

Loss Functions for Image Restoration with Neural Networks

Supplementary Material

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We report here the image quality evaluation for all the images of the dataset considered for the joint demosaicking and denoising problem (Section 1), for the super-resolution problem (Section 2), and for the deblocking problem (3).

Each of the following tables shows a specific error measure computed on all the images in the dataset and for all the networks we trained. For instance, Table 1 shows the MSE error for each one of the images of the test dataset across the networks we trained. The very last row is the average, which is also the number we report in the paper.

1 Joint demosaicking and denoising

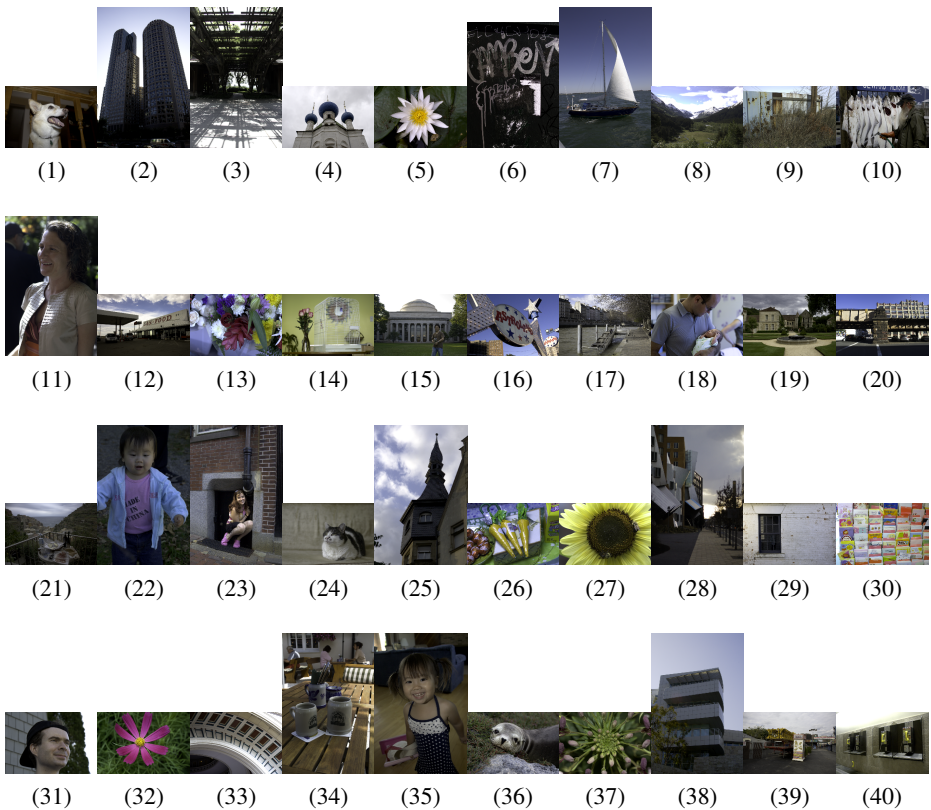


Fig. 1: Testing dataset for joint demosaicking and denoising.

