BM3D : PSNR calculation

2023.02.08.

BM3D : PSNR calculation

C.man	10	20	30	40	50
noise	28.13	22.12	18.54	16.05	14.18
BM3D	29.27	25.86	23.72	22.58	21.85

Table 1. PSNR (dB) results of the proposed grayscale *BM3D* method; can be reproduc

σ¹/PSNR	*C.man* 256x256	*House* 256x256	*Peppers* 256x256	*Montage* 256x256	*Lena* 512x512	*Barbara* 512x512
5 / 34.16	38.29	39.83	38.12	41.14	38.72	38.31
10 / 28.14	34.18	36.71	34.68	37.35	35.93	34.98
15 / 24.61	31.91	34.94	32.7	35.15	34.27	33.11
20 / 22.11	30.48	33.77	31.29	33.61	33.05	31.78
25 / 20.18	29.45	32.86	30.16	32.37	32.08	30.72
30 / 18.59	28.64	32.09	29.28	31.38	31.26	29.81
35 / 17.25	27.93	31.38	28.52	30.46	30.56	28.98
40 / 16.09	27.18	30.65	27.7	29.52	29.86	27.99
50 / 14.16	26.12	29.69	26.68	27.9	29.05	27.23
60 / 12.57	25.32	28.74	25.81	26.84	28.27	26.28
70 / 11.23	24.61	27.91	25.07	25.92	27.57	25.47
75 / 10.63	24.33	27.51	24.73	25.52	27.26	25.12
80 / 10.07	24.04	27.16	24.45	25.15	26.97	24.79
90 / 9.05	23.53	26.48	23.87	24.47	26.45	24.16
100 / 8.135	23.07	25.87	23.39	23.89	25.95	23.62

BM3D : PSNR calculation

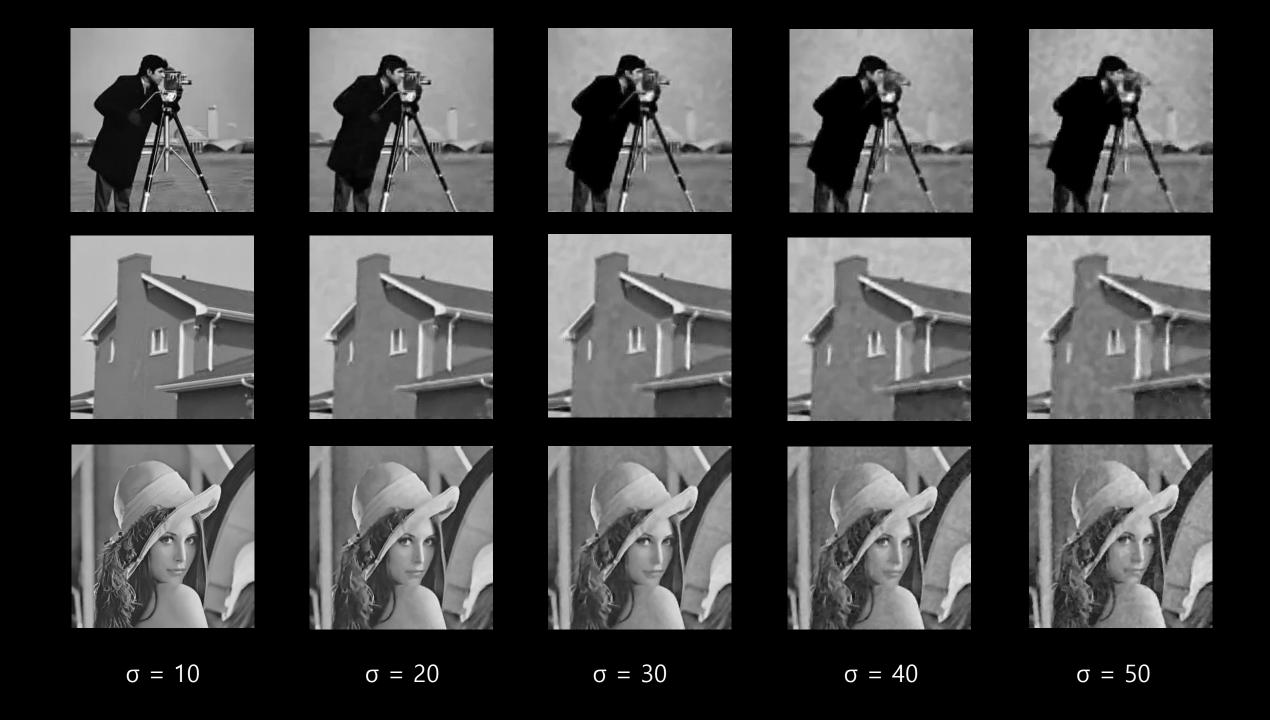| House	10	20	30	40	50
noise	28.13	22.07	18.57	16.07	14.16
BM3D	33.63	29.58	28.24	27.16	26.09

