Image Super Resolution

18 Juli 2023

@mahaamesha
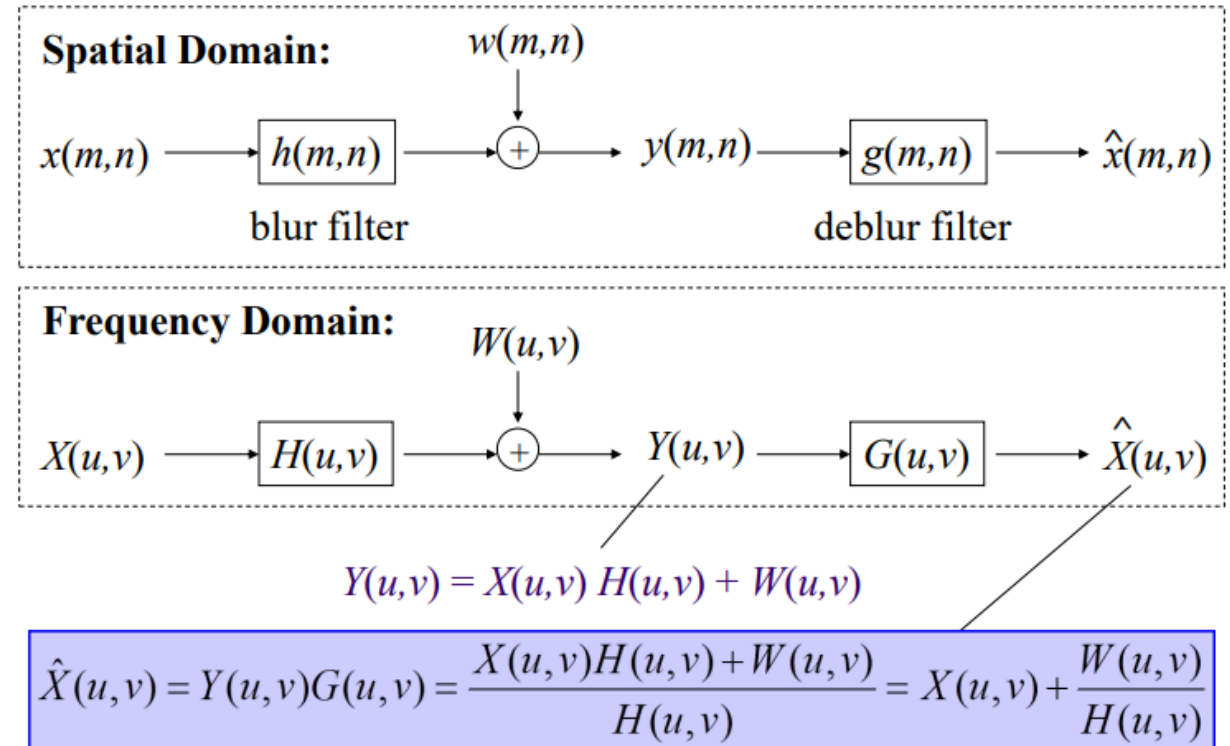
Denoising & Deblurring

Concern:

- Noise amplification.

$$\hat{x} = x * h * g + \boldsymbol{w} * \boldsymbol{g}$$

- The PSF $h(m, n)$ has to be known/estimated to get the inverse filter $G(u, v)$.

- Ringing effect.

Spatial Domain:

$w(m,n)$

$x(m,n) \longrightarrow \boxed{h(m,n)} \longrightarrow \bigoplus \longrightarrow y(m,n) \longrightarrow \boxed{g(m,n)} \longrightarrow \hat{x}(m,n)$

blur filter   deblur filter

Frequency Domain:

$W(u,v)$

$X(u,v) \longrightarrow \boxed{H(u,v)} \longrightarrow \bigoplus \longrightarrow Y(u,v) \longrightarrow \boxed{G(u,v)} \longrightarrow \hat{X}(u,v)$

$$Y(u,v) = X(u,v)\,H(u,v) + W(u,v)$$

$$\hat{X}(u,v) = Y(u,v)G(u,v) = \frac{X(u,v)H(u,v) + W(u,v)}{H(u,v)} = X(u,v) + \frac{W(u,v)}{H(u,v)}$$

Image Pyramid (Laplacian – Upscaling)

High resolution

- Low frequencies

- High frequencies (the details)

