15EEE337 Digital Image Processing

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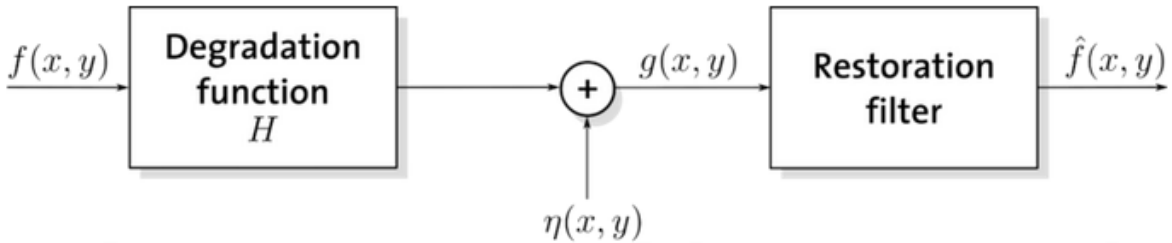
Last Lecture

- Image restoration
- mage denoising

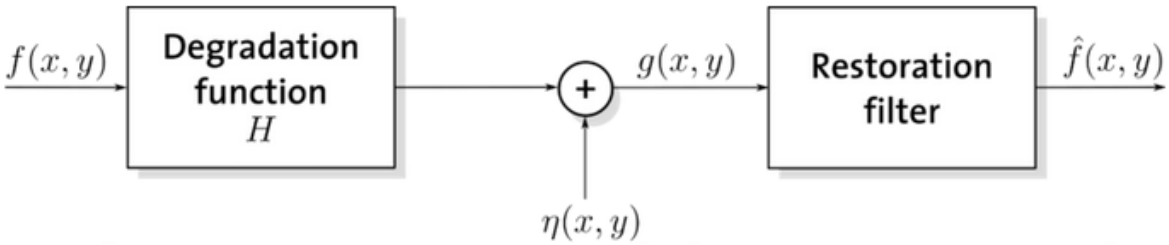

$f(x, y)$
Degradation function H
+
$g(x, y)$
Restoration filter
$\hat{f}(x, y)$
$\eta(x, y)$

Degradation function estimation

- Image restoration process
- Image restoration considering only noise.
- Degradation function.
- Three ways to estimate the degradation function
  - Observation
  - Experimentation
  - Mathematical modeling
- Blind convolution - True degradation function is rarely known completely.

Estimation by Image Observation

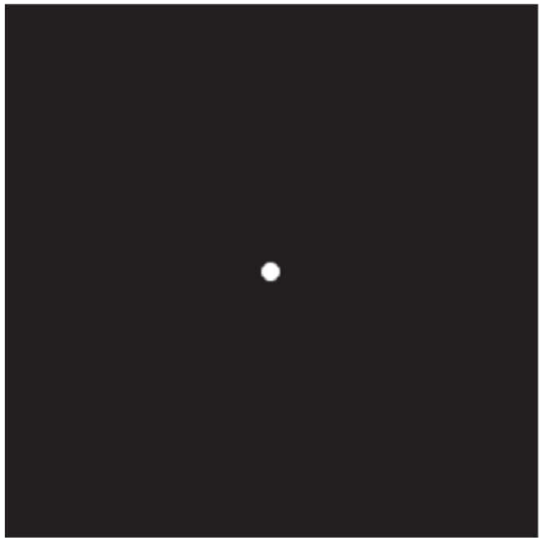
- Gather information from the image itself.
- Look for area in the signal content is strong- Reducing the effect of noise.