Table 1. PSNR (dB) results of the proposed grayscale *BM3D* method; can be reproduc

σ¹/PSNR	C.man 256x256	House 256x256	Peppers 256x256	Montage 256x256	Lena 512x512	Barbara 512x512
5 / 34.16	38.29	39.83	38.12	41.14	38.72	38.31
10 / 28.14	34.18	36.71	34.68	37.35	35.93	34.98
15 / 24.61	31.91	34.94	32.7	35.15	34.27	33.11
20 / 22.11	30.48	33.77	31.29	33.61	33.05	31.78
25 / 20.18	29.45	32.86	30.16	32.37	32.08	30.72
30 / 18.59	28.64	32.09	29.28	31.38	31.26	29.81
35 / 17.25	27.93	31.38	28.52	30.46	30.56	28.98
40 / 16.09	27.18	30.65	27.7	29.52	29.86	27.99
50 / 14.16	26.12	29.69	26.68	27.9	29.05	27.23
60 / 12.57	25.32	28.74	25.81	26.84	28.27	26.28
70 / 11.23	24.61	27.91	25.07	25.92	27.57	25.47
75 / 10.63	24.33	27.51	24.73	25.52	27.26	25.12
80 / 10.07	24.04	27.16	24.45	25.15	26.97	24.79
90 / 9.05	23.53	26.48	23.87	24.47	26.45	24.16
100 / 8.135	23.07	25.87	23.39	23.89	25.95	23.62

BM3D : PSNR calculation

Lena	10	20	30	40	50
noise	28.13	22.11	18.57	16.10	14.16
BM3D	32.24	28.94	27.89	27.07	26.34

Table 1. PSNR (dB) results of the proposed grayscale *BM3D* method; can be reproduc

σ^1/PSNR	C.man 256x256	House 256x256	Peppers 256x256	Montage 256x256	Lena 512x512	Barbara 512x512
5 / 34.16	38.29	39.83	38.12	41.14	38.72	38.31
10 / 28.14	34.18	36.71	34.68	37.35	35.93	34.98
15 / 24.61	31.91	34.94	32.7	35.15	34.27	33.11
20 / 22.11	30.48	33.77	31.29	33.61	33.05	31.78
25 / 20.18	29.45	32.86	30.16	32.37	32.08	30.72
30 / 18.59	28.64	32.09	29.28	31.38	31.26	29.81
35 / 17.25	27.93	31.38	28.52	30.46	30.56	28.98
40 / 16.09	27.18	30.65	27.7	29.52	29.86	27.99
50 / 14.16	26.12	29.69	26.68	27.9	29.05	27.23
60 / 12.57	25.32	28.74	25.81	26.84	28.27	26.28
70 / 11.23	24.61	27.91	25.07	25.92	27.57	25.47
75 / 10.63	24.33	27.51	24.73	25.52	27.26	25.12
80 / 10.07	24.04	27.16	24.45	25.15	26.97	24.79
90 / 9.05	23.53	26.48	23.87	24.47	26.45	24.16
100 / 8.135	23.07	25.87	23.39	23.89	25.95	23.62