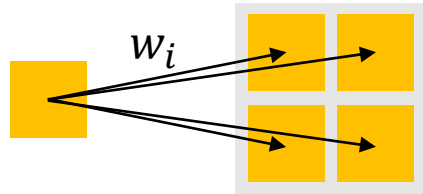The high frequencies handled by performs **interpolation**: Bicubic (common, but blurry).
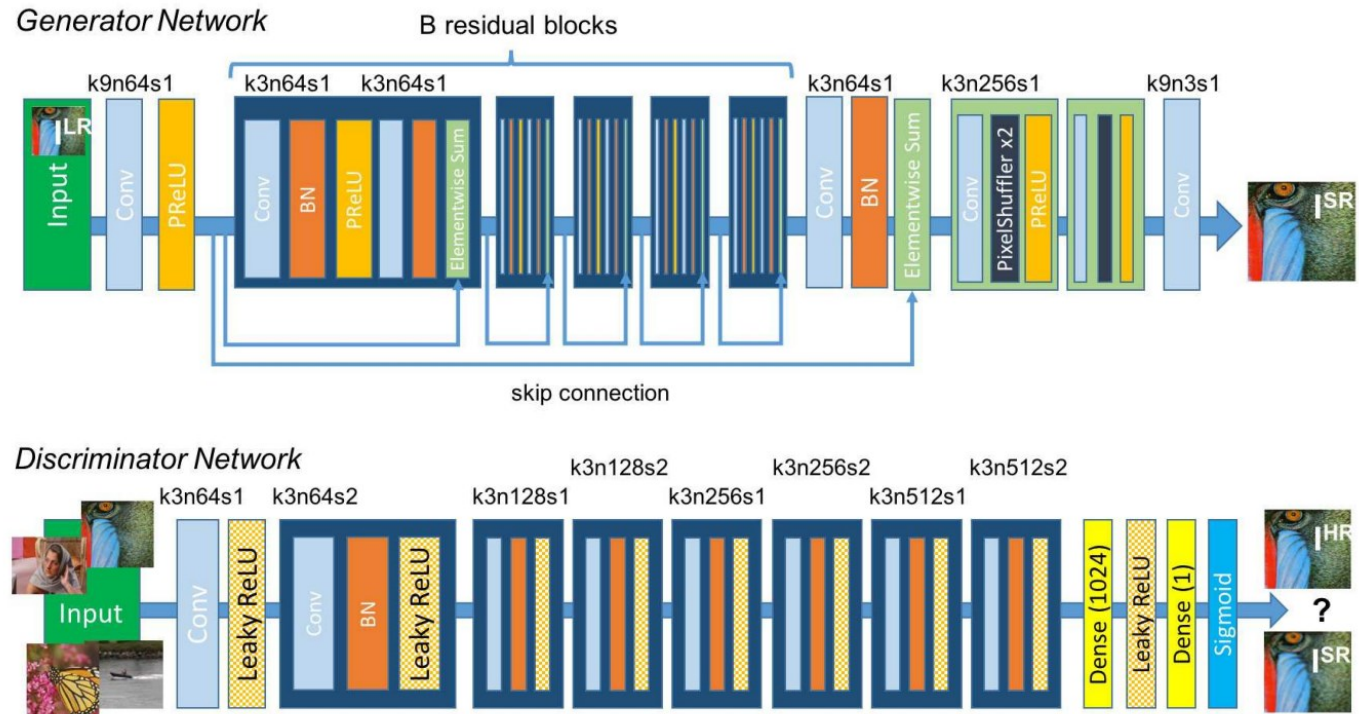
SRGAN

Train model for mapping each pixel, which is storing weight scaling.