Image	Noisy	BM3DZ	ℓ_2	ℓ_1	1 - SSIM ₅	1 - SSIM ₉	1 - MS-SSIM	Mix
1	0.6666	0.1624	0.1915	0.1471	0.1749	0.1701	0.1815	0.1374
2	1.8481	0.4525	0.5951	0.4290	0.6122	0.6429	0.5089	0.4283
3	3.1870	0.7064	0.9541	0.6699	0.9585	0.9637	0.7385	0.6797
4	2.1768	0.3421	0.4941	0.3002	0.4121	0.4162	0.3899	0.2878
5	1.2180	0.4086	0.4345	0.3843	0.4581	0.4693	0.4536	0.3558
6	2.0136	0.5696	0.6850	0.5506	0.7177	0.7191	0.5568	0.5233
7	1.1552	0.2349	0.3054	0.2070	0.2807	0.3435	0.2896	0.1952
8	1.7956	0.6269	0.6792	0.5274	0.7944	0.8521	0.8044	0.5403
9	3.3683	1.2441	1.4655	1.1844	1.5683	1.5890	1.3095	1.1358
10	1.5940	0.4489	0.5010	0.4034	0.4960	0.5024	0.4591	0.3875
11	1.1177	0.2638	0.3105	0.2348	0.2989	0.3036	0.2697	0.2229
12	1.5551	0.2564	0.3658	0.2577	0.3693	0.3903	0.3596	0.2436
13	1.4352	0.4648	0.5281	0.4264	0.6665	0.7608	0.7342	0.3823
14	2.1744	0.5034	0.7513	0.6167	0.8207	0.8279	0.8941	0.5622
15	1.5165	0.4979	0.5377	0.3927	0.4933	0.4983	0.4390	0.3987
16	2.1571	0.6565	0.7955	0.5967	0.9219	1.0367	0.9980	0.5856
17	3.9205	0.9347	1.3985	0.9981	1.4377	1.4287	1.0636	0.9618
18	1.3042	0.3072	0.3902	0.3200	0.4311	0.4818	0.4470	0.3027
19	1.7007	0.4522	0.5489	0.4357	0.5619	0.5539	0.5048	0.4249
20	2.9040	0.6345	0.8644	0.6114	1.0148	1.0851	1.0062	0.6111
21	0.9076	0.2844	0.2805	0.2237	0.2643	0.2707	0.2468	0.2183
22	0.6958	0.1771	0.1996	0.1661	0.2840	0.3300	0.3760	0.1520
23	1.4552	0.5811	0.5735	0.5394	0.6230	0.6330	0.5678	0.5073
24	0.9870	0.1728	0.2179	0.1230	0.1667	0.1457	0.1785	0.1203
25	1.4995	0.2317	0.3250	0.1824	0.2726	0.2980	0.2490	0.1794
26	1.9842	0.7961	0.9190	0.7093	1.0287	1.1566	1.0612	0.6712
27	1.3177	0.4365	0.4882	0.4150	0.4887	0.5116	0.6665	0.3713
28	1.1165	0.2364	0.3019	0.2097	0.2697	0.2705	0.2542	0.2050
29	1.9594	0.6526	0.6418	0.5892	0.6346	0.6480	0.6451	0.5395
30	3.0486	1.1675	1.6892	1.2255	1.8734	2.0201	1.7084	1.1803
31	0.8687	0.1953	0.2383	0.1363	0.1894	0.1909	0.1745	0.1469
32	0.7694	0.2423	0.3654	0.3200	0.4309	0.4766	0.5005	0.2496
33	1.5714	0.3303	0.4905	0.3390	0.4889	0.5013	0.4186	0.3334
34	1.2673	0.2740	0.3172	0.2426	0.3199	0.3231	0.2901	0.2325
35	0.6600	0.1429	0.1765	0.1209	0.1530	0.1554	0.1503	0.1172
36	1.3243	0.5347	0.5342	0.4838	0.5400	0.5432	0.5061	0.4542
37	0.8796	0.2812	0.2989	0.2513	0.2981	0.3012	0.3221	0.2291
38	1.3389	0.2930	0.3699	0.2477	0.3293	0.3609	0.3187	0.2390
39	2.0905	0.4484	0.6338	0.4307	0.6192	0.6129	0.5332	0.4272
40	1.4816	0.4789	0.5218	0.4050	0.5098	0.5026	0.5204	0.4062
Avg	1.6508	0.4531	0.5595	0.4264	0.5818	0.6072	0.5524	0.4087

Table 1: Joint demosaicing and denoising: mean squared error ($1000 \cdot \ell_2$) for the dataset considered here, and the network trained on different cost functions. In bold, the best result for each image.