BM3D : PSNR calculation

Barbara	10	20	30	40	50
noise	28.12	22.09	18.58	16.09	14.16
BM3D	29.47	24.29	21.88	20.62	20.04

Table 1. PSNR (dB) results of the proposed grayscale *BM3D* method; can be reproduc

σ¹/PSNR	C.man 256x256	House 256x256	Peppers 256x256	Montage 256x256	Lena 512x512	Barbara 512x512
5 / 34.16	38.29	39.83	38.12	41.14	38.72	38.31
10 / 28.14	34.18	36.71	34.68	37.35	35.93	34.98
15 / 24.61	31.91	34.94	32.7	35.15	34.27	33.11
20 / 22.11	30.48	33.77	31.29	33.61	33.05	31.78
25 / 20.18	29.45	32.86	30.16	32.37	32.08	30.72
30 / 18.59	28.64	32.09	29.28	31.38	31.26	29.81
35 / 17.25	27.93	31.38	28.52	30.46	30.56	28.98
40 / 16.09	27.18	30.65	27.7	29.52	29.86	27.99
50 / 14.16	26.12	29.69	26.68	27.9	29.05	27.23
60 / 12.57	25.32	28.74	25.81	26.84	28.27	26.28
70 / 11.23	24.61	27.91	25.07	25.92	27.57	25.47
75 / 10.63	24.33	27.51	24.73	25.52	27.26	25.12
80 / 10.07	24.04	27.16	24.45	25.15	26.97	24.79
90 / 9.05	23.53	26.48	23.87	24.47	26.45	24.16
100 / 8.135	23.07	25.87	23.39	23.89	25.95	23.62

σ = 10   σ = 20   σ = 30   σ = 40   σ = 50

BM3D : PSNR calculation

C.man	10	20	30	40	50
noise	28.13	22.12	18.54	16.05	14.18
BM3D	32.44	28.70	26.69	24.96	23.59

Table 1. PSNR (dB) results of the proposed grayscale *BM3D* method; can be reproduc

σ¹/PSNR	C.man 256x256	House 256x256	Peppers 256x256	Montage 256x256	Lena 512x512	Barbara 512x512
5 / 34.16	38.29	39.83	38.12	41.14	38.72	38.31
10 / 28.14	34.18	36.71	34.68	37.35	35.93	34.98
15 / 24.61	31.91	34.94	32.7	35.15	34.27	33.11
20 / 22.11	30.48	33.77	31.29	33.61	33.05	31.78
25 / 20.18	29.45	32.86	30.16	32.37	32.08	30.72
30 / 18.59	28.64	32.09	29.28	31.38	31.26	29.81
35 / 17.25	27.93	31.38	28.52	30.46	30.56	28.98
40 / 16.09	27.18	30.65	27.7	29.52	29.86	27.99
50 / 14.16	26.12	29.69	26.68	27.9	29.05	27.23
60 / 12.57	25.32	28.74	25.81	26.84	28.27	26.28
70 / 11.23	24.61	27.91	25.07	25.92	27.57	25.47
75 / 10.63	24.33	27.51	24.73	25.52	27.26	25.12
80 / 10.07	24.04	27.16	24.45	25.15	26.97	24.79
90 / 9.05	23.53	26.48	23.87	24.47	26.45	24.16
100 / 8.135	23.07	25.87	23.39	23.89	25.95	23.62

BM3D : PSNR calculation

House	10	20	30	40	50
noise	28.13	22.07	18.57	16.07	14.16
BM3D	34.72	31.70	29.67	28.05	26.75

Table 1. PSNR (dB) results of the proposed grayscale *BM3D* method; can be reprodu