Generator: creator

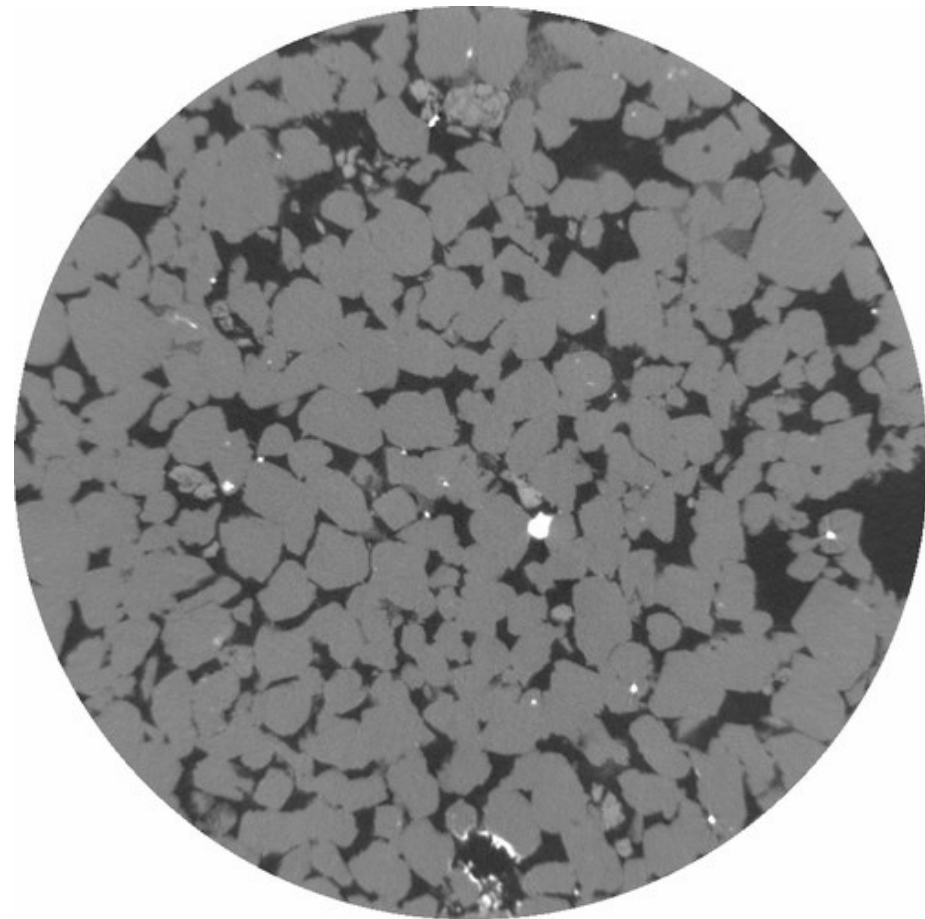Discriminator: corrector

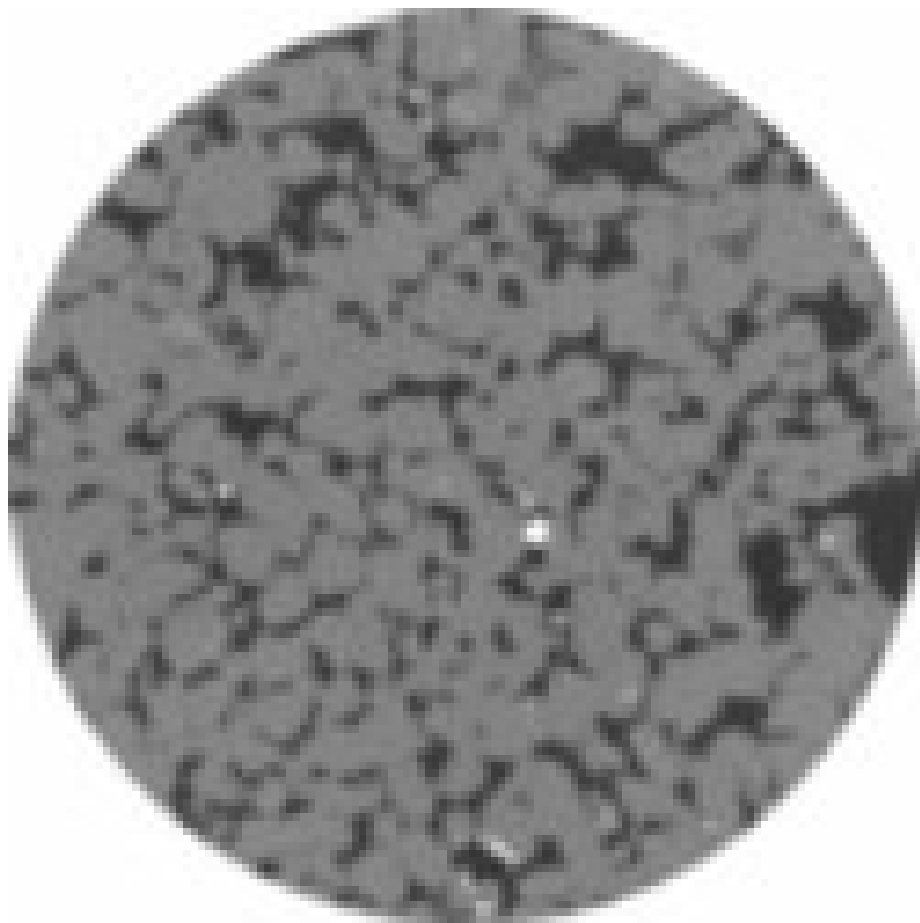SRGAN Network Architecture

Test: Input image

Downsampling the ideal image 4x.

