



# DETECTION AND REGISTRATION OF BLURRED LOCATIONS IN ONLINE SATELLITE IMAGES

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## PROJECT DESCRIPTION

Blurring is a mostly used operation for censoring. Some countries ask for their military facilities to be blurred from Google Earth, Yandex Maps, etc. Also, there are some blurred locations due to some technical problems. Hence, image deblurring is an important and popular branch of image processing. Our aim is to detect blurred locations in downloaded online satellite images and deblur them.

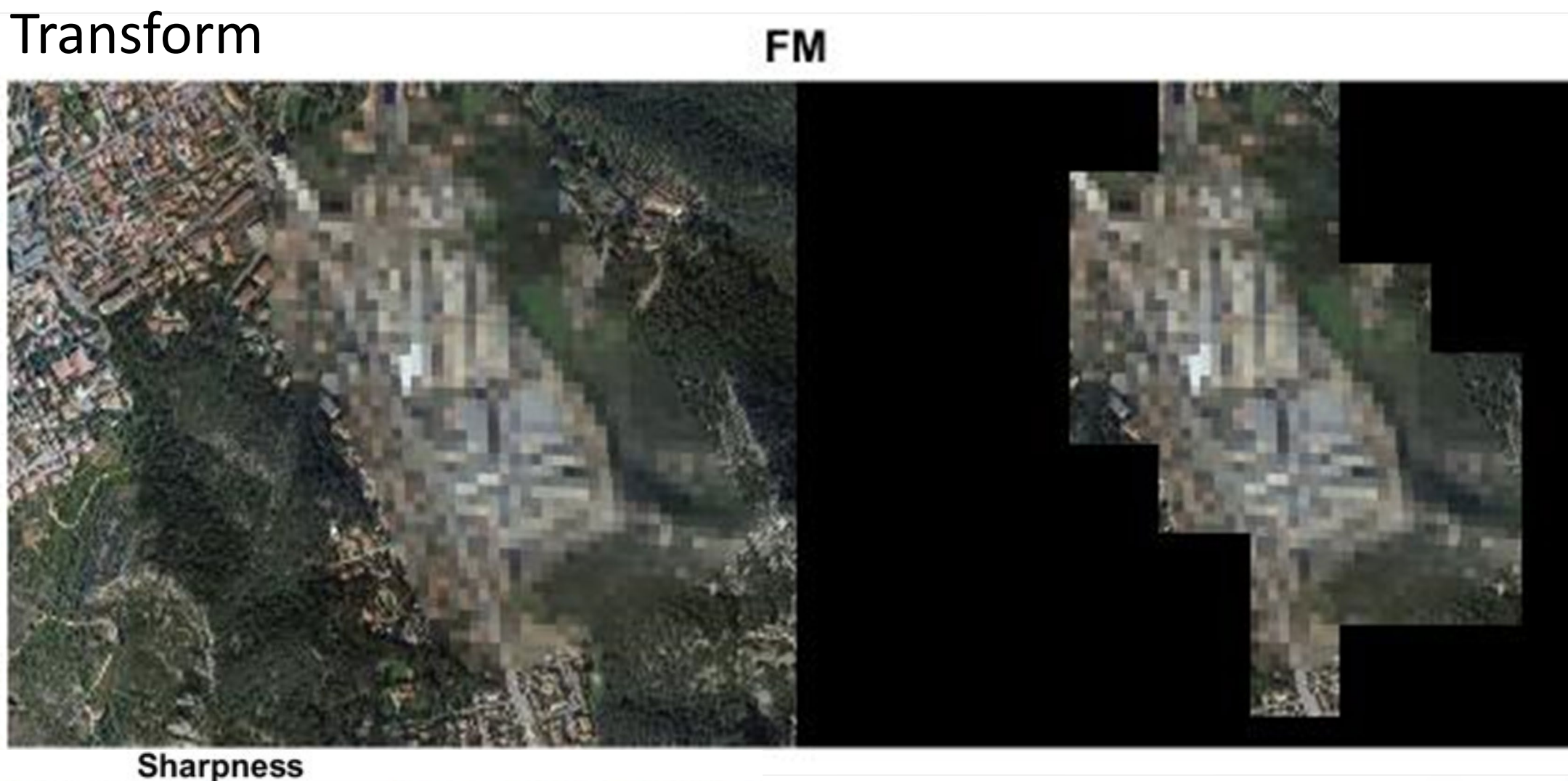
## BLUR DETECTION

Methods we used in our digital system

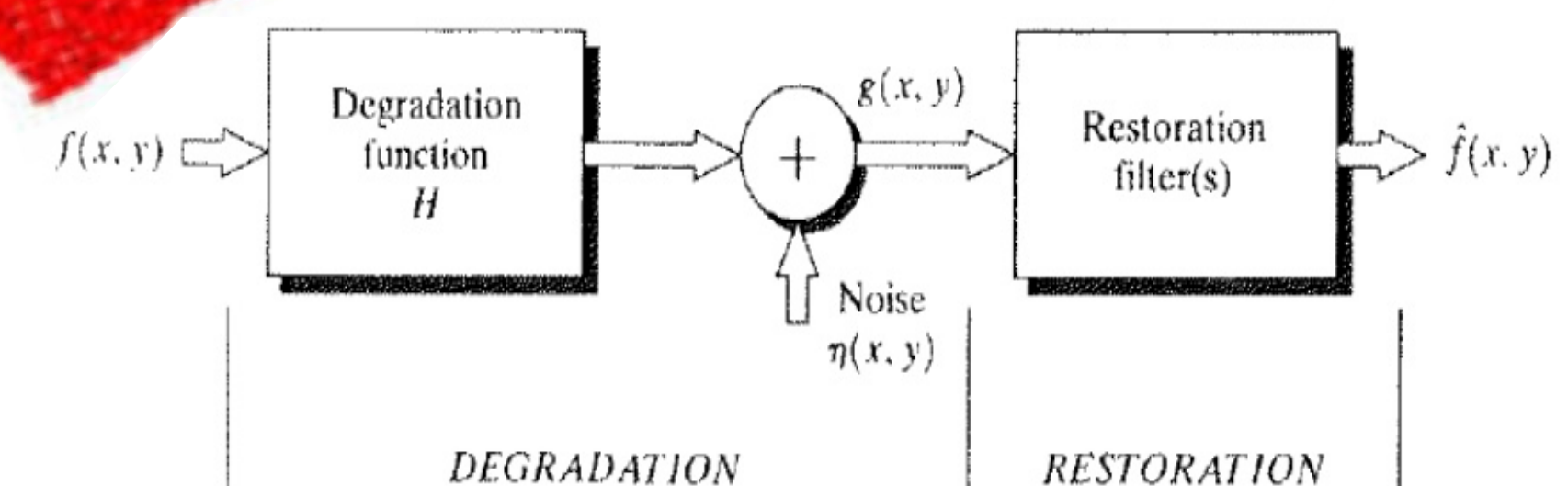
- ✚ Variance of Laplacian
- ✚ Variance of Gaussian
- ✚ Haar Wavelet Transform

Methods we used to detect exact location of blur

- FM(Frequency Domain Image Blur Measure)
- Sharpness Estimation by using Gradients



## IMAGE RESTORATION



### Inverse Filtering

Inverse Filtering is the most basic method in image restoration process. But, it is not popular due to huge noise amplification side effect. The formula is given below:

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

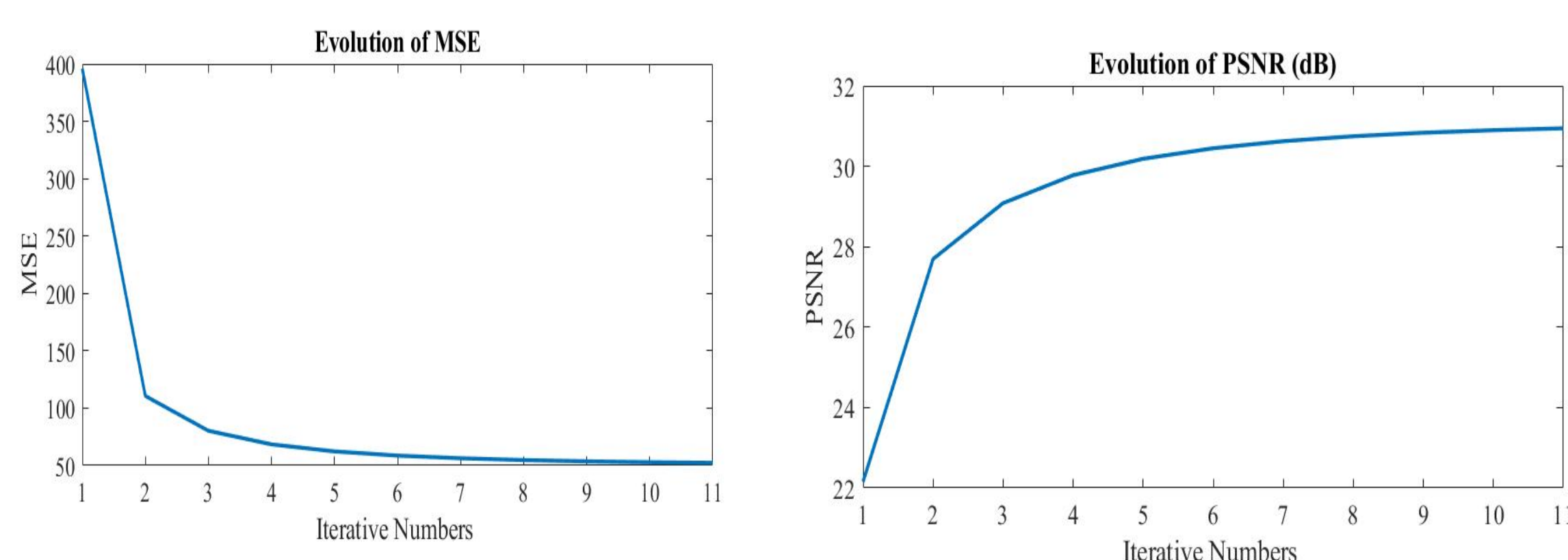
### MATLAB Deconvolution Functions

- ❖ Wiener Filter
- ❖ Lucy-Richardson
- ❖ Blind Deconvolution
- ❖ Regularized Filter

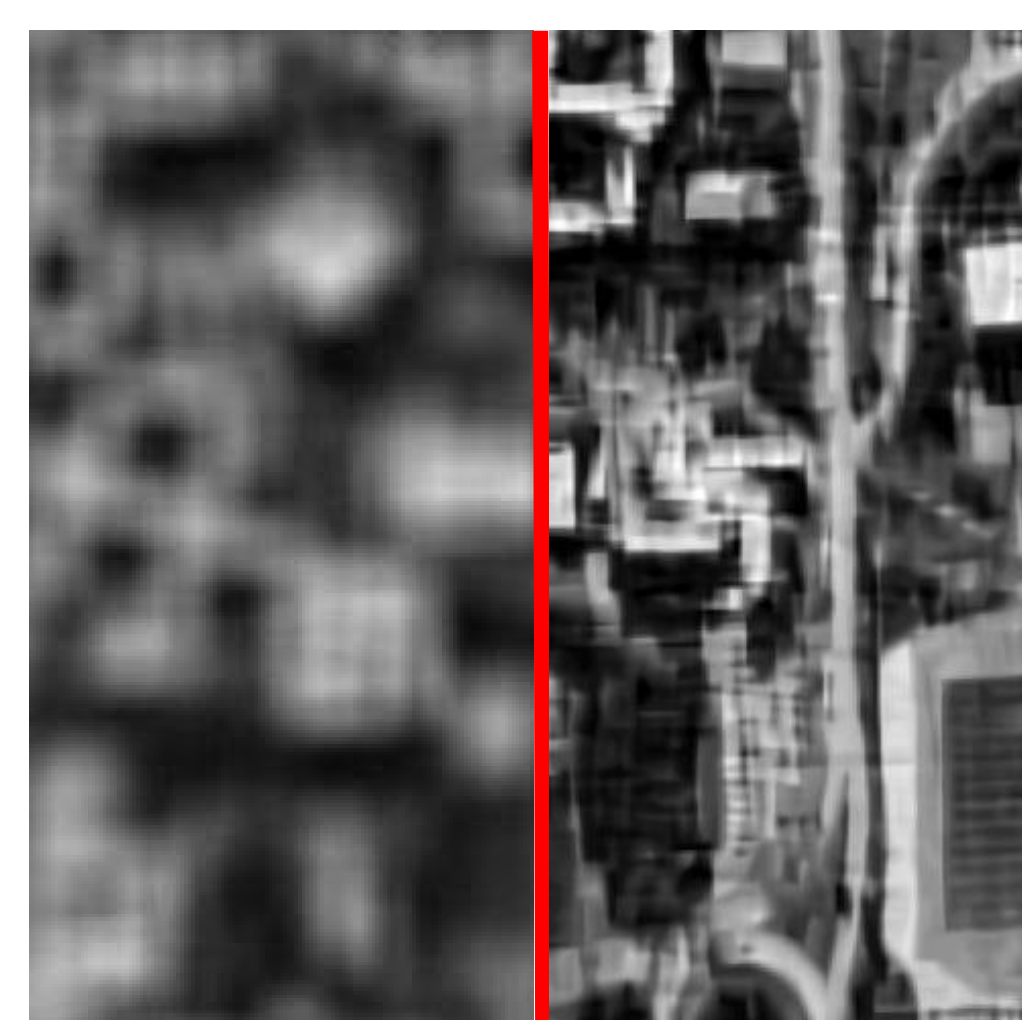
The formula of Wiener filter is given below:

$$R_W(u,w) = \frac{H(u,w)^*}{|H(u,w)|^2 + \frac{S_n(u,w)}{S_f(u,w)}}$$

## Sparse Modeling



Our image reconstruction results with Sparse Signal Modelling techniques are shown above via Evolution of MSE (Mean-Squared-Error) and Evolution of PSNR (Peak-Signal-to-Noise-Ratio) and they are shown at the right hand-side on the image of our Beytepe campus.



Degraded Deblurred