σ¹/PSNR	C.man 256x256	House 256x256	Peppers 256x256	Montage 256x256	Lena 512x512	Barbara 512x512
5 / 34.16	38.29	39.83	38.12	41.14	38.72	38.31
10 / 28.14	34.18	36.71	34.68	37.35	35.93	34.98
15 / 24.61	31.91	34.94	32.7	35.15	34.27	33.11
20 / 22.11	30.48	33.77	31.29	33.61	33.05	31.78
25 / 20.18	29.45	32.86	30.16	32.37	32.08	30.72
30 / 18.59	28.64	32.09	29.28	31.38	31.26	29.81
35 / 17.25	27.93	31.38	28.52	30.46	30.56	28.98
40 / 16.09	27.18	30.65	27.7	29.52	29.86	27.99
50 / 14.16	26.12	29.69	26.68	27.9	29.05	27.23
60 / 12.57	25.32	28.74	25.81	26.84	28.27	26.28
70 / 11.23	24.61	27.91	25.07	25.92	27.57	25.47
75 / 10.63	24.33	27.51	24.73	25.52	27.26	25.12
80 / 10.07	24.04	27.16	24.45	25.15	26.97	24.79
90 / 9.05	23.53	26.48	23.87	24.47	26.45	24.16
100 / 8.135	23.07	25.87	23.39	23.89	25.95	23.62

BM3D : PSNR calculation

Lena	10	20	30	40	50
noise	28.13	22.11	18.57	16.10	14.16
BM3D	34.31	31.37	29.50	27.85	26.62

Table 1. PSNR (dB) results of the proposed grayscale *BM3D* method; can be reproduc

σ¹/PSNR	*C.man* 256x256	*House* 256x256	*Peppers* 256x256	*Montage* 256x256	*Lena* 512x512	*Barbara* 512x512
5 / 34.16	38.29	39.83	38.12	41.14	38.72	38.31
10 / 28.14	34.18	36.71	34.68	37.35	35.93	34.98
15 / 24.61	31.91	34.94	32.7	35.15	34.27	33.11
20 / 22.11	30.48	33.77	31.29	33.61	33.05	31.78
25 / 20.18	29.45	32.86	30.16	32.37	32.08	30.72
30 / 18.59	28.64	32.09	29.28	31.38	31.26	29.81
35 / 17.25	27.93	31.38	28.52	30.46	30.56	28.98
40 / 16.09	27.18	30.65	27.7	29.52	29.86	27.99
50 / 14.16	26.12	29.69	26.68	27.9	29.05	27.23
60 / 12.57	25.32	28.74	25.81	26.84	28.27	26.28
70 / 11.23	24.61	27.91	25.07	25.92	27.57	25.47
75 / 10.63	24.33	27.51	24.73	25.52	27.26	25.12
80 / 10.07	24.04	27.16	24.45	25.15	26.97	24.79
90 / 9.05	23.53	26.48	23.87	24.47	26.45	24.16
100 / 8.135	23.07	25.87	23.39	23.89	25.95	23.62

BM3D : PSNR calculation

Barbara	10	20	30	40	50
noise	28.12	22.09	18.58	16.09	14.16
BM3D	31.96	28.26	25.98	23.84	22.12

Table 1. PSNR (dB) results of the proposed grayscale *BM3D* method; can be reprodu

σ¹/PSNR	C.man 256x256	House 256x256	Peppers 256x256	Montage 256x256	Lena 512x512	Barbara 512x512
5 / 34.16	38.29	39.83	38.12	41.14	38.72	38.31
10 / 28.14	34.18	36.71	34.68	37.35	35.93	34.98
15 / 24.61	31.91	34.94	32.7	35.15	34.27	33.11
20 / 22.11	30.48	33.77	31.29	33.61	33.05	31.78
25 / 20.18	29.45	32.86	30.16	32.37	32.08	30.72
30 / 18.59	28.64	32.09	29.28	31.38	31.26	29.81
35 / 17.25	27.93	31.38	28.52	30.46	30.56	28.98
40 / 16.09	27.18	30.65	27.7	29.52	29.86	27.99
50 / 14.16	26.12	29.69	26.68	27.9	29.05	27.23
60 / 12.57	25.32	28.74	25.81	26.84	28.27	26.28
70 / 11.23	24.61	27.91	25.07	25.92	27.57	25.47
75 / 10.63	24.33	27.51	24.73	25.52	27.26	25.12
80 / 10.07	24.04	27.16	24.45	25.15	26.97	24.79
90 / 9.05	23.53	26.48	23.87	24.47	26.45	24.16
100 / 8.135	23.07	25.87	23.39	23.89	25.95	23.62

σ = 10   σ = 20   σ = 30   σ = 40   σ = 50

σ = 10   σ = 20   σ = 30   σ = 40   σ = 50

σ = 10   σ = 20   σ = 30   σ = 40   σ = 50

σ = 10   σ = 20   σ = 30   σ = 40   σ = 50

NL algorithm for image denoising : Implemenation

2023.02.08.