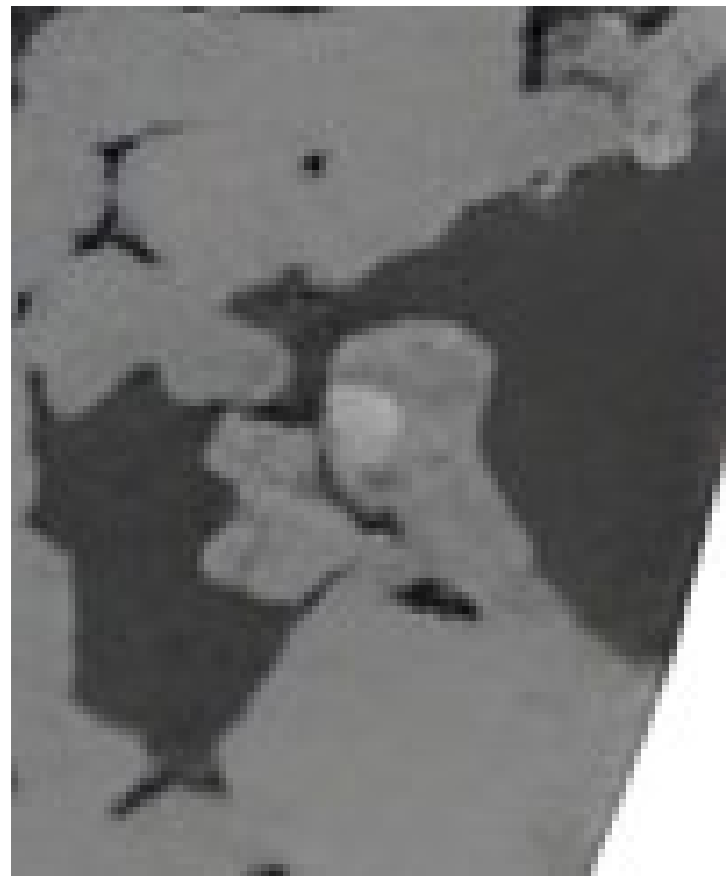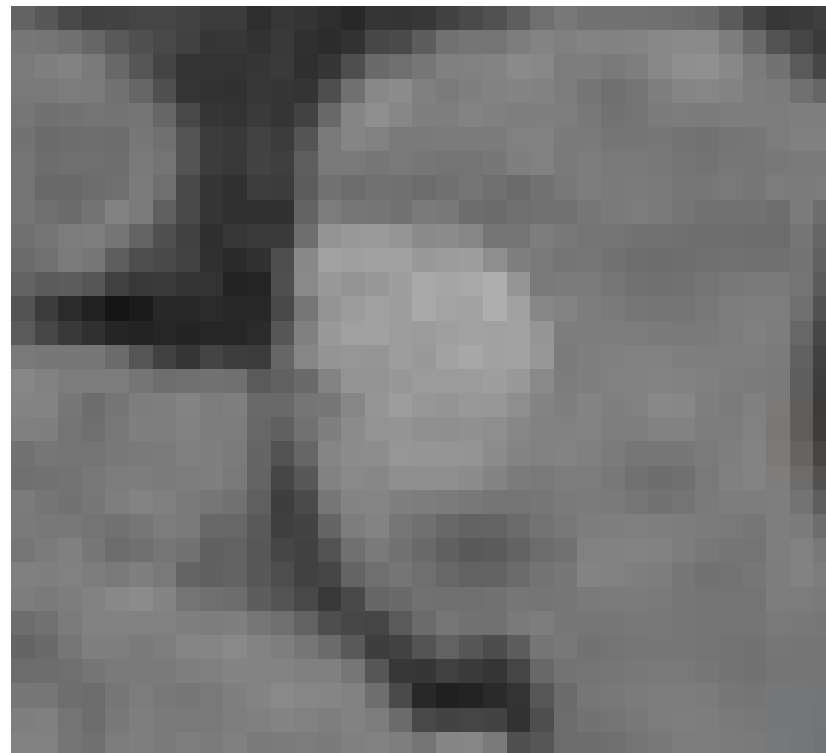|	
Ideal image	500 x 500
Input image	125 x 125

