

Image Processing Prog#1

Meeting 9/5

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Presentation Overview

① Experiment Setting

② Intensity Transformation

 Gamma Transformation

 Histogram Equalization

③ High Pass Filter

 Edge Detection

 Sharpening

④ Denoising

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 Mean Filter

 Order-Static Filter

⑤ Conclusion

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Experiment Setting

- Environment
 - Python 3.10.12
 - OpenCV 4.8.0
 - NumPy 1.23.5
 - Platform: Google Colab
- RGB to GRAY
 - $0.299 \cdot R + 0.587 \cdot G + 0.114 \cdot B$

Intensity Transformation

Gamma Transformation

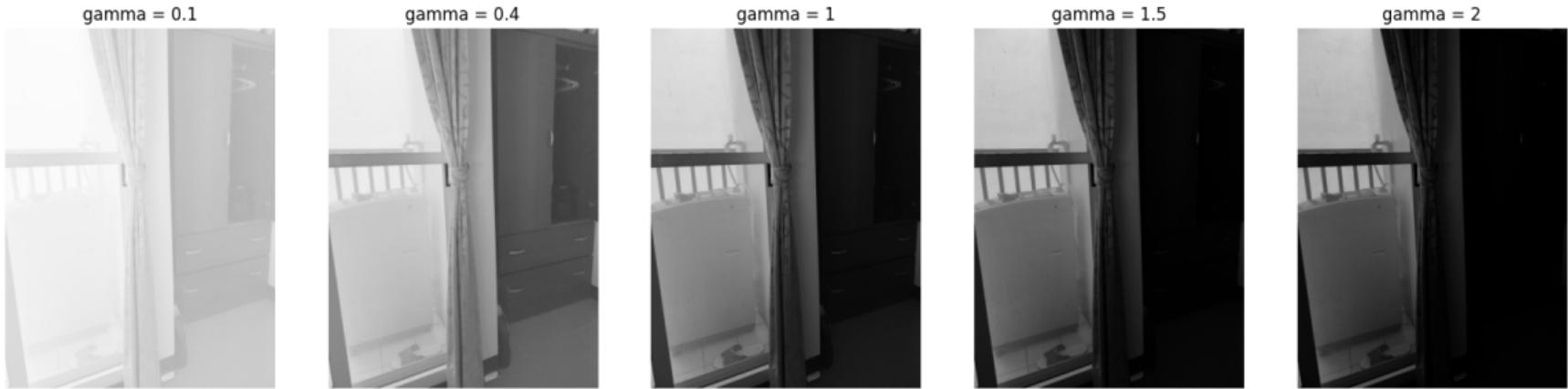


Figure 1: Gamma transformation by sampling 5 different γ value

Intensity Transformation

Gamma Transformation

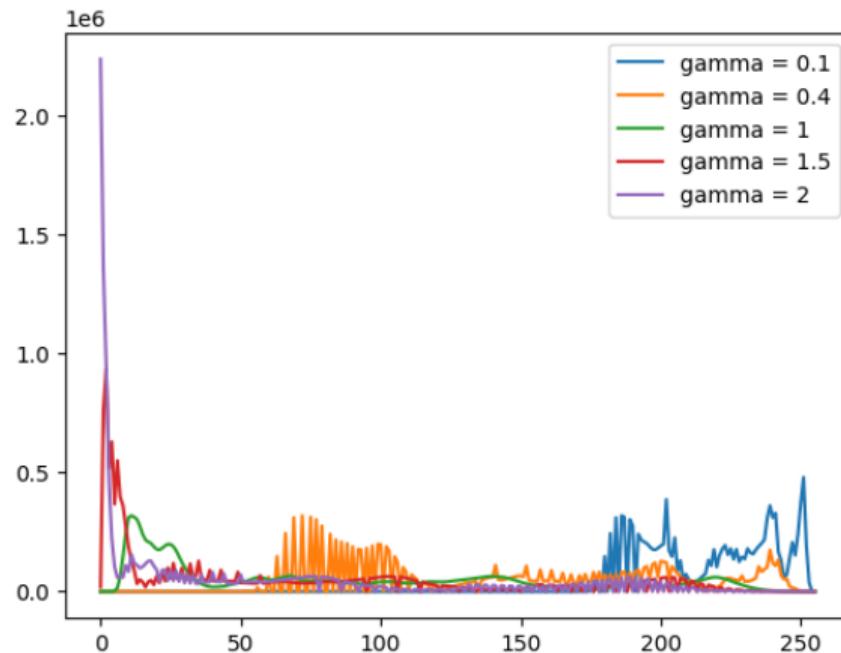


Figure 2: Histogram of images in fig. 1