NL : PSNR calculation

C.man	10	20	30	40	50
noise	28.13	22.12	18.54	16.05	14.18
NL	29.44	22.53	19.01	16.68	14.85

NL : PSNR calculation

House	10	20	30	40	50
noise	28.13	22.07	18.57	16.07	14.16
NL	29.51	22.24	18.72	16.31	14.59

NL : PSNR calculation

Lena	10	20	30	40	50
noise	28.13	22.11	18.57	16.10	14.16
NL	29.45	22.23	18.70	16.36	14.59

σ	10	20	30	40	50	10	20	30	40	50
Input Image	Lena 512 x 512					Barbara 512 x 512				
WT	33.23	29.97	28.25	27.07	26.09	31.45	27.70	25.55	24.10	23.11
MRBF	34.07	31.21	**29.60**	**28.31**	**27.16**	32.14	28.08	25.59	24.13	23.24
BF	32.01	29.70	28.43	27.39	26.40	27.32	25.04	24.24	23.65	23.09
NL-means	34.56	30.54	28.20	26.68	25.77	34.40	28.88	25.89	23.99	22.86
NLFMT	**35.41**	**31.62**	29.44	27.91	26.71	**35.18**	**29.96**	**26.88**	**24.84**	**23.50**
BM3D	35.79	32.94	31.16	29.79	28.70	35.37	32.04	29.87	27.98	26.60

B. K., Shreyamsha Kumar. (2013).

NL : PSNR calculation

Barbara	10	20	30	40	50
noise	28.12	22.09	18.58	16.09	14.16
NL	29.04	22.48	19.14	16.86	15.16

σ	10	20	30	40	50	10	20	30	40	50
Input Image	Lena 512 x 512					Barbara 512 x 512				
WT	33.23	29.97	28.25	27.07	26.09	31.45	27.70	25.55	24.10	23.11
MRBF	34.07	31.21	**29.60**	**28.31**	**27.16**	32.14	28.08	25.59	24.13	23.24
BF	32.01	29.70	28.43	27.39	26.40	27.32	25.04	24.24	23.65	23.09
NL-means	34.56	30.54	28.20	26.68	25.77	34.40	28.88	25.89	23.99	22.86
NLFMT	**35.41**	**31.62**	29.44	27.91	26.71	**35.18**	**29.96**	**26.88**	**24.84**	**23.50**
BM3D	35.79	32.94	31.16	29.79	28.70	35.37	32.04	29.87	27.98	26.60

B. K., Shreyamsha Kumar. (2013).

σ = 10   σ = 20   σ = 30   σ = 40   σ = 50

BM3D

Dabov, K., Foi, A., Katkovnik, V., & Egiazarian, K. (2007). Image denoising by sparse 3-D transform-domain collaborative filtering. *IEEE Transactions on image processing*, *16*(8), 2080-2095.

Lebrun, M. (2012). An analysis and implementation of the BM3D image denoising method. *Image Processing On Line*, *2012*, 175-213.

NL algorithm

Buades, B. Coll and J. . -M. Morel, "A non-local algorithm for image denoising," *2005 IEEE Computer Society Conference on Computer Vision and Pattern Recognition (CVPR'05)*, San Diego, CA, USA, 2005, pp. 60-65 vol. 2, doi: 10.1109/CVPR.2005.38.

B. K., Shreyamsha Kumar. (2013). Image denoising based on non-local means filter and its method noise thresholding. Signal, Image and Video Processing. 7. 1211-1227. 10.1007/s11760-012-0389-y.