.

$$f(x) = \sum_{i=0}^n c_i x^i$$

$$l(x_i, y) = (y - f(x_i))^2$$

$$\hat{R}(x) = \frac{1}{m} \sum_{i=1}^m l(f(x_i), y_i)$$

f CHOSN DE FORZ OBSERVING D_m

$$P\left\{\left|\hat{R}(x) - R(x)\right| \geq \varepsilon\right\} \leq \dots$$

$$\min_{C} \hat{R}(f) \rightarrow f^*$$

ERRO R f* AND ARE ARE n.i.o.l. ?

$$\min_{C} \hat{R}(f) + \lambda \underline{C(f)}$$

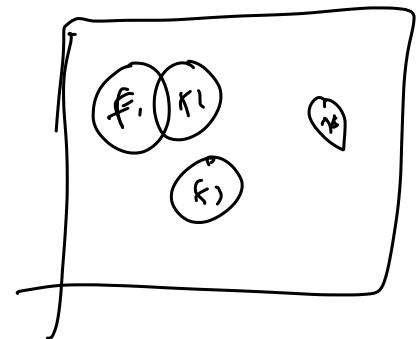
↓
OPTIMIZATION

↓
REGULARIZATION



$$F' = \{ f_1, \dots, f_{m_x} \}$$

F' chosen before δ_m



$$\left\{ P \left\{ | \hat{R}(f_1) - R(f_2) | \geq \varepsilon \right\} \leq e^{-2m\varepsilon^2} \right.$$

;

$$\left. P \left\{ | \hat{R}(f_{n_x}) - R(f_{n_x}) | \geq \varepsilon \right\} \leq e^{-2m\varepsilon^2} \right)$$

$$P \left\{ (\hat{R}(f^*) - R(f^*)) \geq \varepsilon \right\} \leq m_x e^{-2m\varepsilon^2} = \delta$$

$$\varepsilon = \sqrt{\frac{h\left(\frac{m_x}{8}\right)}{2n}} \leq \sqrt{\frac{h(m_x)}{2n}} + \sqrt{\frac{h\left(\frac{1}{8}\right)}{2n}}$$

$$|\hat{R}(x) - R(x)| \leq \sqrt{\frac{h(m_x)}{2n}} + \sqrt{\frac{h\left(\frac{1}{8}\right)}{2n}}$$

↑
(L-8)

$$\min_x [R(x)] \leq \min_x [\hat{R}(x) + \sqrt{\frac{h(m_x)}{2n}}]$$

↑

$$\hat{R}(x) + \lambda C(x)$$

$$f(x) = \sum_{i=0}^p c_i x^i$$

$$C(f) = \|\underline{c}\|^2 \leftarrow \text{RAD EMULATOR CONVEXITY}$$

$\leq \dots$

$\geq \dots$

$= \dots$

$$\min_{\underline{x}} \hat{R}(x) + \lambda \|\underline{c}\|^2 \text{ OCCAN RAZE}$$

$$D_m = \{(x_1, y_1), \dots, (x_n, y_n)\} \quad i.i.d. \quad x \in \mathbb{R} \quad y \in \mathbb{R}$$

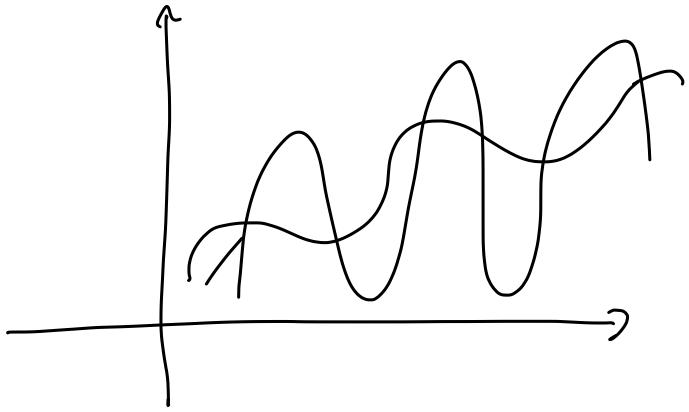
$$f(x) = \sum_{i=0}^p c_i x^i$$

$$\ell(f(x), y) = (y - f(x))^2$$

$$\hat{R}(x) = \frac{1}{n} \sum_{i=1}^n \ell(f(x_i), y_i)$$

$$C(x) = \sum_{i=0}^p \|c_i\|^2 = \sum_{i=0}^p \|c_i\|_B^2$$

$$\min \underbrace{\hat{R}(x) + \lambda C(x)}_{R(x)} \rightarrow \min_{c_0 \dots c_p} \sum_{i=1}^n \left(\sum_{j=0}^p c_j x_j^i - y_i \right)^2 + \lambda \|c\|_B^2$$