Test: Results

granite_LR 125x125
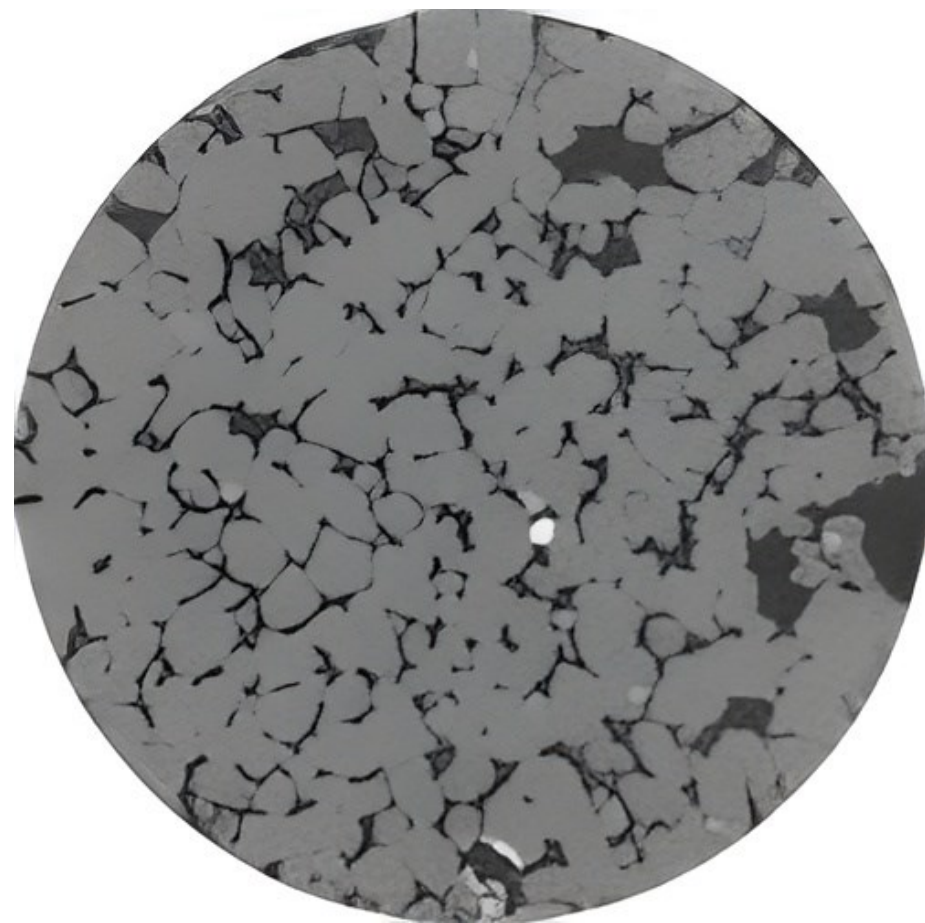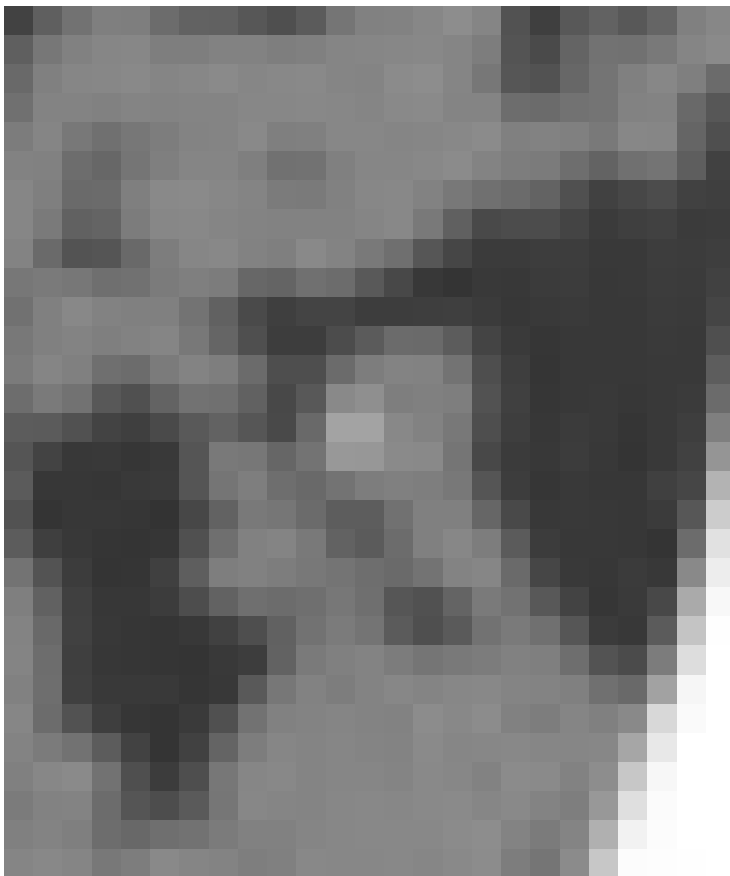
granite_SR 500x500

