

# Noise Reduction Filtering



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# Filtering for The Reduction of Noise

- Low pass filter
  - Gaussian noise
- Wiener filter
  - Gaussian noise
- Median filter
  - Impulse noise (salt-and-pepper noise)

# Corrupted Images

①



②



**PSNR = 18.5dB**

③



**PSNR = 18.6dB**

# Reduction of Gaussian Noise



**PSNR = 18.5dB**

**Low Pass  
Filtering**

②

1/16	2/16	1/16
2/16	4/16	2/16
1/16	2/16	1/16



**PSNR = 23.0dB**

# Reduction of Gaussian Noise



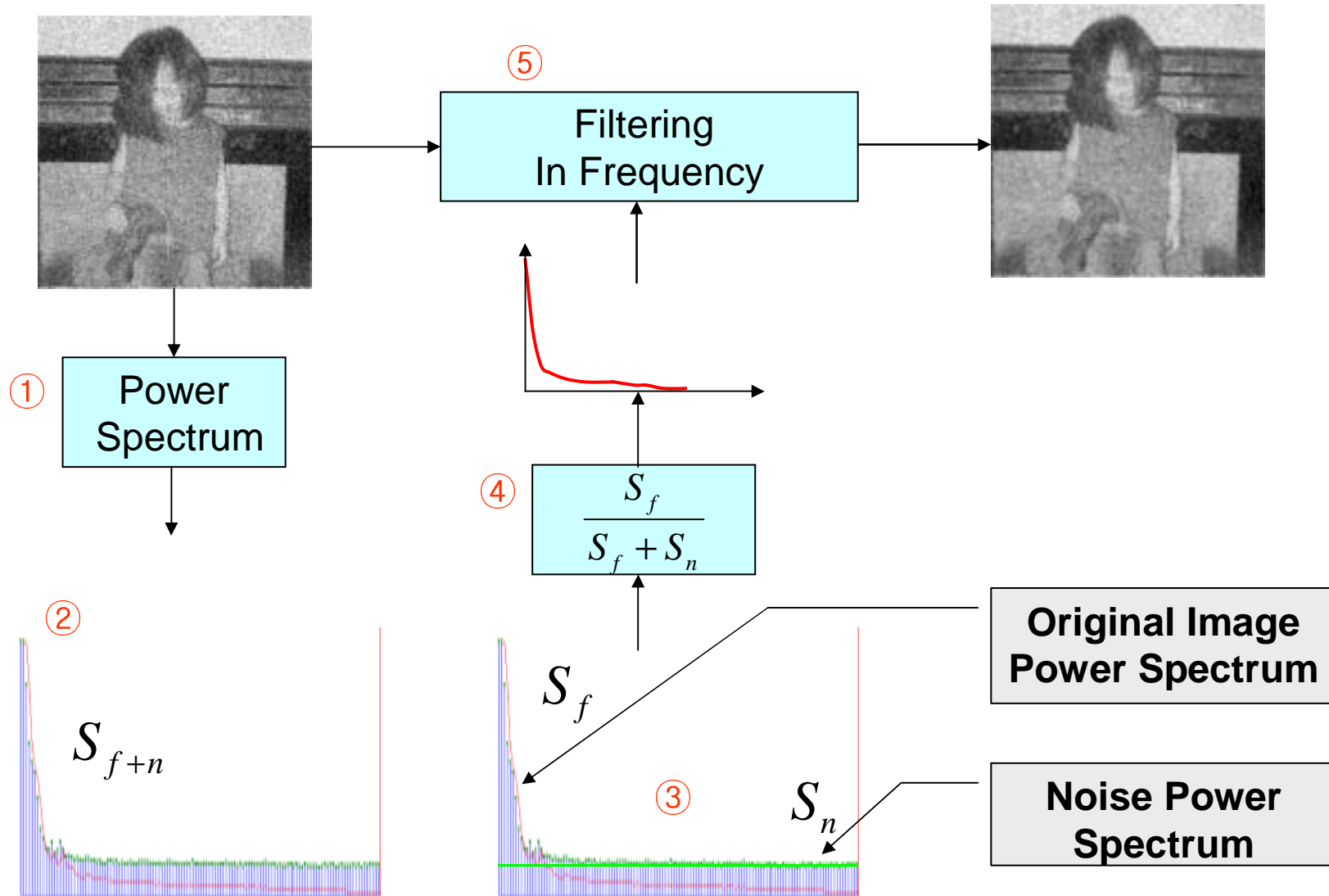
**PSNR = 18.5dB**

**Wiener  
Filtering**

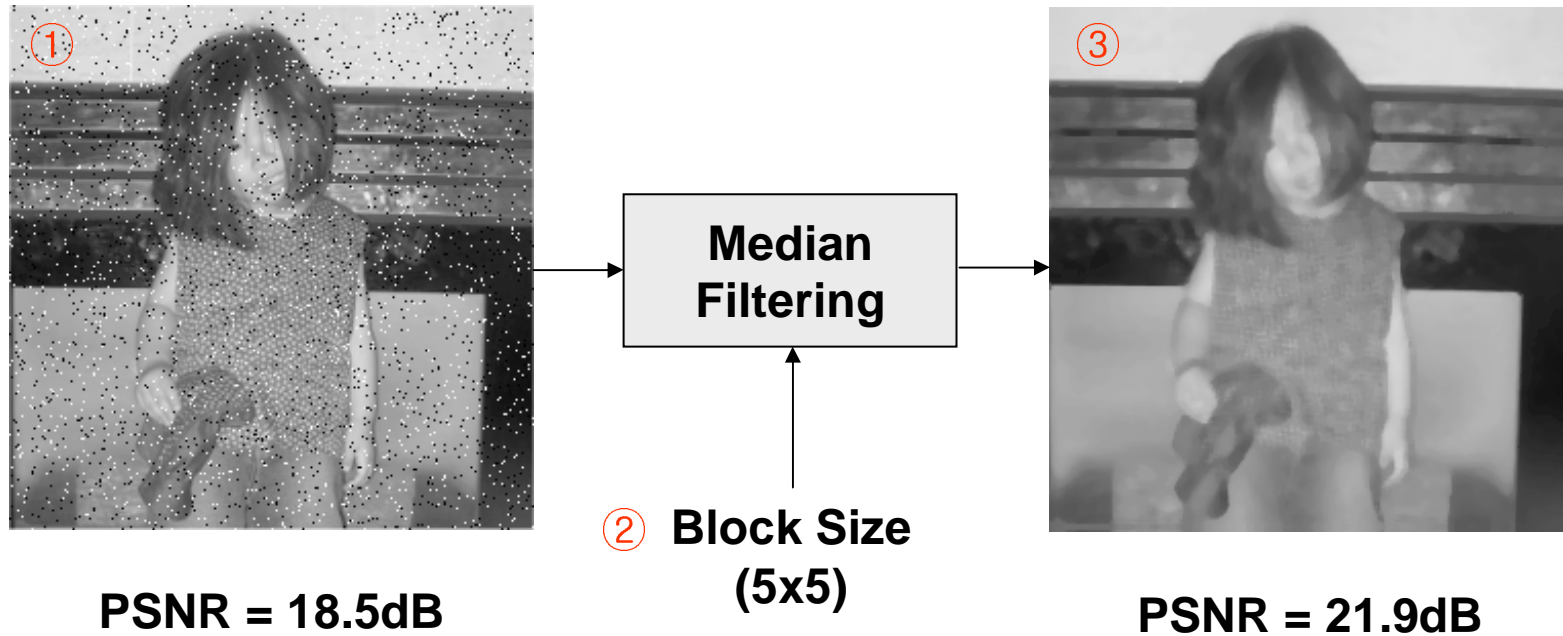


**PSNR = 25.1dB**

# Wiener Filtering



# Reduction of Impulse Noise



# Median Filtering

## ① Input image

X[0,0]	X[0,1]	X[0,2]	X[0,3]
X[1,0]	X[1,1]	X[1,2]	X[1,3]
X[2,0]	X[2,1]	X[2,2]	X[2,3]
X[3,0]	X[3,1]	X[3,2]	X[3,3]



Block Size

## ②

X[0,0]	X[0,1]	X[0,2]
X[1,0]	X[1,1]	X[1,2]
X[2,0]	X[2,1]	X[2,2]

Median

## ③

Y[1,1]

## ④

41	42	220
35	44	54
1	32	62

## ⑤

Sorting

{1,32,35,41,42,44,54,62,220} → 42



# Results of Median Filtering

**PSNR  
18.5dB**



**Block Size  
(3x3)**

**PSNR  
24.6dB**



**Block Size  
(5x5)**

**PSNR  
21.9dB**



**Block Size  
(7x7)**

**PSNR  
20.4dB**



# Summary

- Low pass filter
- Wiener filter
- Median filter