Intensity Transformation

Histogram Equalization

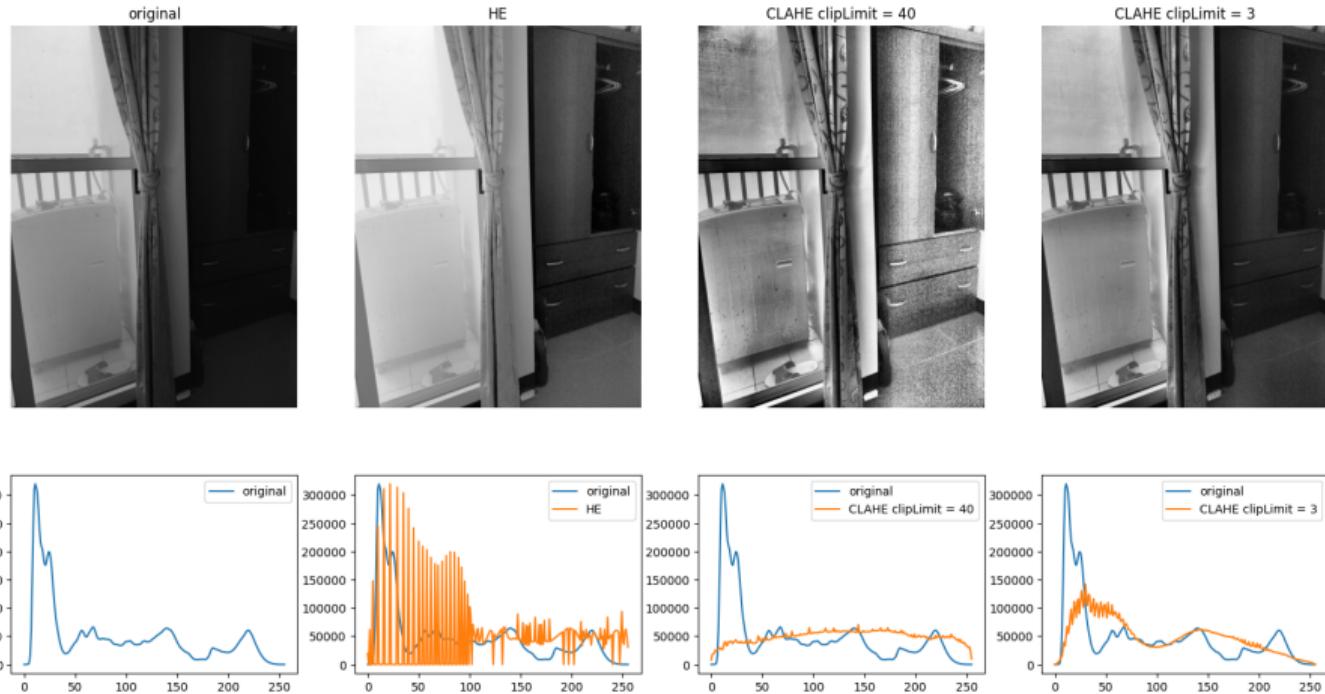


Figure 3: Comparison with different histogram processing method

High Pass Filter

Edge Detection

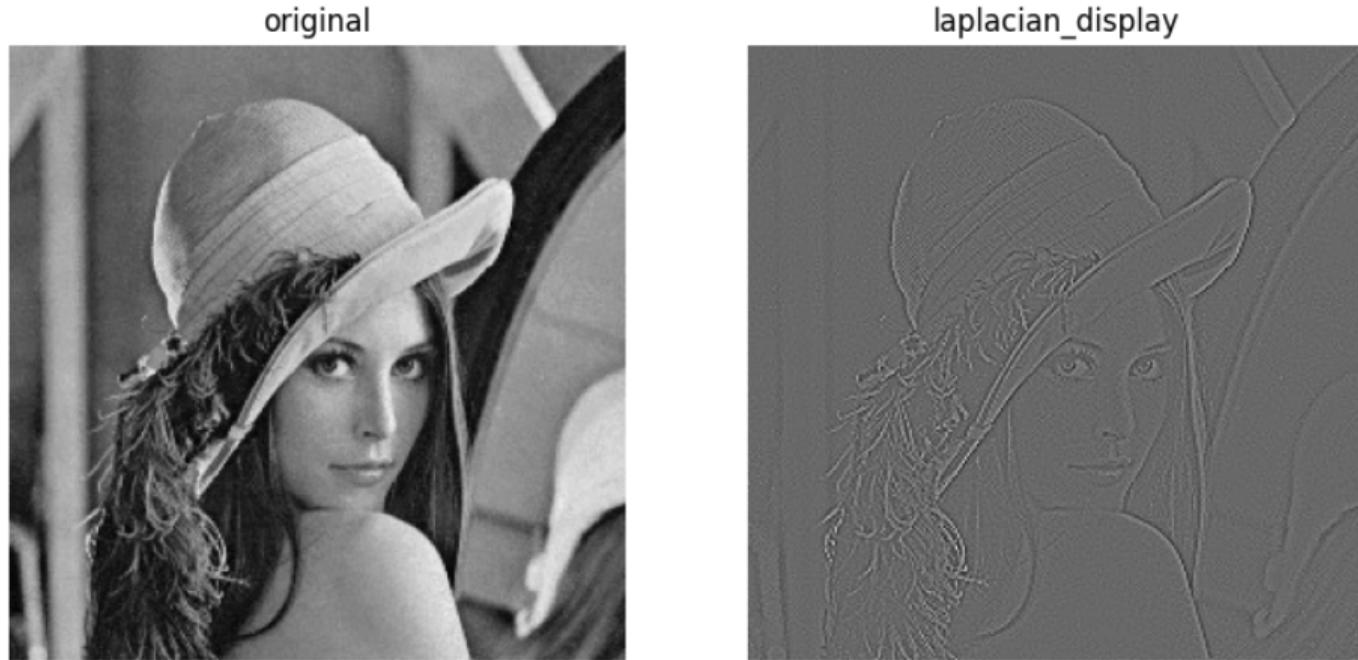


Figure 4: Edge detection by Laplacian operator

High Pass Filter

Edge Detection

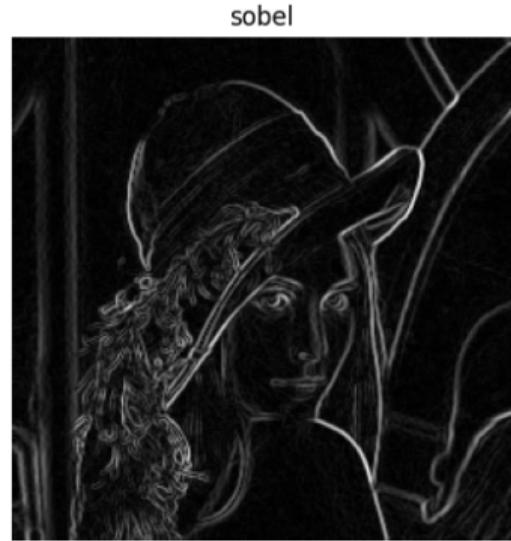
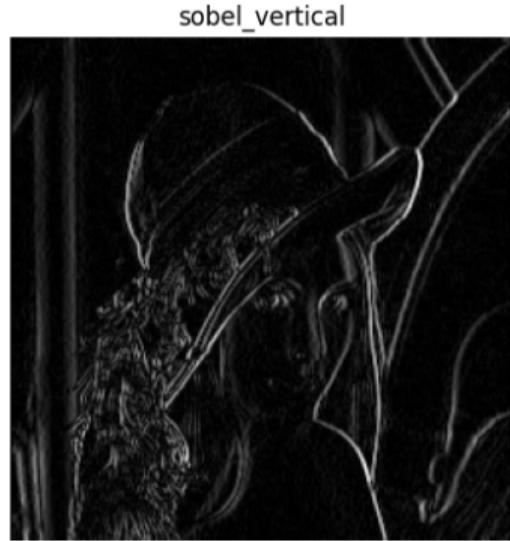
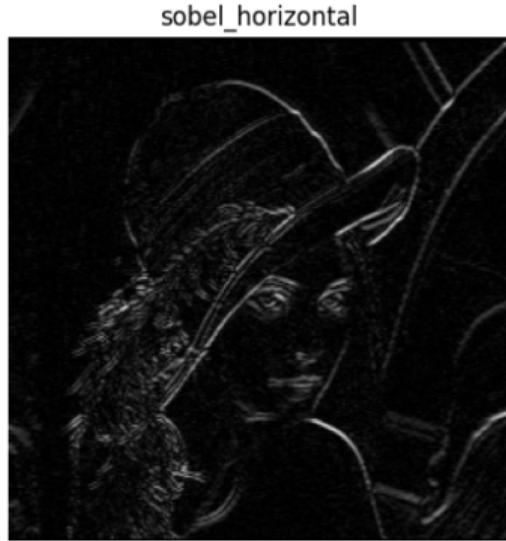