Test: Results

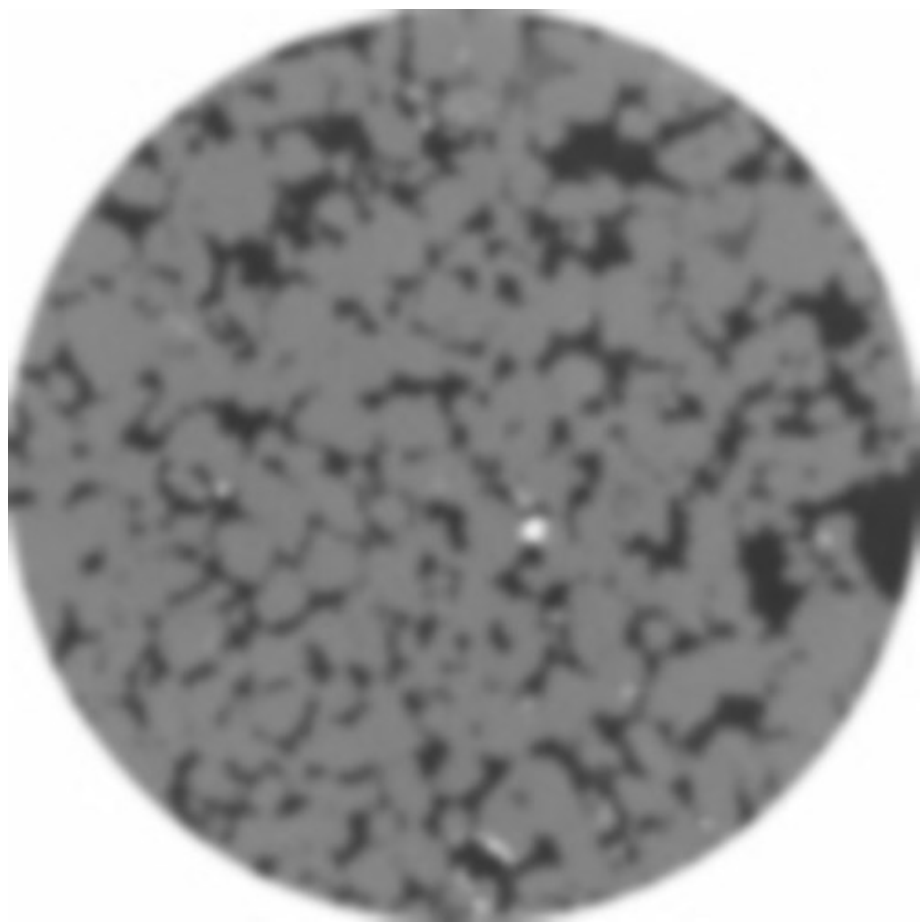granite_LR 125x125

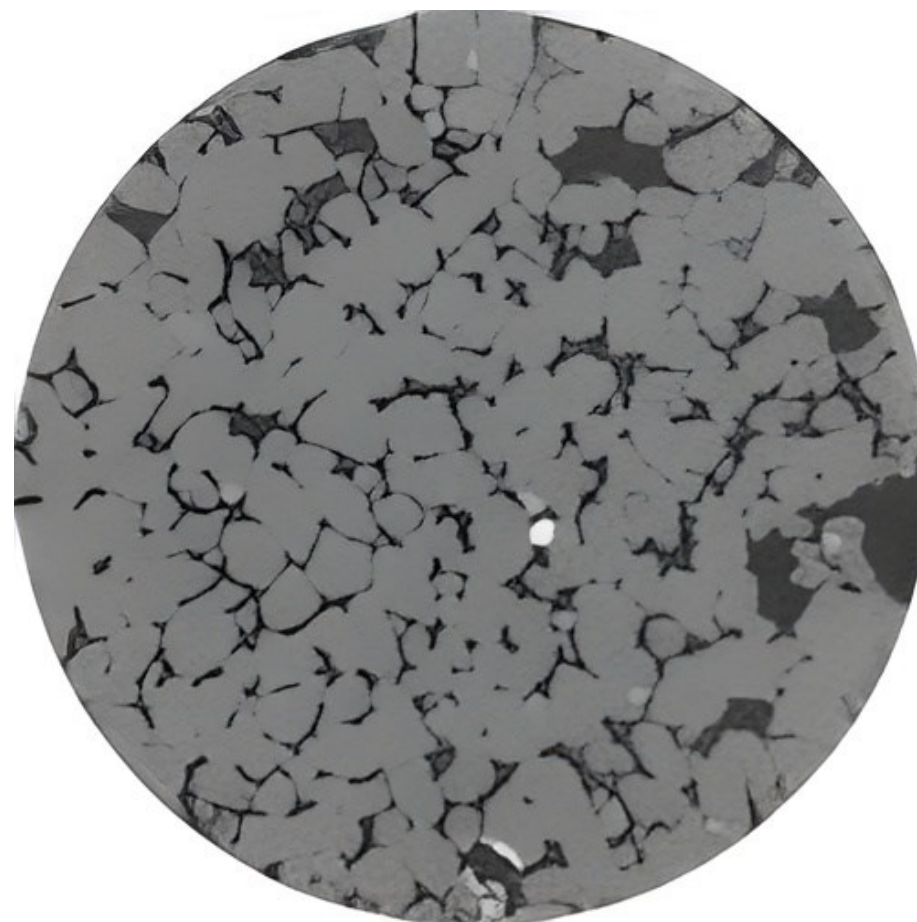granite_SR 500x500

Test: Results

granite_LR 125x125
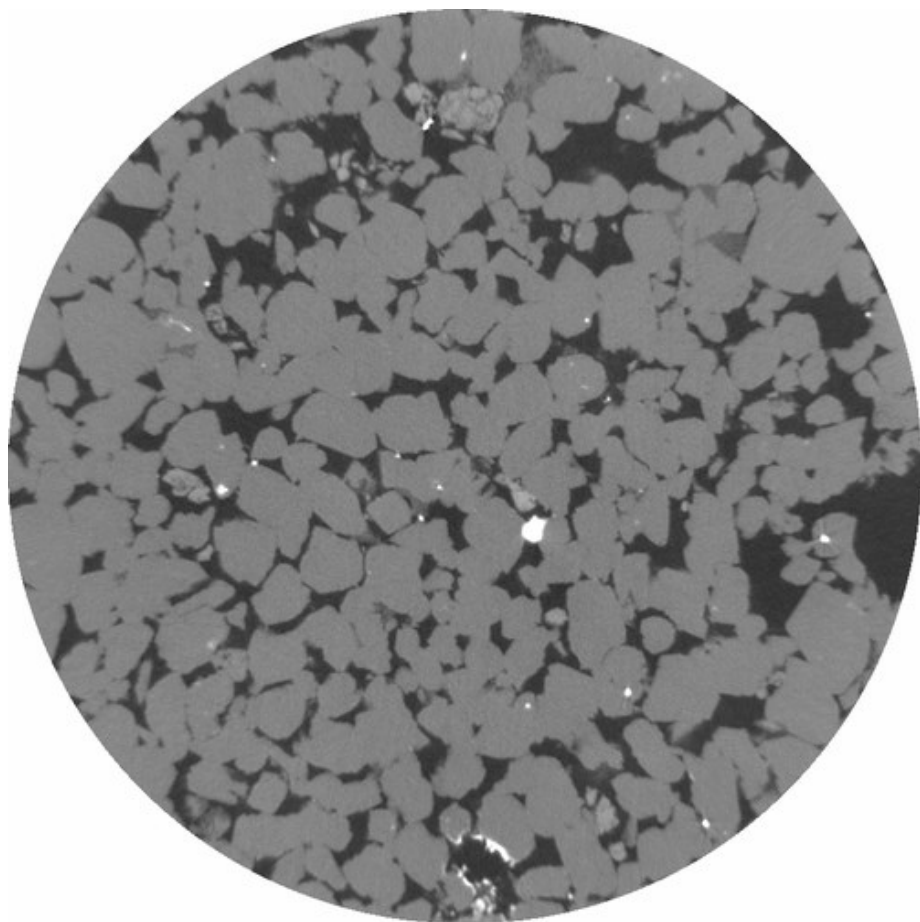

granite_SR 500x500

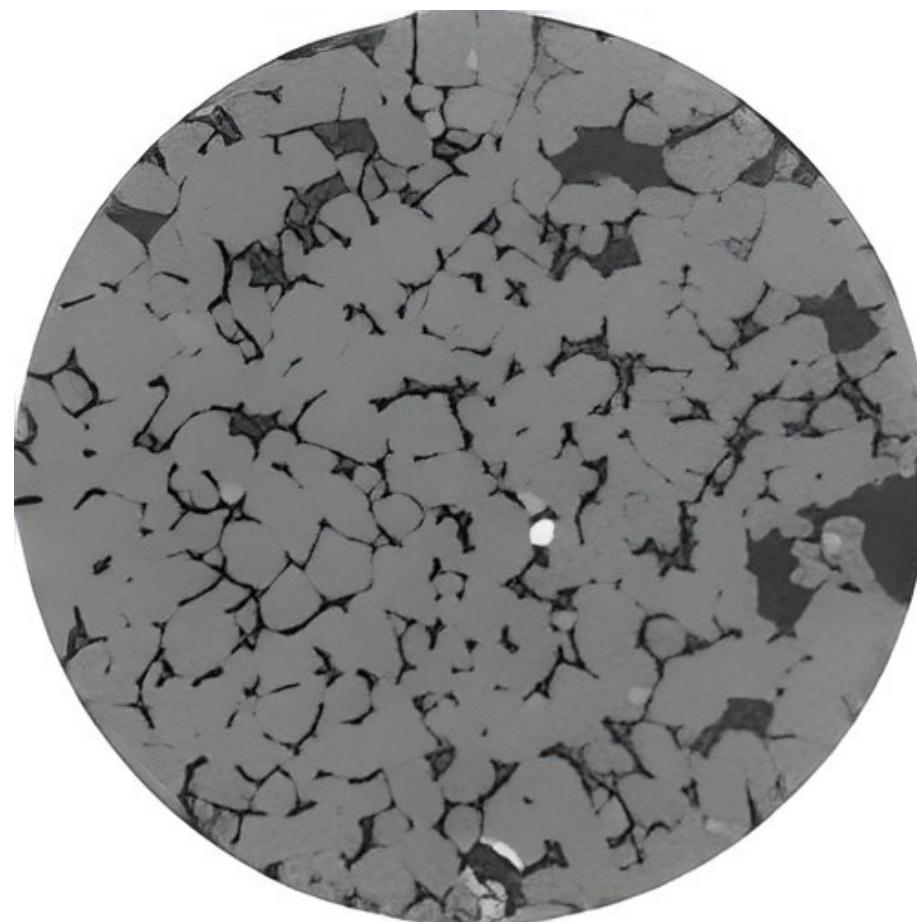# Test: Bicubis vs SRGAN

