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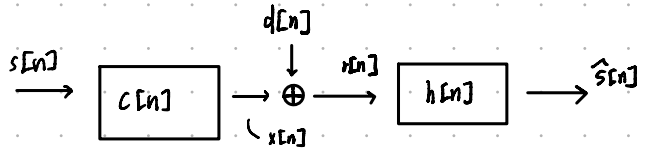
Stoch Proj 6 : MMSE FIR



$s[n]$: ± 1 iid , $p = .6$

$d[n]$: white Gaussian noise, $\sigma^2 = 1$.

$c[n]$: FIR filter with imp= $[1 \ 2 \ 4]$

$$R_{ss}[n] = E[s[m]s[m+n]] = \begin{cases} 1 & n=0 \\ 0 & \text{else} \end{cases} \quad \delta[n]$$

$R_{rs}[n] = R_{xs}[n]$ (eq. 11.8 s,d uncorrelated) $\rightarrow R_{\hat{s}x}[m] = h[m] * R_{xx}[m]$

$R_{xs}[n] = R_{ss}[n] * c[n] = c[n]$

s, d uncorrelated

$R_{rr}[n] = R_{xx}[n] + R_{dd}[n]$

xcorr of gaussian

$R_{dd}[n] = \sigma^2 \cdot \delta[n]$; $\sigma^2 = 1$

Wiener - Khinchin

$R_{xx}[n] = R_{ss}[n] * R_{cc}[n]$; $R_{cc}[n] = c[n] * c[n]$

$N = 4$

$$\begin{bmatrix} R_{rr}[0] & R_{rr}[-1] & R_{rr}[-2] & R_{rr}[-3] \\ R_{rr}[1] & R_{rr}[0] & R_{rr}[-1] & R_{rr}[-2] \\ R_{rr}[2] & R_{rr}[1] & R_{rr}[0] & R_{rr}[-1] \\ R_{rr}[3] & R_{rr}[2] & R_{rr}[1] & R_{rr}[0] \end{bmatrix} \begin{bmatrix} h[0] \\ h[1] \\ h[2] \\ h[3] \end{bmatrix} = \begin{bmatrix} R_{\hat{s}r}[0] \\ R_{\hat{s}r}[1] \\ R_{\hat{s}r}[2] \\ R_{\hat{s}r}[3] \end{bmatrix}, \quad R_{sr} = R_{\hat{s}s}$$

$$\begin{bmatrix} 1.2 & 0.28 & 0.4 & 0 \\ 0.28 & 1.2 & 0.28 & 0.4 \\ 0.4 & 0.28 & 1.2 & 0.28 \\ 0 & 0.4 & 0.28 & 1.2 \end{bmatrix} \begin{bmatrix} h[0] \\ h[1] \\ h[2] \\ h[3] \end{bmatrix} = \begin{bmatrix} 1 \\ 0 \\ 0 \\ 0 \end{bmatrix}$$

$$h = \begin{bmatrix} 0.99 \\ -0.20 \\ -0.31 \\ 0.14 \end{bmatrix}$$