A Review of an Old Dilemma: Demosaicking First, or Denoising First?
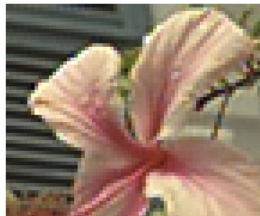
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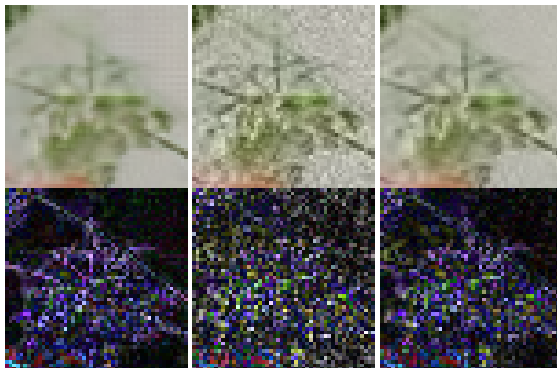
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Denoise→Demosaic vs Demosaic→Denoise

(a) *DN&DM* /26.92dB (b) *DM&DN* /25.38dB (c) *DM&1.5DN* /26.95dB

DN&DM Pros: iid AWG Cons: over-smooth, checkerboard effects

DM&DN Pros: more details, no checkerboard effects Cons: chromatic and spatial correlations noise

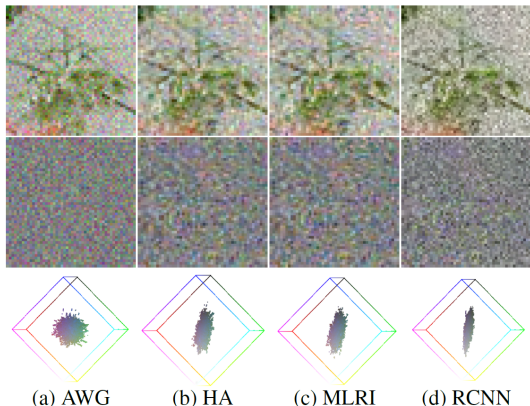# Analyze the demosaicking noise

Figure: AWG noise image and demosaicking noise with standard deviation $\sigma = 20$ for respectively HA[1], MLRI[2], RCNN[3]. Last row: the color spaces (in standard (R,G,B) Cartesian coordinates) of each noise, presented in their projection with maximal area.

(a) AWG   (b) HA   (c) MLRI   (d) RCNN

Variance and covariance of (R, G, B) and (Y, C_1, C_2)

	(i,j)	$(i,j+1)$	$(i,j+2)$	$(i+1,j)$	$(i+1,j+1)$	$(i+1,j+2)$	$(i+2,j)$	$(i+2,j+1)$	$(i+2,j+2)$
R	400.6	0.6	0.4	0.7	0.1	0.7	0.3	0.2	0.8
G	401.7	0.5	1.1	0.1	0.3	0.9	1.0	0.6	0.4
B	400.2	1.2	0.1	0.5	0.6	0.0	1.9	0.3	1.9
Y	399.6	1.1	0.1	0.3	0.1	0.9	0.2	0.5	1.2
C_1	401.5	0.1	0.8	0.6	0.3	0.3	0.9	0.5	1.3
C_2	401.4	0.2	1.8	0.9	0.2	1.0	0.6	0.2	0.2

(a) AWG noise

	(i,j)	$(i,j+1)$	$(i,j+2)$	$(i+1,j)$	$(i+1,j+1)$	$(i+1,j+2)$	$(i+2,j)$	$(i+2,j+1)$	$(i+2,j+2)$
R	359.9	47.8	5.0	51.9	21.8	17.8	5.1	19.4	9.2
G	354.8	32.6	4.4	36.3	5.8	8.4	6.4	8.8	0.6
B	356.0	49.6	6.3	53.7	23.6	18.8	7.3	19.4	9.2
Y	972.3	69.0	20.8	76.4	3.6	18.6	28.9	17.3	2.2
C_1	55.1	33.8	15.3	36.0	26.1	14.6	19.0	16.6	11.8
C_2	43.3	27.3	12.3	29.4	21.5	11.7	16.0	13.7	9.4

(c) RCNN

Summary of experiments (simulated images)

Table: Comparison of the results (CPSNR in dB) changing the order of denoising and demosaicking for the **Kodak** image set.

σ	*DN&DM* BM3D+RCNN	*DM&1.5DN* RCNN+CBM3D
1	40.55	40.98
5	34.89	36.55
10	30.93	33.36
20	27.70	29.98
40	24.78	26.71
60	22.55	24.42
Av	28.35	30.19

Summary of experiments (real images)

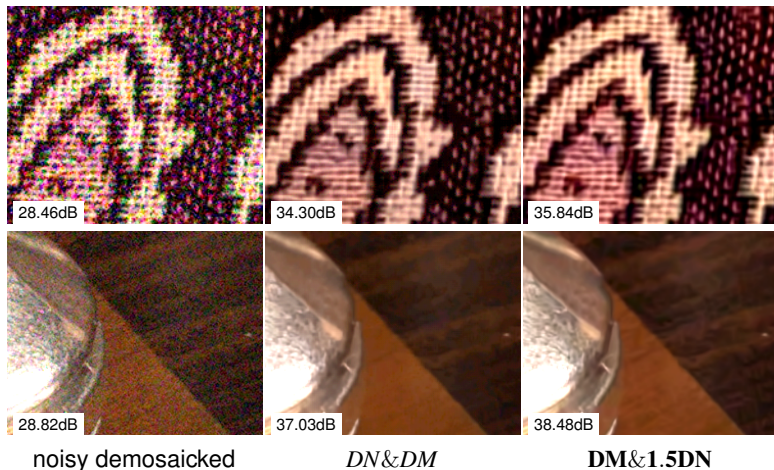noisy demosaicked   *DN&DM*   **DM&1.5DN**

Figure: Details of a real images (enhanced contrast) from the SIDD [8] dataset. From left to right: noisy input (demosaicked), BM3D+RCNN , and RCNN+CBM3D.

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Gharbi et al. Deep joint demosaicking and denoising. ACM Transactions on Graphics, 2016, 35(6): 191.

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