Image	Noisy	BM3DZ	ℓ_2	ℓ_1	1 - SSIM ₅	1 - SSIM ₉	1 - MS-SSIM	Mix
1	31.76	37.89	37.18	38.32	37.57	37.69	37.41	38.62
2	27.33	33.44	32.25	33.68	32.13	31.92	32.93	33.68
3	24.97	31.51	30.20	31.74	30.18	30.16	31.32	31.68
4	26.62	34.66	33.06	35.23	33.85	33.81	34.09	35.41
5	29.14	33.89	33.62	34.15	33.39	33.29	33.43	34.49
6	26.96	32.44	31.64	32.59	31.44	31.43	32.54	32.81
7	29.37	36.29	35.15	36.84	35.52	34.64	35.38	37.09
8	27.46	32.03	31.68	32.78	31.00	30.70	30.95	32.67
9	24.73	29.05	28.34	29.27	28.05	27.99	28.83	29.45
10	27.98	33.48	33.00	33.94	33.05	32.99	33.38	34.12
11	29.52	35.79	35.08	36.29	35.25	35.18	35.69	36.52
12	28.08	35.91	34.37	35.89	34.33	34.09	34.44	36.13
13	28.43	33.33	32.77	33.70	31.76	31.19	31.34	34.18
14	26.63	32.98	31.24	32.10	30.86	30.82	30.49	32.50
15	28.19	33.03	32.69	34.06	33.07	33.03	33.58	33.99
16	26.66	31.83	30.99	32.24	30.35	29.84	30.01	32.32
17	24.07	30.29	28.54	30.01	28.42	28.45	29.73	30.17
18	28.85	35.13	34.09	34.95	33.65	33.17	33.50	35.19
19	27.69	33.45	32.61	33.61	32.50	32.57	32.97	33.72
20	25.37	31.98	30.63	32.14	29.94	29.65	29.97	32.14
21	30.42	35.46	35.52	36.50	35.78	35.67	36.08	36.61
22	31.58	37.52	37.00	37.80	35.47	34.81	34.25	38.18
23	28.37	32.36	32.41	32.68	32.06	31.99	32.46	32.95
24	30.06	37.62	36.62	39.10	37.78	38.37	37.48	39.20
25	28.24	36.35	34.88	37.39	35.64	35.26	36.04	37.46
26	27.02	30.99	30.37	31.49	29.88	29.37	29.74	31.73
27	28.80	33.60	33.11	33.82	33.11	32.91	31.76	34.30
28	29.52	36.26	35.20	36.78	35.69	35.68	35.95	36.88
29	27.08	31.85	31.93	32.30	31.98	31.88	31.90	32.68
30	25.16	29.33	27.72	29.12	27.27	26.95	27.67	29.28
31	30.61	37.09	36.23	38.65	37.23	37.19	37.58	38.33
32	31.14	36.16	34.37	34.95	33.66	33.22	33.01	36.03
33	28.04	34.81	33.09	34.70	33.11	33.00	33.78	34.77
34	28.97	35.62	34.99	36.15	34.95	34.91	35.37	36.34
35	31.80	38.45	37.53	39.17	38.15	38.08	38.23	39.31
36	28.78	32.72	32.72	33.15	32.68	32.65	32.96	33.43
37	30.56	35.51	35.24	36.00	35.26	35.21	34.92	36.40
38	28.73	35.33	34.32	36.06	34.82	34.43	34.97	36.22
39	26.80	33.48	31.98	33.66	32.08	32.13	32.73	33.69
40	28.29	33.20	32.82	33.93	32.93	32.99	32.84	33.91
Avg	28.24	34.05	33.18	34.42	33.15	32.98	33.29	34.61

Table 2: Joint demosaicing and denoising: PSNR for the dataset considered here, and the network trained on different cost functions. In bold, the best result for each image.

