No. of objects in Sub image $\propto$ Part-size

No. of objects in Sub image = $K(\text{Part-size})^2$

Let the Size of Sub image = $\bar{N} \times \bar{N}$

where $\bar{N} < N$.

$$\alpha = N/\bar{N} \Rightarrow \alpha > 1$$

$$\bar{P} = P/\alpha^2$$

$$\bar{R}_{LAT} = \alpha\left(2\bar{N}^2 + 2\bar{N}n + \bar{P}^2 n^2\right)$$

$$= \alpha\left(\frac{2N^2}{\alpha^2} + \frac{2N}{\alpha}n + \frac{P^2}{\alpha^4}n^2\right)$$

$$= \frac{2N^2}{\alpha} + 2Nn + \frac{P^2}{\alpha^3}n^2$$

$$= \alpha\left[2N^2 + 2\alpha Nn + \frac{P^2}{\alpha^2}n^2\right]$$

- Too big $\alpha \Rightarrow$ loss of information.
- Complexity has reduced because of loss of information as $P \to 0$. i.e. P becomes nearly 0, zero.

- α should be chosen as such the it accomodates the size of the object.

Optimum Size.

$$\bar{R}_{LAT} = \alpha\left[2N^2 + 2\alpha Nn + \frac{p^2}{\alpha^2} n^2\right]$$

$$\boxed{\frac{d\,\bar{R}_{LAT}}{d\alpha} = 2N^2 + 4\alpha Nn - \frac{n^2 p^2}{\alpha^2}}$$

(dividing α in $\bar{R}_{LAT}$)

$$\frac{d\,\bar{R}_{LAT}}{d\alpha} = 2Nn - \frac{2p^2n^2}{\alpha^3} = 0$$

if $\alpha = 1$

$$\Rightarrow p = \sqrt{2} \cdot N/n$$

Adjust α such that

$$\bar{N} = n\bar{p}$$

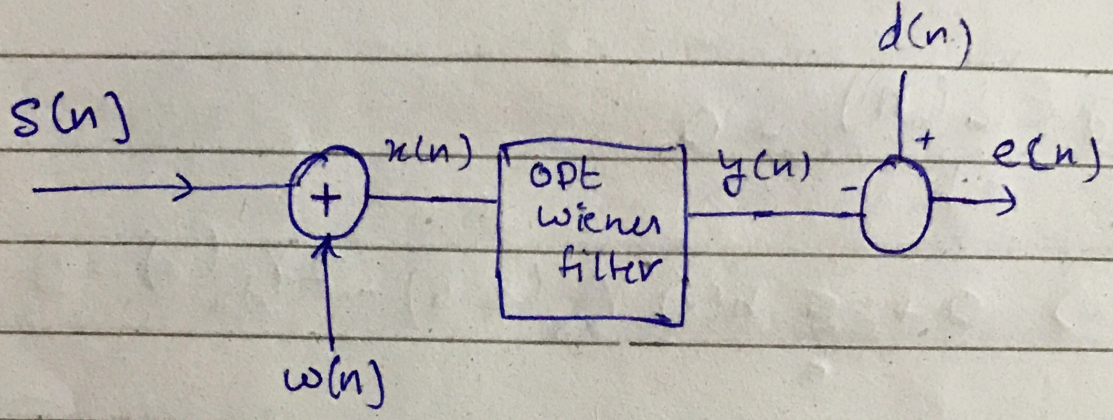
$$\bar{N} = n \quad (\text{if } p = 1)$$

$$\Rightarrow \boxed{\alpha = np/N}$$

Wiener Filter

⇓

A priori Knowledge



$$x(n) = s(n) + w(n)$$

$$y(n) = \sum_{k=1}^{m} h(k)\, x(n-k)$$

$$e(n) = d(n) - y(n)$$

$$\mathcal{E}_m(n) = E\left[e^2(n)\right]$$

$$= E\left[d(n) - \sum_{k=1}^{m} h(k)\, x(n-k)\right]^2$$

$$= E\left[d(n)\, d(n)\right] + \sum_{k}\sum_{l} h(k)\, h(l)\, E\left[x(n-k)\, x(n-l)\right] - 2\sum_{k} E\left[x(n-k)\, d(n)\right]$$

$$= \gamma_{dd}(0) + \sum_k \sum_l h(k)\, h(l)\, \gamma_{xx}(k-l)$$

$$- 2 \sum_k h(k)\, \gamma_{dx}(k)$$

$$\frac{\partial \mathcal{E}_m(n)}{\partial h} = 0$$

$$\Rightarrow \quad 0 + 2 \sum_k h(k)\, \gamma_{xx}(k-l) - 2\gamma_{dx}(k) = 0$$

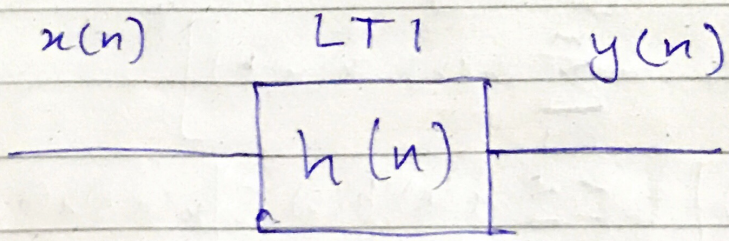
$$\sum_k h(k)\, \gamma_{xx}(k-l) = \gamma_{dx}(k)$$

$$\downarrow$$

$$h_m \Gamma_m = \gamma_d$$

$$\boxed{h_m = \Gamma_m^{-1} \gamma_d}$$

Symmetrical & Toeplitz.



Question: (Task)

Take any foggy image from net
Use wiener filter to see the response?

Bernoulli's Distribution.

Trial → Success
Trial → Failure

$$X = \begin{cases} 1 \Rightarrow \text{Success (S)} \\ 0 \Rightarrow \text{Failure (F)} \end{cases} \quad (\text{random trial})$$

$$P(x=1) = p \qquad P(x=0) = 1-p$$

$$P(x=i) = p^{i}(1-p)^{1-i}$$

$$E[x] = p \qquad \text{Var}[x] = p(1-p)$$

Bionomial Distribution

Let 'M' be the identical independent bernoullis trials.

Let 'x' be the no. of success out of 'M' trials and let it be bionominally Distributed.

$$P(X=i) = \binom{N}{i} p^i (1-p)^{N-i}$$

$$E[x] = Np \qquad Var[x] = Np(1-p)$$