Figure 5: Edge detection by Sobel operator

High Pass Filter

Sharpening



Figure 6: Laplacian sharpening and unsharp masking

High Pass Filter

Sharpening



Figure 7: Highboost filtering

Denoising

Noise

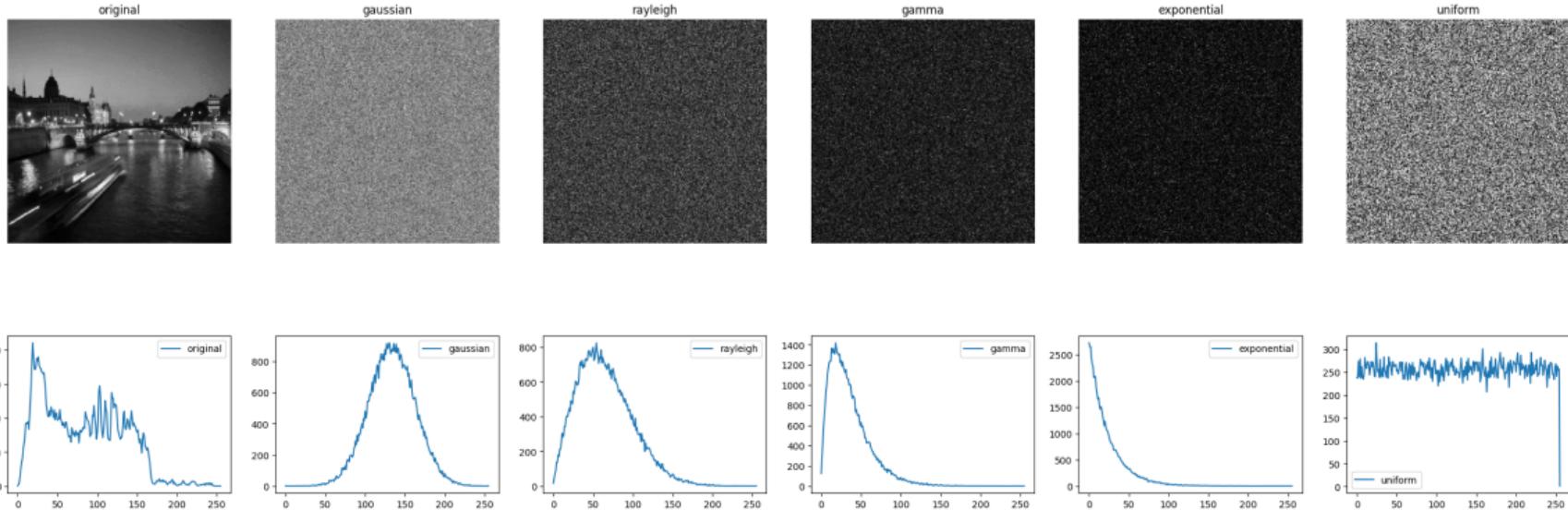


Figure 8: Additive noise model and PDF

Denoising Noise

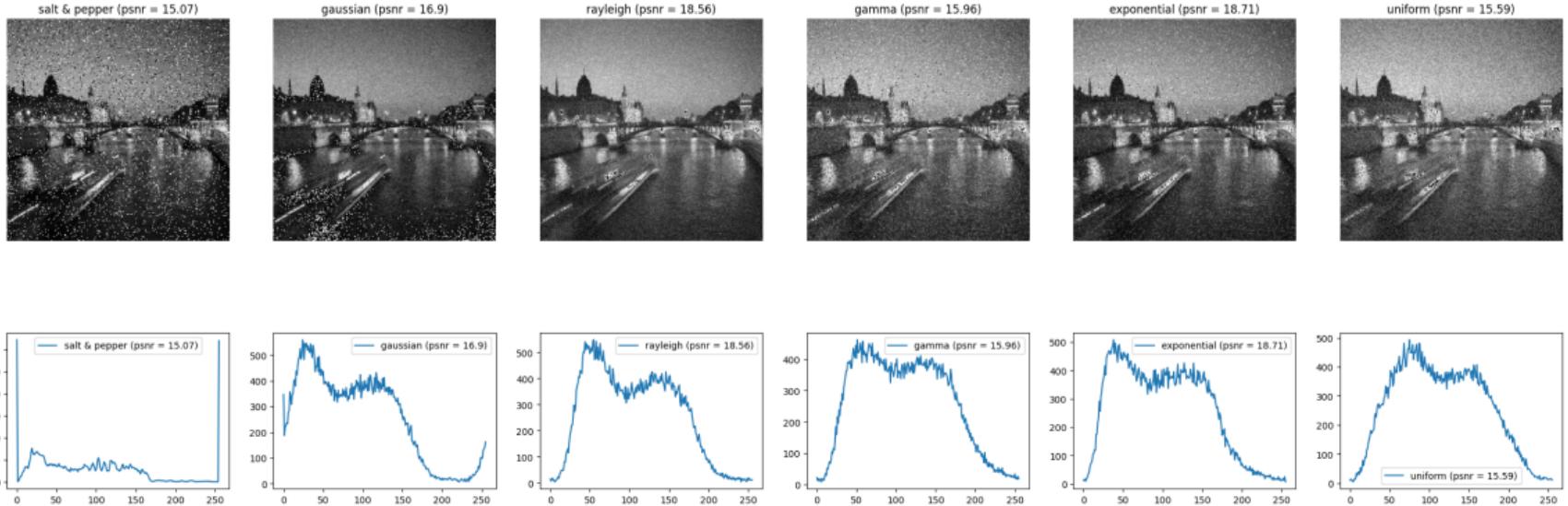


Figure 9: Noise image, histogram, and PSNR

Denoising

Mean Filter

$Q = -1.5$ (psnr = 16.82)



$Q = -1$ (psnr = 16.78)



$Q = -0.5$ (psnr = 16.51)



$Q = 0$ (psnr = 19.2)



Figure 10: Mean filter denoising

Denoising

Mean Filter

$Q = 0.5$ (psnr = 15.88)



$Q = 1$ (psnr = 13.8)



$Q = 1.5$ (psnr = 12.78)



geometric mean (psnr = 18.92)



Figure 11: Mean filter denoising (Cont.)

Mean Filter

Arithmetic Mean Filter

gaussian noise arith mean (psnr = 21.74)



rayleigh noise arith mean (psnr = 19.27)



gamma noise arith mean (psnr = 17.52)



exponential noise arith mean (psnr = 20.74)



uniform noise arith mean (psnr = 16.69)