Image	Noisy	BM3DZ	ℓ_2	ℓ_1	1 - SSIM ₅	1 - SSIM ₉	1 - MS-SSIM	Mix
1	17.5788	8.7728	9.6404	8.0181	8.7745	8.6312	8.7849	7.7033
2	28.0500	14.5813	16.8237	13.4120	17.0967	17.7267	15.8457	13.7168
3	31.3699	16.1437	18.4300	15.0452	18.0860	18.3105	16.1509	15.5479
4	34.4481	13.1232	16.2567	11.6136	13.8518	13.9710	14.6067	11.3758
5	24.1421	13.9486	14.6893	13.6856	14.9951	15.1143	15.2707	13.0809
6	25.5620	14.9086	16.1827	14.5664	16.3966	16.4284	14.7210	14.2311
7	24.6762	10.0605	12.3548	9.1395	11.4991	13.5161	12.4991	8.6869
8	28.0062	17.5393	17.9326	15.3186	19.6325	20.5504	19.7816	16.1093
9	41.3944	25.6367	27.7441	25.0677	29.2365	29.5129	27.0345	24.6831
10	28.1744	14.9676	16.1597	14.2110	15.7614	15.9165	15.3279	13.9848
11	21.2568	10.0660	11.1767	9.1791	10.4300	10.6066	10.2255	8.9356
12	25.9771	10.9348	13.1016	10.4731	12.6709	13.2157	13.1137	10.2029
13	27.2044	14.8868	16.3473	14.5721	18.3416	19.9964	20.0691	13.5821
14	33.7412	15.1408	19.2643	16.5568	20.0758	19.9585	22.3439	15.6179
15	27.0400	16.0345	16.6723	13.5566	15.6944	15.8341	14.6781	14.1913
16	31.9225	16.9181	19.3221	16.3344	21.1799	22.7805	23.1982	16.1783
17	40.4127	21.2825	24.7373	21.5293	25.0823	25.1079	22.5111	21.1017
18	27.2305	13.0340	14.8937	13.0483	15.4075	16.3070	15.8167	12.6617
19	27.8527	15.0668	16.3988	14.4561	16.1722	16.1024	15.8780	14.2449
20	32.2724	14.6981	17.8112	14.2203	19.6564	20.6320	20.6499	14.1194
21	21.9432	12.3766	12.5850	10.9251	12.0554	12.2910	11.6938	10.8136
22	19.2721	9.7575	10.3800	9.3080	11.9096	12.6291	13.2604	8.8894
23	27.2421	16.9921	17.3044	16.5684	17.9627	18.1979	17.2277	16.0860
24	24.0936	10.0435	11.4221	8.1657	9.8134	9.0045	10.1466	8.1277
25	27.8196	11.4942	13.4793	9.7170	12.0410	12.8143	12.0310	9.6899
26	31.3444	19.1537	21.0438	18.7851	22.6188	24.2083	24.3325	17.9814
27	26.5332	15.1891	16.5002	15.0352	16.1259	16.4930	19.4286	14.0840
28	23.5100	10.5027	12.2344	9.6635	11.0832	11.1226	10.8929	9.5767
29	33.1198	18.3564	18.6840	17.2668	18.1187	18.3994	18.1513	16.6406
30	38.4885	21.1115	27.6016	23.2691	29.7416	31.2515	29.2183	22.4259
31	21.0514	10.4052	11.4294	8.2280	10.1640	10.1437	9.6422	8.7432
32	19.9372	10.4781	12.9271	12.2075	14.0006	14.8524	15.8301	10.3240
33	27.9327	12.8019	15.6829	12.4156	15.2092	15.3989	14.1859	12.5189
34	24.3751	11.4564	12.7782	10.8269	12.4653	12.4426	11.9844	10.5889
35	18.3425	8.4892	9.7571	7.7948	8.8503	8.9011	8.8380	7.6306
36	26.2423	16.8610	16.8714	16.0048	16.7903	16.8484	16.4884	15.4744
37	21.1894	11.1754	12.1554	10.8392	11.9543	11.9672	12.8729	10.1330
38	26.8080	11.5396	13.9467	10.3845	12.9853	14.0376	13.1007	10.2188
39	30.4031	13.6545	16.6438	13.1565	15.7785	15.5907	15.6328	13.1086
40	26.5977	15.9039	16.6638	14.1598	16.3200	16.1954	16.3038	14.5906
Avg	27.3640	14.1372	15.9007	13.4681	15.9007	16.3252	15.9942	13.1900

Table 3: Joint demosaicing and denoising: mean absolute ($1000 \cdot \ell_1$) error for the dataset considered here, and the network trained on different cost functions. In bold, the best result for each image.