granite_HR_bicubic 500x500

granite_SR 500x500

Test: Ideal vs SRGAN

granite_ideal 500x500

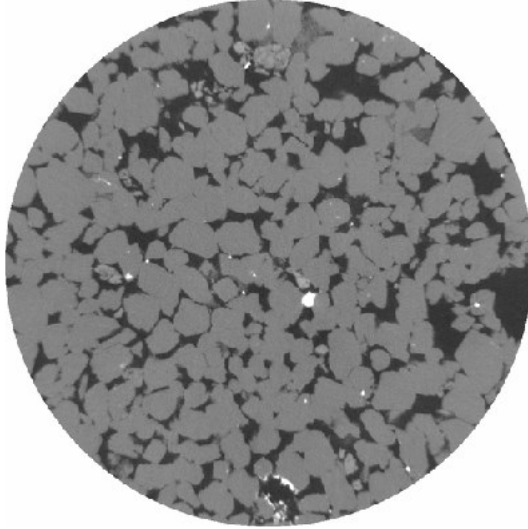granite_SR 500x500

Thanks

Other Attachments – Matlab

Notes: Blurred image is simulated by known PSF.
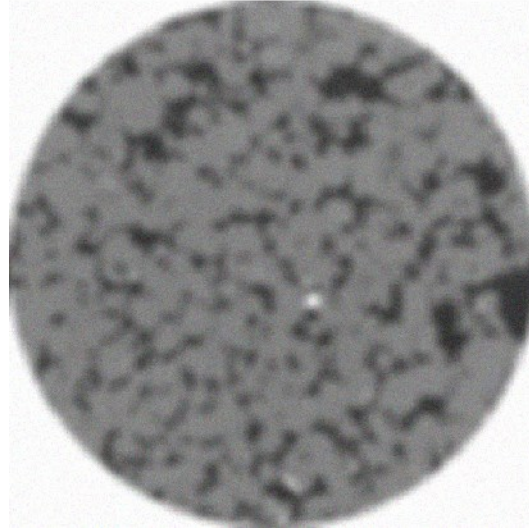
