

NLM based algorithms for noise removal

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Used NLM filter implementations

“NLM Base” – the original NLM filter, new pixel values are averaged depending on the whole patch

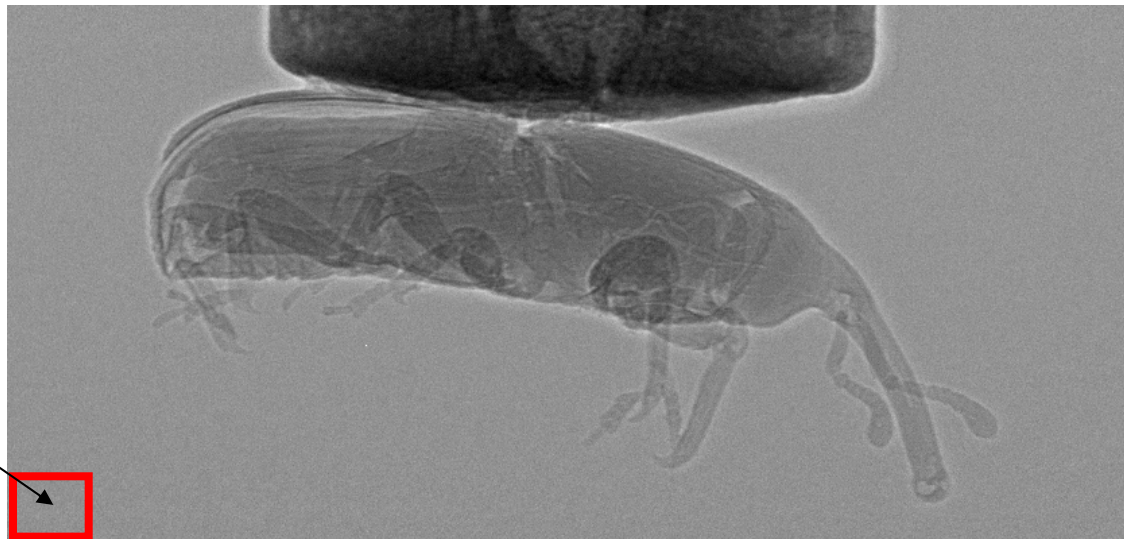
“NLM CImg” – NLM filter implementation used in CImg library, the original image is preliminarily blurred using an anisotropic exponential filter (Deriche filter of order 0)

“NLM Var” – NLM filter implementation included preliminarily blurring (combination of NLM CImg techniques with more sophisticated weight calculations)

These implementations use different equations for computing weights

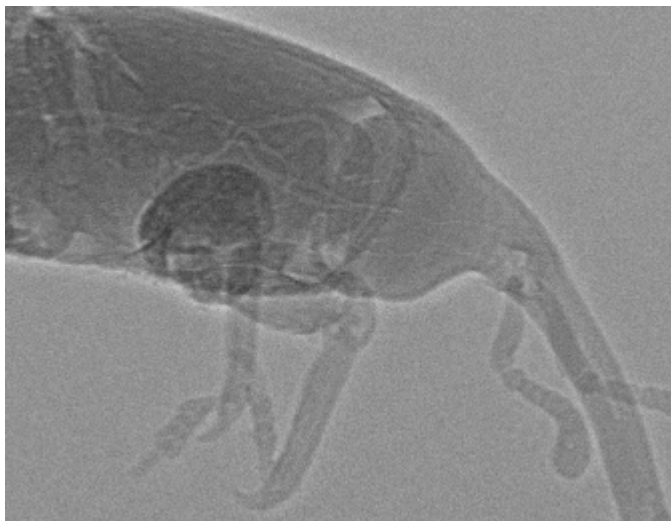
Real data – test image (noise standard deviation (sigma) of noisy image = 0.012, 1.21 %)