Image	Noisy	BM3DZ	ℓ_2	ℓ_1	1 - SSIM ₅	1 - SSIM ₉	1 - MS-SSIM	Mix
1	0.8392	0.9476	0.9421	0.9631	0.9625	0.9630	0.9645	0.9662
2	0.7829	0.9511	0.9359	0.9620	0.9560	0.9557	0.9622	0.9634
3	0.8870	0.9712	0.9691	0.9761	0.9729	0.9724	0.9761	0.9770
4	0.6484	0.9539	0.9068	0.9644	0.9637	0.9638	0.9689	0.9667
5	0.8220	0.9237	0.9230	0.9312	0.9306	0.9287	0.9300	0.9348
6	0.9333	0.9748	0.9783	0.9817	0.9801	0.9796	0.9816	0.9827
7	0.7349	0.9519	0.9243	0.9609	0.9599	0.9597	0.9629	0.9639
8	0.7974	0.9420	0.9323	0.9465	0.9427	0.9417	0.9437	0.9487
9	0.7937	0.9295	0.9298	0.9417	0.9344	0.9334	0.9421	0.9451
10	0.8512	0.9512	0.9475	0.9562	0.9549	0.9539	0.9565	0.9587
11	0.8499	0.9664	0.9550	0.9720	0.9686	0.9697	0.9725	0.9732
12	0.7989	0.9585	0.9430	0.9639	0.9617	0.9608	0.9637	0.9663
13	0.8408	0.9498	0.9375	0.9521	0.9464	0.9444	0.9496	0.9566
14	0.7393	0.9452	0.9016	0.9347	0.9260	0.9264	0.9345	0.9403
15	0.8282	0.9536	0.9462	0.9592	0.9576	0.9570	0.9597	0.9614
16	0.7867	0.9459	0.9242	0.9504	0.9454	0.9443	0.9496	0.9522
17	0.8069	0.9370	0.9397	0.9459	0.9430	0.9419	0.9481	0.9504
18	0.7395	0.9374	0.9082	0.9319	0.9249	0.9250	0.9302	0.9343
19	0.8154	0.9394	0.9350	0.9477	0.9453	0.9454	0.9472	0.9495
20	0.8424	0.9716	0.9587	0.9777	0.9738	0.9734	0.9772	0.9784
21	0.8363	0.9424	0.9435	0.9573	0.9558	0.9559	0.9581	0.9590
22	0.8450	0.9558	0.9492	0.9597	0.9583	0.9576	0.9597	0.9620
23	0.8305	0.9222	0.9289	0.9306	0.9278	0.9275	0.9339	0.9370
24	0.7295	0.9504	0.9243	0.9637	0.9597	0.9634	0.9658	0.9640
25	0.7234	0.9523	0.9264	0.9670	0.9642	0.9646	0.9684	0.9675
26	0.8326	0.9316	0.9218	0.9369	0.9293	0.9266	0.9327	0.9390
27	0.8256	0.9333	0.9247	0.9376	0.9356	0.9344	0.9372	0.9420
28	0.7930	0.9613	0.9393	0.9666	0.9638	0.9642	0.9675	0.9675
29	0.7158	0.8773	0.8858	0.8806	0.8888	0.8845	0.8895	0.8974
30	0.7996	0.9347	0.8948	0.9266	0.9006	0.8949	0.9084	0.9285
31	0.8116	0.9657	0.9476	0.9710	0.9692	0.9704	0.9726	0.9721
32	0.8613	0.9577	0.9373	0.9493	0.9434	0.9444	0.9496	0.9571
33	0.8359	0.9655	0.9479	0.9633	0.9594	0.9584	0.9633	0.9660
34	0.8515	0.9603	0.9502	0.9633	0.9599	0.9602	0.9623	0.9643
35	0.8538	0.9682	0.9539	0.9735	0.9697	0.9710	0.9737	0.9743
36	0.8677	0.9390	0.9429	0.9451	0.9451	0.9441	0.9480	0.9506
37	0.8817	0.9634	0.9581	0.9690	0.9664	0.9670	0.9697	0.9714
38	0.7179	0.9434	0.9137	0.9581	0.9552	0.9548	0.9600	0.9603
39	0.7525	0.9527	0.9280	0.9604	0.9571	0.9574	0.9611	0.9611
40	0.7983	0.9358	0.9279	0.9421	0.9403	0.9398	0.9427	0.9448
Avg	0.8075	0.9479	0.9346	0.9535	0.9500	0.9495	0.9536	0.9564

Table 4: Joint demosaicing and denoising: SSIM for the dataset considered here, and the network trained on different cost functions. In bold, the best result for each image.

