DO NOT ASSUME ANYTHING:

~~$f_1() \dots f_n()$~~

NONPARAMETRIC APPROACH

$u_k \rightarrow$ BLOCK BOX $\rightarrow y_k$

$$R(u) = E\{y_k \mid u_k = u\} = \gamma_0 \mu(u) + c$$

c – some offset $\quad c = \sum_{i=1}^{\infty} \gamma_i \cdot E w_k$

KRE

$$\hat{R}(u) = \frac{\sum_{k=1}^{N} y_k K\left(\frac{u_k - u}{h}\right)}{\sum_{k=1}^{N} K\left(\frac{u_k - u}{h}\right)}$$

THEOREM $\quad h \to 0 \quad Nh \to \infty \quad N \to \infty$

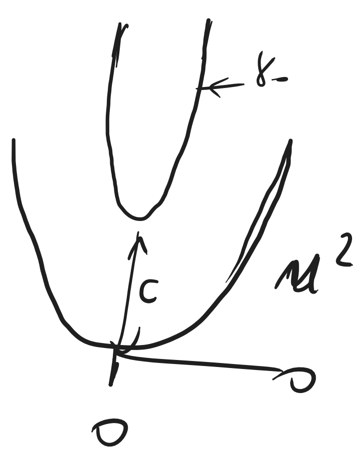
$\mu()$ – continuous

$$\hat{R}(u) \xrightarrow{P.1} \gamma_0 \mu(u) + c$$

not a problem

We know 1 point

e.g. $\boxed{\mu(0) = 0}$



$$\hat{\mu}(u) = \hat{R}(u) - \hat{R}(0)$$

$$(\gamma_0 \mu(u) + \cancel{c}) \quad - \quad (\gamma_0 \mu(0) + \cancel{c})$$

$\mu(0) = 0$

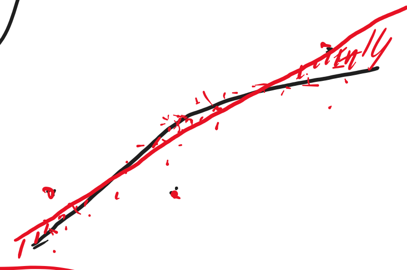
Specific case

$$\hat{\mu}(u) \xrightarrow{P.1} \gamma_0 \mu(u)$$

$$\hat{\mu}(u) = \frac{\sum y_k K\left(\frac{u_k - u}{h}\right)}{\sum K\left(\frac{u_k - u}{h}\right)} - \frac{\sum_i y_k K\left(\frac{u_k - 0}{h}\right)}{\sum K\left(\frac{u_k - 0}{h}\right)}$$

$\gamma_0 \mu(u) + c \qquad \to c$

$N = 3$



$\mu(u) = c_1 u + c_2 \qquad P$

DYNAMIC SUBSYSTEM / BLOCK / COMPONENT

$u_k \sim$ i.i.d.

$E u_k = 0$

BUSSGANG THEOREM

random variable $\qquad k+T \neq k \qquad$ independent

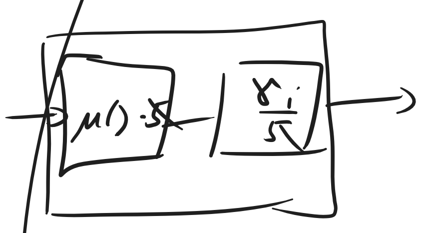
$$C_{y,u}(\tau) = E y_{k+T} u_k = E\{(\gamma_0 \mu(u_{k+T}) + \gamma_1 \mu(u_{k+T-1}) + \dots + \gamma_\tau \mu(u_{k+T-T}) + \dots + z_k) u_k\}$$

u_k

const. (indep. of k)

$$= \gamma_\tau \, E u_k \mu(u_k)$$

γ



$\neq 0$

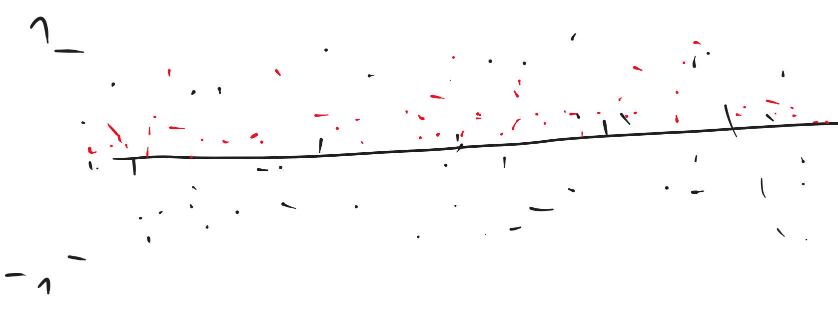
$$C_{y,u}(\tau) = \text{const} \cdot \gamma_\tau$$

$$\boxed{\hat{\gamma}_\tau = \frac{1}{N-T} \sum_{k=1}^{N-T} u_k y_{k+T}}$$

0

$\hat{\gamma}_\tau \to$ ~~ratio~~ γ_τ const

$u_k \sim U[-1, 1]$



0

$W_k = \mu(u_k)$

$\mu(u) = u^2$

$$E u \cdot \mu(u) = E u^3 = 0$$