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Part-B

Q.5] Adaptive filters :-

- The Adaptive filters adapt to the behaviour based on the statistical characteristics of the image inside the filter region S_{xy}.
- It provides improved performance over increased complexity.
- In adaptive local noise reduction filter we use measurement of mean and variance.
- Parameters on local region S_{xy}
  - $g(x,y)$: noisy image pixel value
  - σ_η^2 : noise variance
  - m_L : local mean
  - σ_L^2 : local variance
- Our aim is to :
  - If σ_η^2 is zero, return $g(x,y)$
  - If $\sigma_L^2 > \sigma_\eta^2$, return close to $g(x,y)$
  - If $\sigma_L^2 = \sigma_\eta^2$, return arithmetic mean of m_L.
- It is given by the formula:

$$\hat{f}(x,y) = g(x,y) - \frac{\sigma_\eta^2}{\sigma_L^2}\left[g(x,y) - m_L\right]$$

- In inverse filtering, with the estimated degradation function $H(u,v)$

$$G(u,v) = F(u,v)\cdot H(u,v) + N(u,v)$$

$$\Rightarrow \hat{F}(u,v) = \frac{G(u,v)}{H(u,v)} = F(u,v) + \frac{N(u,v)}{H(u,v)}$$

($\hat{F}(u,v)$: Estimate of original image; $N(u,v)$: Unknown Noise)