Background sample for estimating noise

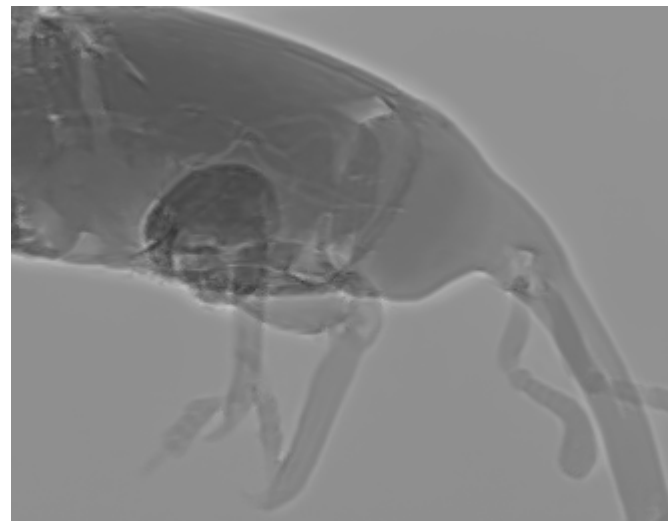


Denoised image fragments, patch radius = 3, search radius = 20

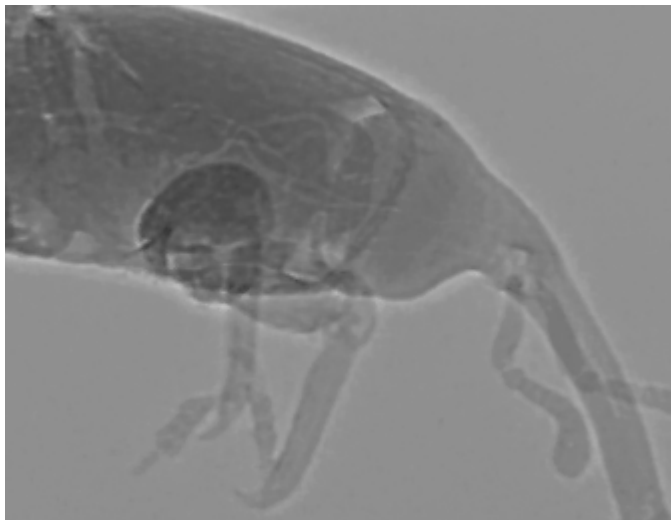
Original image



NLM Base



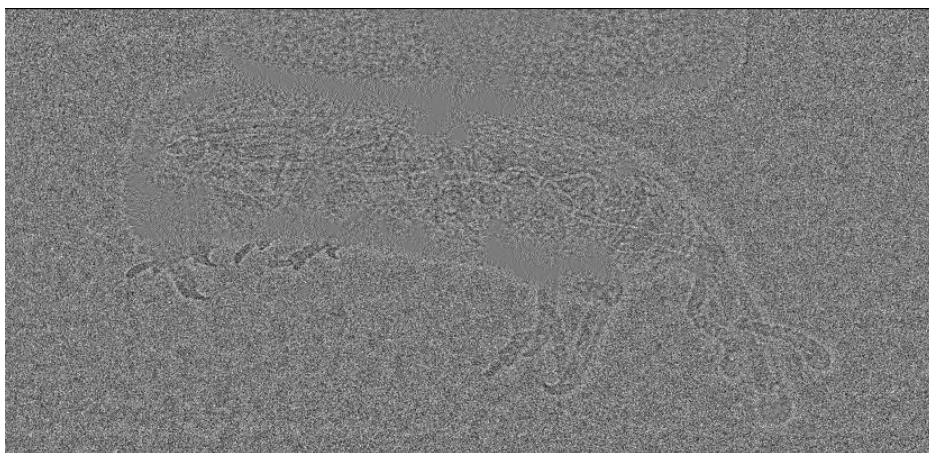
NLM CImg



NLM Var

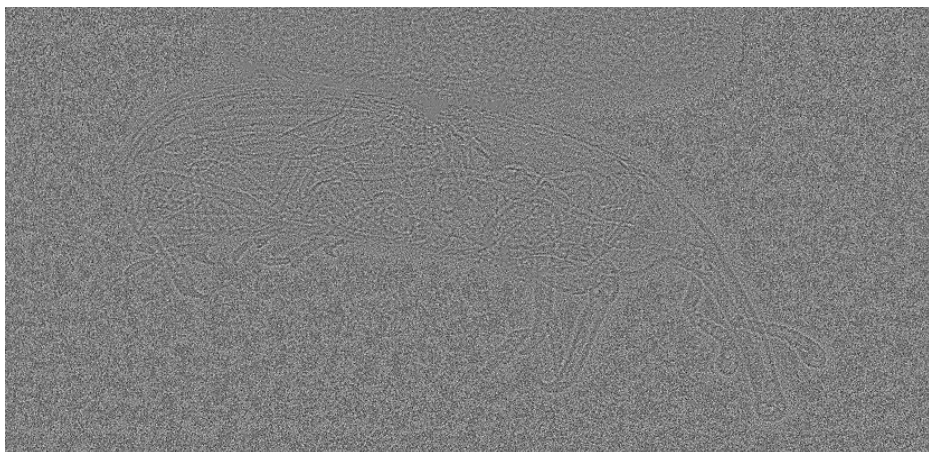


Removed noise, patch radius = 3, search radius = 20



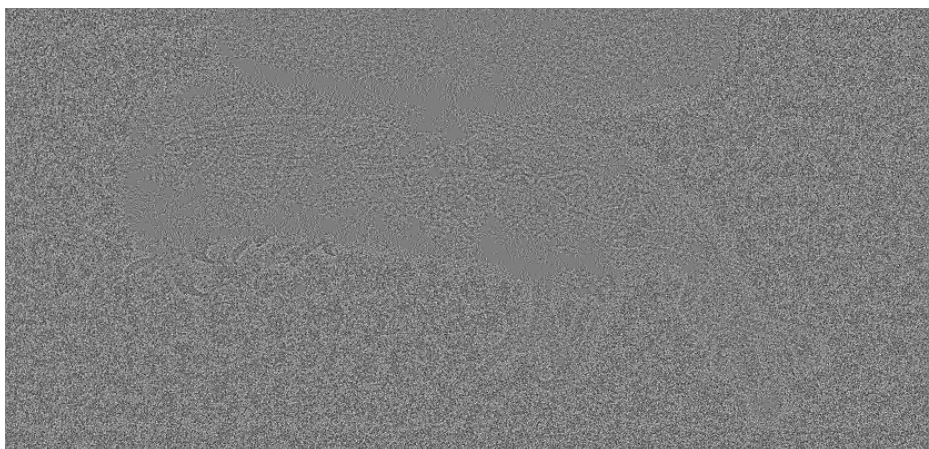
-0.045933 0.048701
Count: 332800 Min: -0.045933
Mean: 0.000124 Max: 0.048701
StdDev: 0.010452 Mode: 0.000090 (5169)
Bins: 256 Bin Width: 0.000370

NLM Base



-0.046399 0.047181
Count: 332800 Min: -0.046399