Image	Noisy	BM3DZ	ℓ_2	ℓ_1	1 - SSIM ₅	1 - SSIM ₉	1 - MS-SSIM	Mix
1	0.9257	0.9800	0.9740	0.9817	0.9808	0.9812	0.9823	0.9826
2	0.8854	0.9747	0.9632	0.9774	0.9739	0.9738	0.9778	0.9779
3	0.9432	0.9856	0.9840	0.9878	0.9858	0.9856	0.9877	0.9881
4	0.7929	0.9730	0.9402	0.9768	0.9767	0.9768	0.9805	0.9776
5	0.9117	0.9623	0.9618	0.9655	0.9650	0.9643	0.9652	0.9670
6	0.9412	0.9778	0.9791	0.9820	0.9796	0.9794	0.9822	0.9830
7	0.8490	0.9730	0.9536	0.9766	0.9757	0.9758	0.9781	0.9778
8	0.8898	0.9677	0.9605	0.9687	0.9628	0.9620	0.9614	0.9698
9	0.8905	0.9615	0.9603	0.9673	0.9625	0.9618	0.9669	0.9686
10	0.9260	0.9758	0.9738	0.9784	0.9775	0.9771	0.9785	0.9795
11	0.9199	0.9811	0.9747	0.9843	0.9823	0.9830	0.9844	0.9847
12	0.8963	0.9792	0.9694	0.9806	0.9790	0.9786	0.9800	0.9815
13	0.9175	0.9734	0.9669	0.9749	0.9710	0.9696	0.9720	0.9771
14	0.8508	0.9677	0.9411	0.9592	0.9538	0.9546	0.9588	0.9618
15	0.9095	0.9753	0.9706	0.9783	0.9772	0.9770	0.9786	0.9792
16	0.8850	0.9716	0.9576	0.9733	0.9697	0.9689	0.9715	0.9742
17	0.8974	0.9657	0.9662	0.9702	0.9681	0.9676	0.9711	0.9722
18	0.8591	0.9666	0.9501	0.9653	0.9617	0.9617	0.9639	0.9661
19	0.9060	0.9695	0.9664	0.9733	0.9718	0.9719	0.9731	0.9740
20	0.9180	0.9852	0.9770	0.9878	0.9853	0.9852	0.9873	0.9881
21	0.9167	0.9704	0.9708	0.9778	0.9769	0.9770	0.9783	0.9785
22	0.9200	0.9756	0.9730	0.9782	0.9768	0.9762	0.9767	0.9793
23	0.9112	0.9598	0.9624	0.9642	0.9623	0.9622	0.9652	0.9669
24	0.8478	0.9684	0.9549	0.9776	0.9756	0.9777	0.9790	0.9773
25	0.8494	0.9731	0.9575	0.9807	0.9791	0.9794	0.9815	0.9805
26	0.9152	0.9649	0.9600	0.9679	0.9634	0.9616	0.9647	0.9689
27	0.9078	0.9637	0.9598	0.9666	0.9653	0.9647	0.9659	0.9687
28	0.8842	0.9783	0.9637	0.9805	0.9790	0.9793	0.9811	0.9807
29	0.8364	0.9298	0.9343	0.9349	0.9397	0.9374	0.9396	0.9433
30	0.8972	0.9666	0.9446	0.9607	0.9428	0.9386	0.9463	0.9621
31	0.9020	0.9823	0.9716	0.9841	0.9832	0.9839	0.9852	0.9845
32	0.9294	0.9775	0.9670	0.9723	0.9689	0.9686	0.9711	0.9771
33	0.9162	0.9821	0.9731	0.9817	0.9794	0.9790	0.9814	0.9828
34	0.9234	0.9793	0.9741	0.9811	0.9792	0.9793	0.9804	0.9815
35	0.9244	0.9829	0.9752	0.9855	0.9834	0.9841	0.9853	0.9857
36	0.9307	0.9670	0.9698	0.9710	0.9708	0.9702	0.9720	0.9737
37	0.9419	0.9814	0.9794	0.9844	0.9828	0.9830	0.9844	0.9854
38	0.8375	0.9693	0.9470	0.9749	0.9734	0.9734	0.9770	0.9757
39	0.8613	0.9724	0.9563	0.9762	0.9743	0.9745	0.9769	0.9761
40	0.8924	0.9657	0.9603	0.9694	0.9678	0.9676	0.9695	0.9704
Avg	0.8965	0.9719	0.9636	0.9745	0.9721	0.9718	0.9741	0.9757

Table 5: Joint demosaicing and denoising: MS-SSIM for the dataset considered here, and the network trained on different cost functions. In bold, the best result for each image.

