Detection and Registration of Blurred Locations in Online Satellite Images

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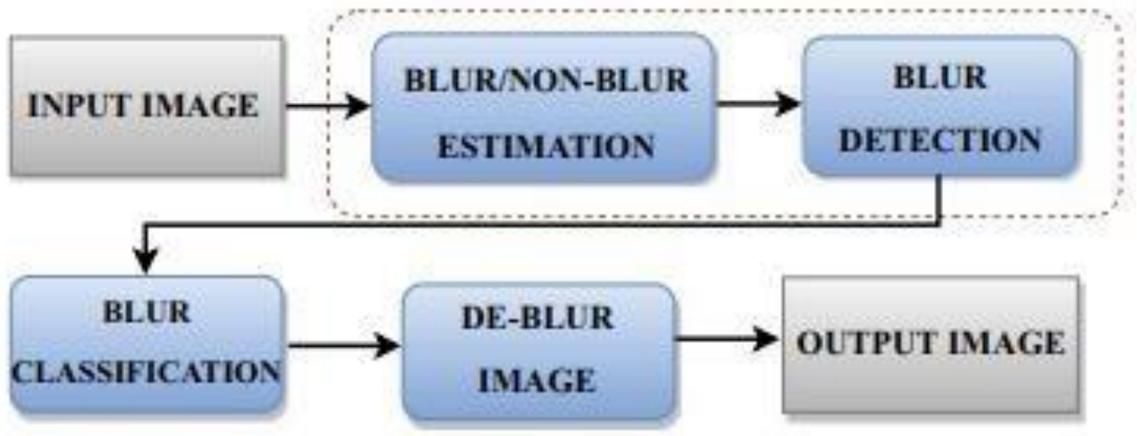
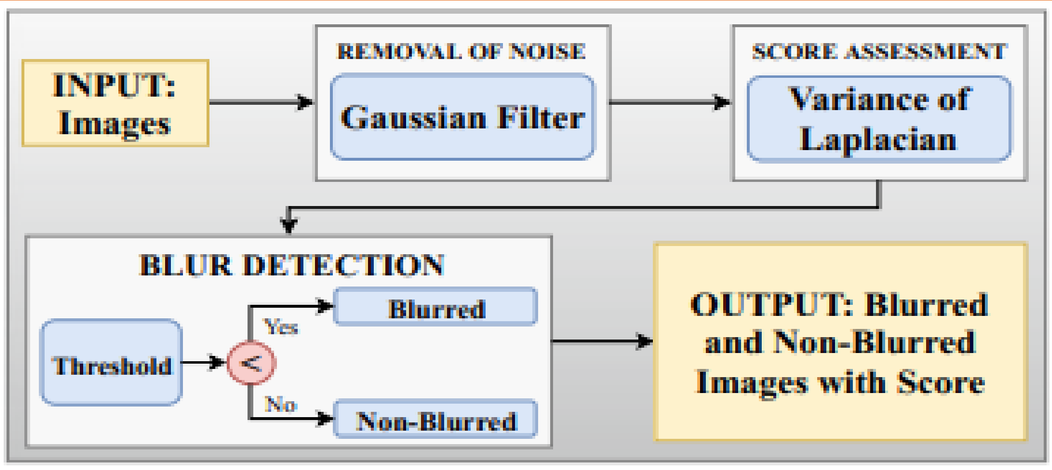
Project Description: There are many satellite map services such as Google Map or Yandex Map. Strategic regions such as military bases etc. are wanted to be hidden by the relevant countries. Some fuzzy locations in the map service are not blurred in another map service. In this project, Fuzzy locations are detected in one map service and this location is checked in another map service. If the non-blurry location is determined, it will be saved. If the non-blurry place is not detected, deburring methods are applied to this blurred place and reconstruction is made.