$$C(f) = P$$

$$C(g) = \|c\|^2$$

$$f(x) = \sum_{i=0}^P c_i x^i$$

$$f'(x) = \sum_{i=1}^P c_i x^{i-1} (i)$$

$$f''(x) = \sum_{i=2}^P c_i x^{i-2} i(i-1)$$

$$= \int \sum_{i=2}^P \sum_{j=2}^P i(i-1) j(j-1) c_i c_j x^{i-2} x^{j-2} dx$$

$$= \sum_{i=2}^P \sum_{j=2}^P i(i-1) j(j-1) c_i c_j \underbrace{\int_0^1 x^{i+j-4} dx}_{\frac{x^{i+j-3}}{i+j-3}} \cdot \underbrace{\int_0^1}_{0} \frac{x^{i+j-3}}{i+j-3}$$

$$= \sum_{i=1}^n \sum_{x=1}^n \left[\frac{i(i-1)x(x-1)}{i+x-3} \right] c_i c_x$$

$$= C^1 B C$$

0	0	-	-
0	0	-	-
:	:		
1	1		

HIER BEI

$$= (C^1 C^2 = C^1 I C)$$

$$X = \begin{bmatrix} x_1^0 & \dots & x_1^p \\ \vdots & & \vdots \\ x_n^0 & \dots & x_n^p \end{bmatrix} \quad c = \begin{bmatrix} c_0 \\ \vdots \\ c_n \end{bmatrix} \quad y = \begin{bmatrix} y_1 \\ \vdots \\ y_n \end{bmatrix}$$

$$\min_{\underline{c}} R(\underline{x}) + \lambda C(\underline{x}) \rightarrow \underline{c}^T B \underline{c}$$

$$\downarrow$$

$$\sum_{i=1}^n \left(\underbrace{\sum_{j=0}^p c_j x_i^j}_{c_i} - y_i \right)^2 = \| X \underline{c} - \underline{y} \|_2^2$$

$$\min_{\underline{c}} \| X \underline{c} - \underline{y} \|_2^2 + \lambda \underline{c}^T B \underline{c}$$

$$P_c(\quad \quad) = 0$$

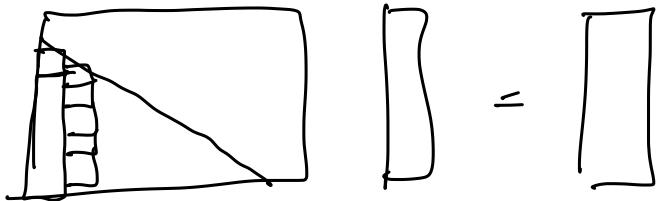
$$\sum_{i=1}^m \|x_{c_i} - z\|^2 + \lambda c_i' B c_i$$

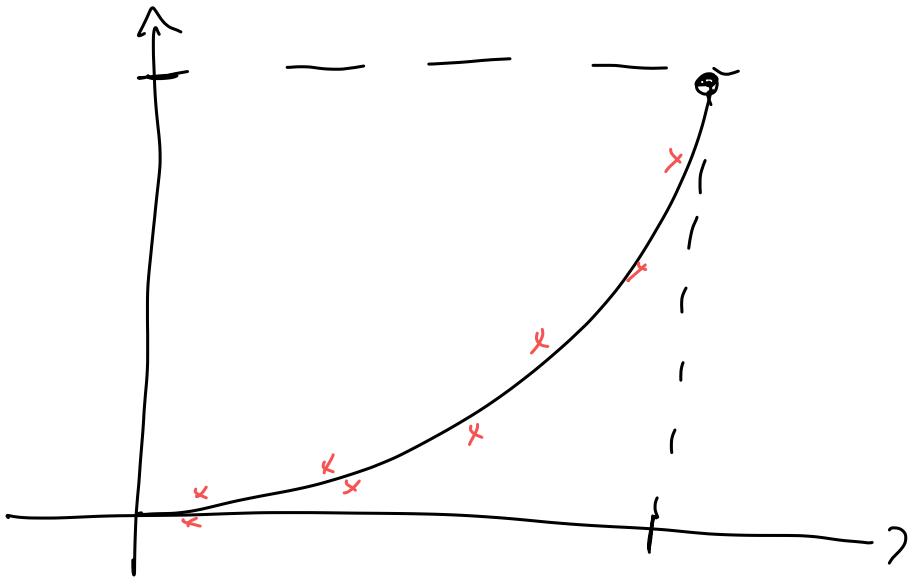
$$P_c(x' x_c - z c' x' y + z' y + \lambda c' B c) = 0$$

$$x' x_c - z c' y + \lambda c' B c = 0$$

$$(x' x + \lambda B) c = x' y$$

$$A c = y$$





$$y = x^2$$

$$p = 2$$