In blind deconvolution it's used for initial guess.
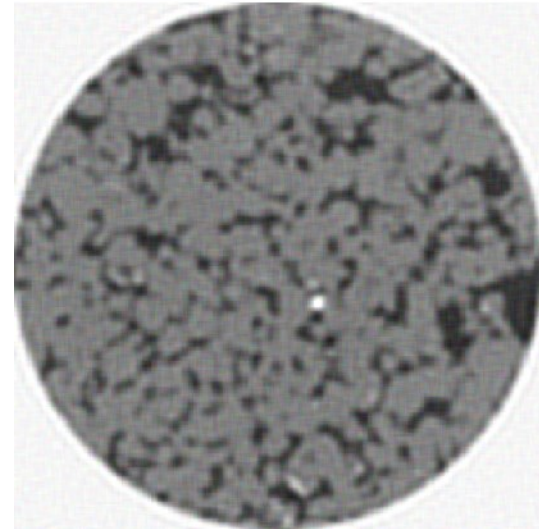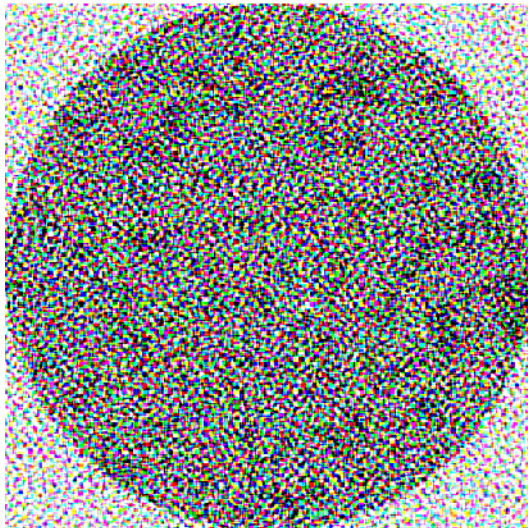
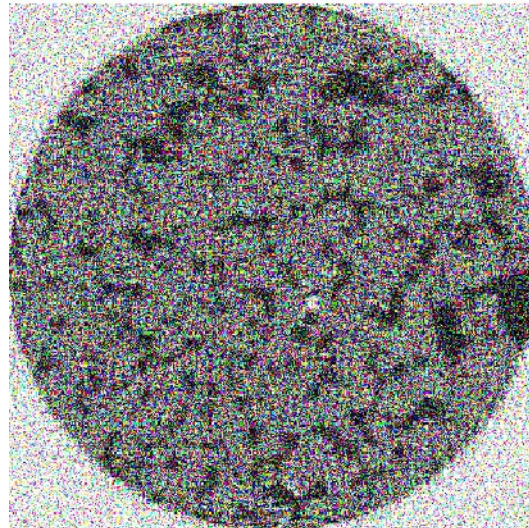Wiener filter need known PSF and NSR.

Source image   Blurred image   Wiener

Regul   Blind   Lucy