Mean: 0.000064 Max: 0.047181
StdDev: 0.010111 Mode: -0.000888 (4978)
Bins: 256 Bin Width: 0.000366

NLM Clmg



-0.042787 0.043728
Count: 332800 Min: -0.042787
Mean: 0.000073 Max: 0.043728
StdDev: 0.009681 Mode: -0.000036 (9841)
Bins: 256 Bin Width: 0.000338

NLM Var

Experiments on the test image

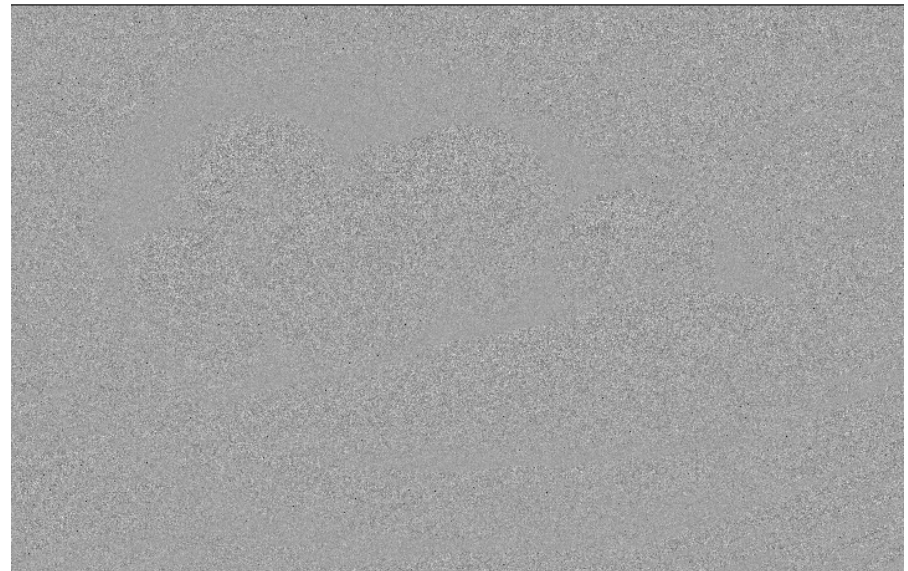
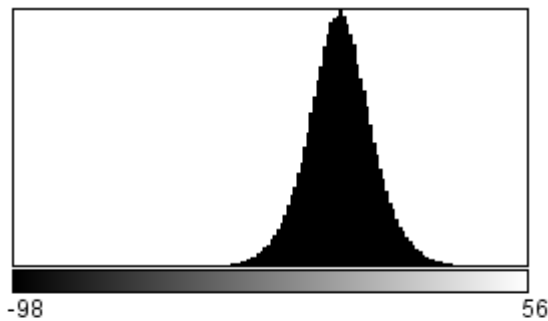


Original image



Noisy image (Poisson noise)

Added noise



Images fragments, patch radius = 2, search radius = 10

Original image



Noisy image



NLM Var



NLM CImg



NLM Base



Method noise,
patch radius = 2,
search radius = 10