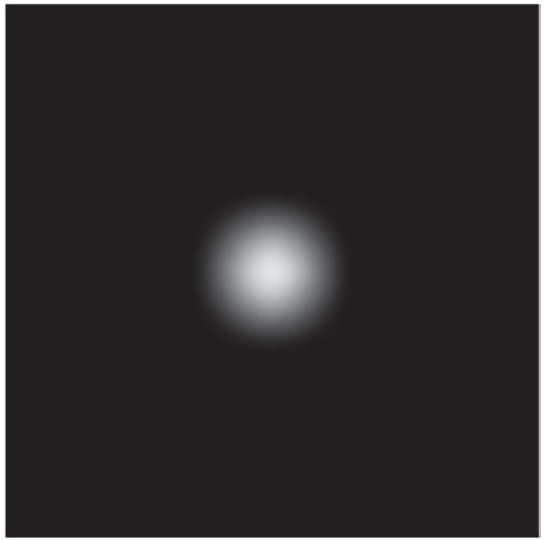


$$G(u,v) = H(u,v)F(u,v) + N(u,v)$$

Estimation by Experimentation

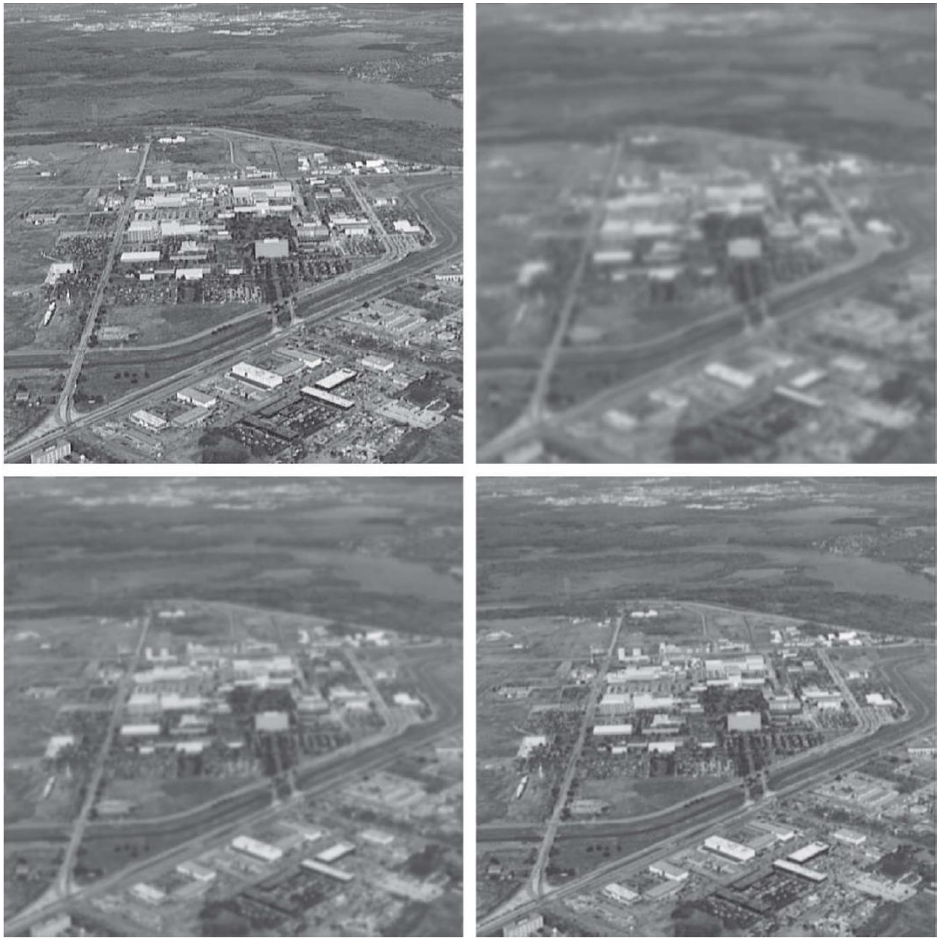
- Equipment similar to the one used for acquiring the degraded image
- Changing system setting – acquiring images – as close as to the image we want to restore.
- Underlying idea- obtain the impulse response of degradation
- Small dot of light as bright as possible.





Estimation by modeling

- Model can consider the environmental conditions also.