Figure 12: Arithmetic mean filter denoising

Mean Filter

Arithmetic Mean Filter

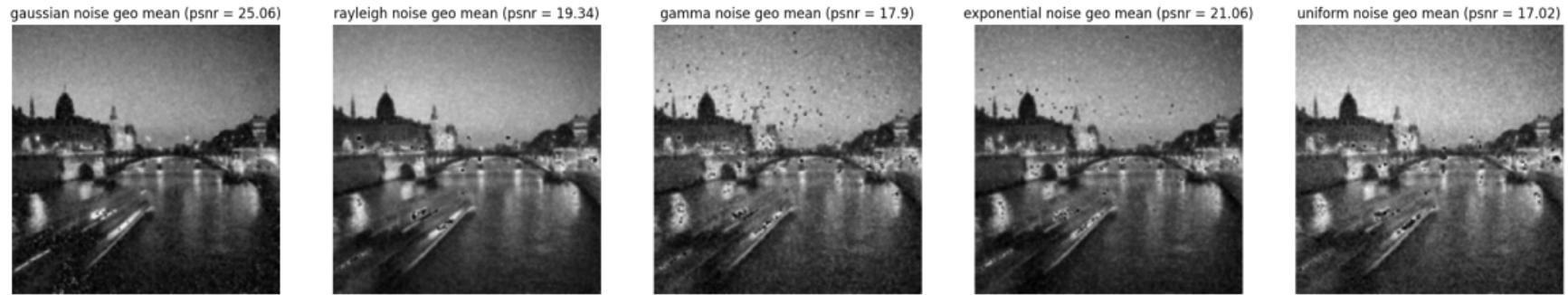


Figure 13: Geometric mean filter denoising

Order-Static Filter

Median Filter

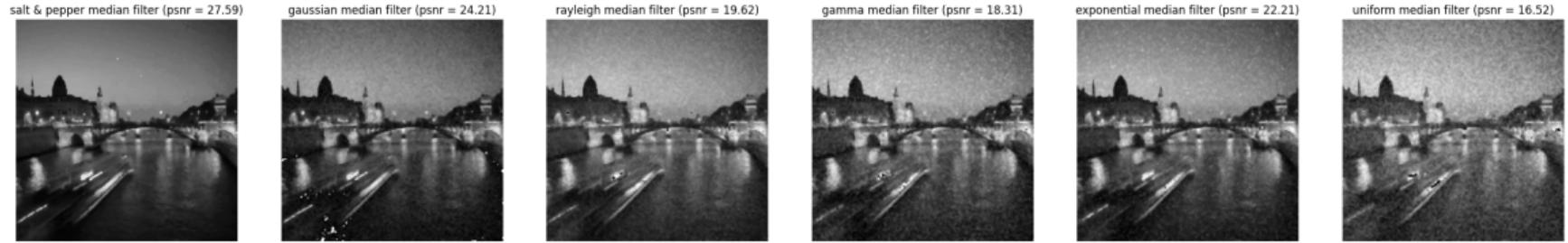


Figure 14: Median filter denoising

Order-Static Filter

Pepper Noise

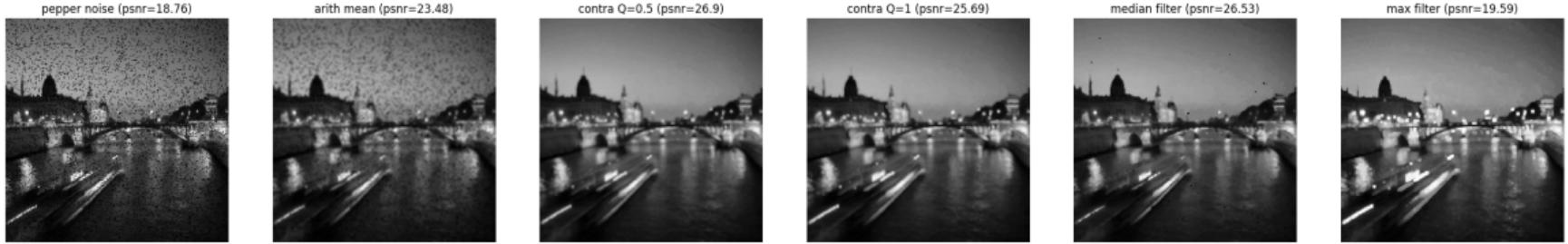


Figure 15: Denoising pepper noise image

Order-Static Filter

Salt Noise

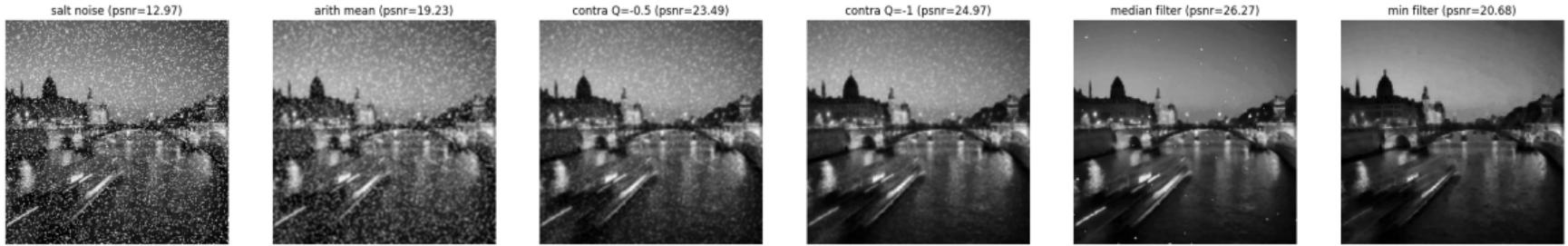


Figure 16: Denoising salt noise image

Order-Static Filter