BLOCK SCHEME OF THE PROJECT



BLUR DETECTION



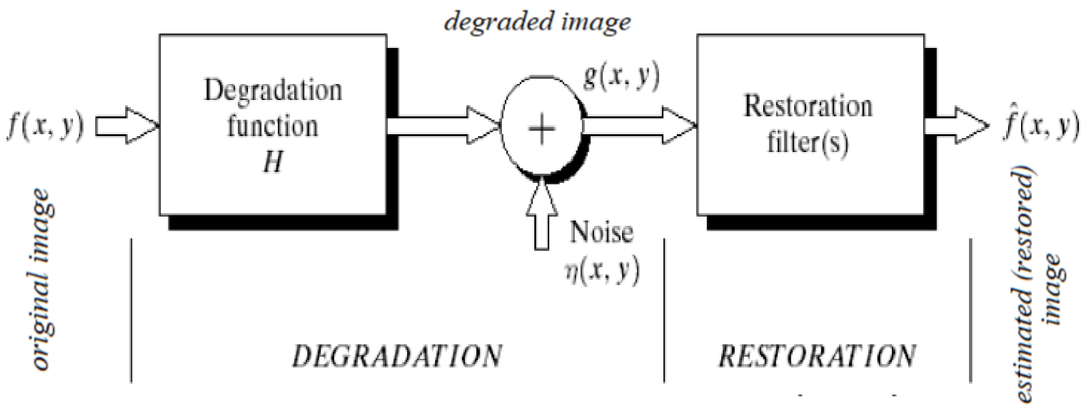
Laplacian is used in digital image processing for edge detection

$$\Delta f = \nabla^2 f = \nabla . \nabla f \qquad \nabla^2 f = \sum_{i=1}^{n} \frac{\partial^2 f}{\partial x_i^2}$$

Positive Laplacian Operator: It consists of a standard mask in which corner elements should be zero of the mask and centre elements should be negative of the mask.

$$\begin{bmatrix} 0 & 1 & 0 \\ 1 & 4 & 1 \\ 0 & 1 & 0 \end{bmatrix}$$

IMAGE DEBLURRING



$$g(x,y) = h(x,y) * f(x,y) + n(x,y) \quad \text{Spatial}$$

$$G(u,v) = H(u,v)\,F(u,v) + N(u,v) \quad \text{Fourier}$$

Blind Deconvolution Algorithm: The blind deconvolution algorithm can be used effectively when no information about the distortion (blurring and noise) is known.

Average Filter: A box blur is a spatial domain linear filter in which each pixel in the resulting image has a value equal to the average value of neighboring pixels in the input image.

$$\frac{1}{9}\begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$$

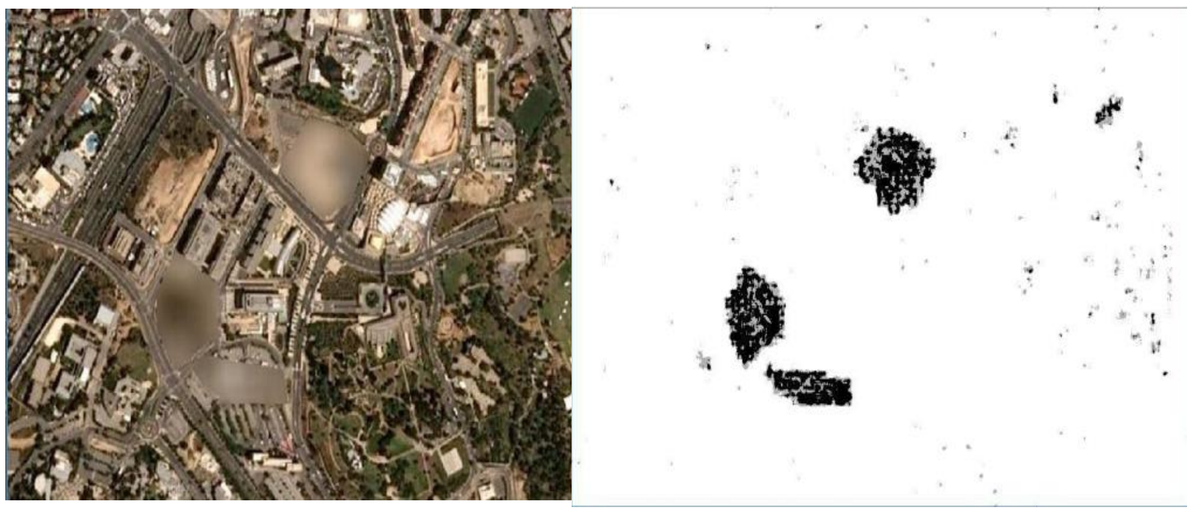
Gaussian Filter: It's a type of image blur filter that uses the Gaussian function to calculate the transformation to be applied to each pixel in the image. **Disk Filter**: The disk filter uses a circular averaging filter.

SSIM: It is used for evaluate the quality of our algorithm. "SSIM is a weighted combination of three comparative measurements (luminance, contrast and structure) between the input image and the reference image:

TEST SET OF BLUR DETECTION BY LAPLACIAN

Blurred Area Detection: Patio de los Naranjos Spain

36°50'20"N 2°28'20"W



Blurred Area Detection : Jerusalem Israel

RECONSTRUCTION OF THE IMAGES