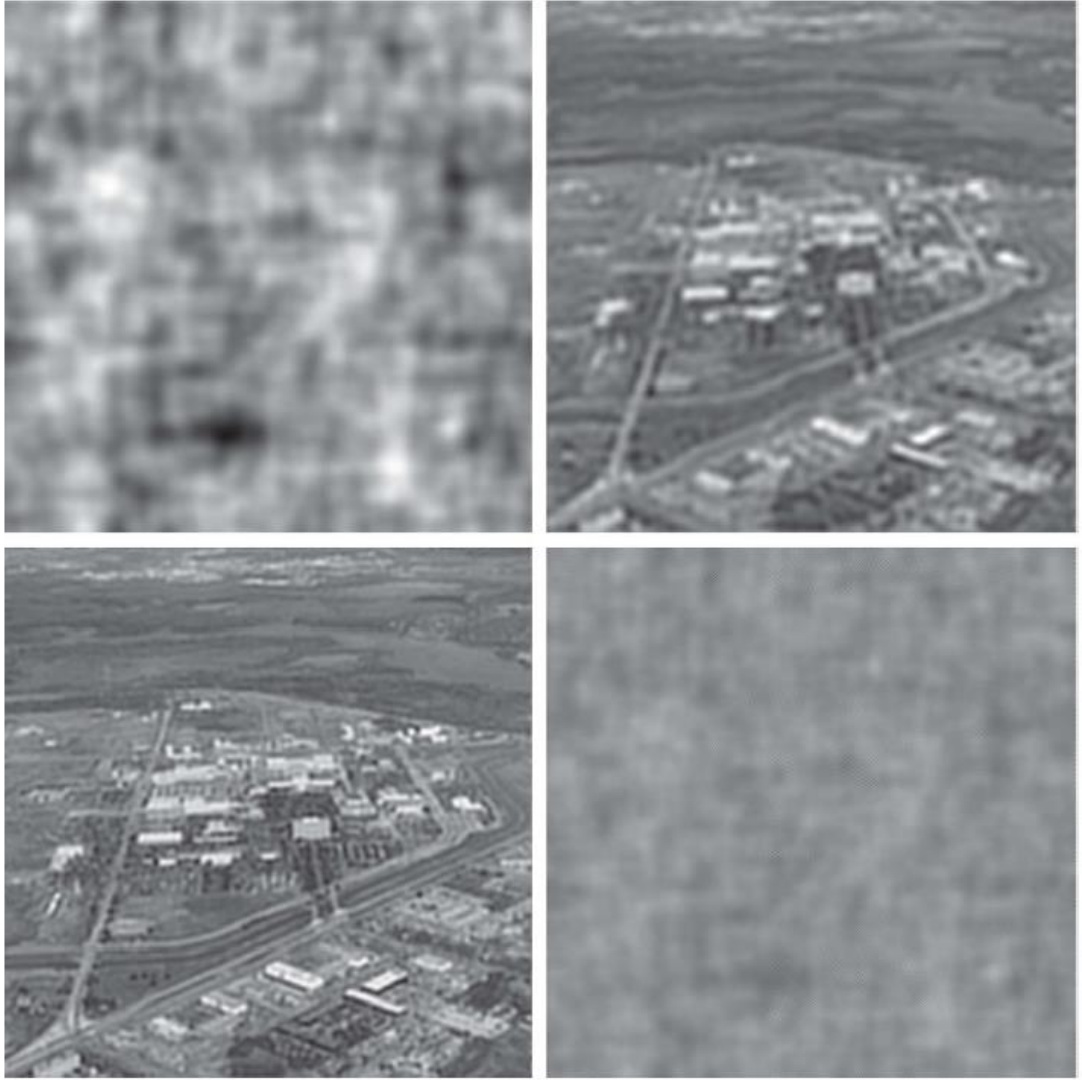


Inverse filtering

- The simplest approach to restoration is direct inverse filtering,
- where we compute an estimate of the transform of the original image by dividing the transform of the degraded image

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

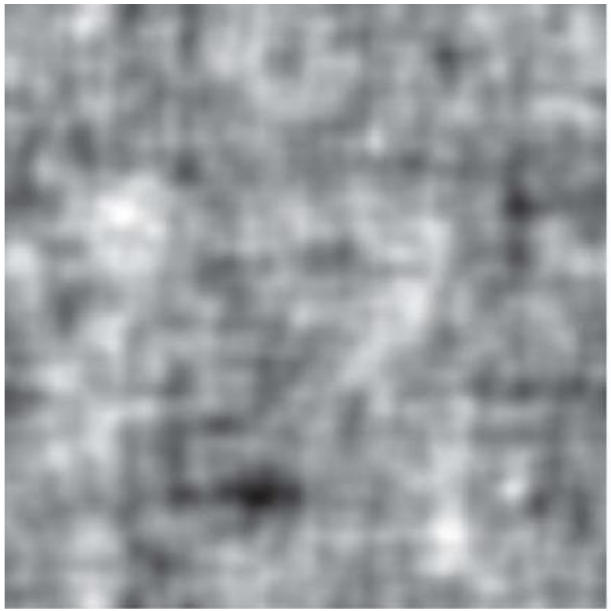
$$H(u,v) = e^{-k\left[(u+M/2)^2+(v-N/2)^2\right]^{5/6}}$$



Min Mean Square Error Filtering

- Image and noise –Random variable
- Error – keep it minimal.

$$e^2 = E\left\{(f - \hat{f})^2\right\}$$

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