Adaptive Median Filter

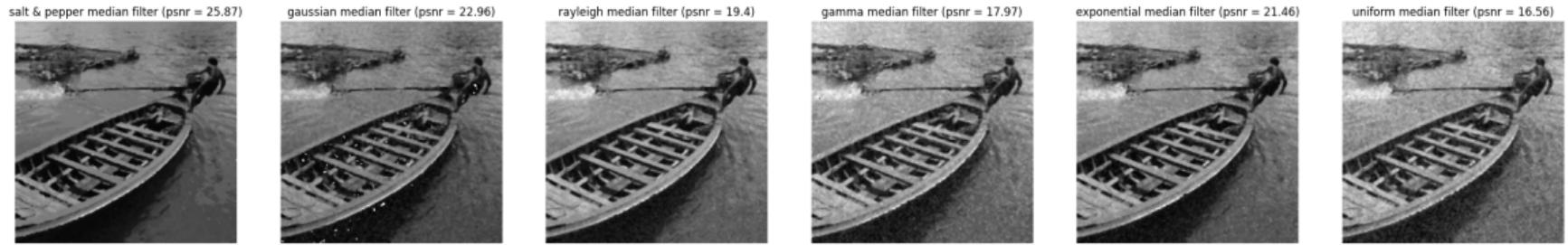


Figure 17: Median filter denoising

Order-Static Filter

Adaptive Median Filter

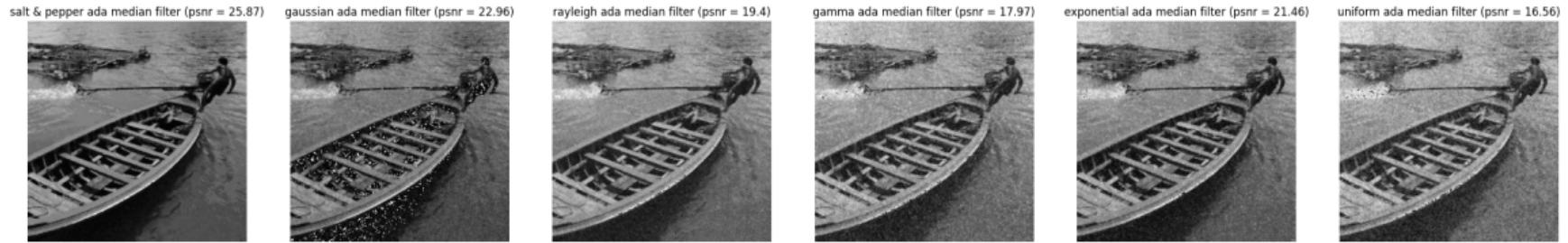


Figure 18: Adaptive median filter denoising

Conclusion

- Design pattern of image processing algorithm
 - local processing, adaptive parameter, etc
- Choice of the test image
 - show the pros and cons of each method in single image
- Multiple processing
 - how to implement multiple technique (order, ...)

Thanks for Listening

Q & A