Image	Noisy	BM3DZ	ℓ_2	ℓ_1	1 - SSIM ₅	1 - SSIM ₉	1 - MS-SSIM	Mix
1	0.8652	0.9564	0.9466	0.9590	0.9583	0.9582	0.9607	0.9613
2	0.8765	0.9684	0.9535	0.9684	0.9643	0.9642	0.9686	0.9688
3	0.9352	0.9836	0.9821	0.9859	0.9832	0.9830	0.9857	0.9863
4	0.7514	0.9547	0.9006	0.9520	0.9521	0.9522	0.9596	0.9529
5	0.8807	0.9479	0.9480	0.9526	0.9519	0.9505	0.9521	0.9552
6	0.9332	0.9762	0.9771	0.9803	0.9775	0.9772	0.9805	0.9814
7	0.7886	0.9484	0.9108	0.9455	0.9446	0.9444	0.9495	0.9476
8	0.8629	0.9507	0.9395	0.9465	0.9380	0.9364	0.9372	0.9484
9	0.8948	0.9609	0.9594	0.9659	0.9607	0.9600	0.9654	0.9670
10	0.9057	0.9689	0.9670	0.9724	0.9711	0.9706	0.9726	0.9739
11	0.8791	0.9656	0.9556	0.9697	0.9667	0.9678	0.9703	0.9705
12	0.8561	0.9663	0.9519	0.9675	0.9654	0.9645	0.9670	0.9689
13	0.8904	0.9603	0.9515	0.9613	0.9550	0.9527	0.9577	0.9646
14	0.8268	0.9558	0.9193	0.9387	0.9319	0.9335	0.9378	0.9415
15	0.8937	0.9663	0.9624	0.9709	0.9690	0.9690	0.9712	0.9721
16	0.8709	0.9688	0.9485	0.9691	0.9631	0.9619	0.9672	0.9702
17	0.8922	0.9633	0.9635	0.9683	0.9659	0.9655	0.9693	0.9700
18	0.7977	0.9455	0.9188	0.9459	0.9424	0.9429	0.9460	0.9470
19	0.8837	0.9620	0.9577	0.9667	0.9648	0.9650	0.9667	0.9674
20	0.9080	0.9823	0.9723	0.9835	0.9796	0.9794	0.9826	0.9839
21	0.8923	0.9599	0.9606	0.9701	0.9690	0.9692	0.9708	0.9709
22	0.8836	0.9617	0.9584	0.9653	0.9636	0.9625	0.9641	0.9673
23	0.8953	0.9519	0.9555	0.9582	0.9564	0.9562	0.9594	0.9612
24	0.7671	0.9346	0.9140	0.9501	0.9469	0.9506	0.9528	0.9497
25	0.7923	0.9510	0.9265	0.9611	0.9594	0.9596	0.9632	0.9608
26	0.8902	0.9543	0.9469	0.9583	0.9510	0.9482	0.9543	0.9598
27	0.8839	0.9506	0.9457	0.9533	0.9516	0.9503	0.9518	0.9561
28	0.8437	0.9655	0.9404	0.9657	0.9634	0.9638	0.9672	0.9658
29	0.8095	0.9091	0.9188	0.9209	0.9281	0.9252	0.9278	0.9317
30	0.8859	0.9594	0.9314	0.9511	0.9280	0.9225	0.9340	0.9525
31	0.8518	0.9643	0.9490	0.9666	0.9651	0.9661	0.9682	0.9671
32	0.8926	0.9635	0.9424	0.9523	0.9429	0.9422	0.9467	0.9596
33	0.9027	0.9785	0.9682	0.9771	0.9740	0.9734	0.9770	0.9787
34	0.9023	0.9721	0.9665	0.9744	0.9718	0.9718	0.9735	0.9750
35	0.8911	0.9720	0.9603	0.9753	0.9720	0.9727	0.9748	0.9753
36	0.9111	0.9567	0.9609	0.9621	0.9621	0.9614	0.9637	0.9657
37	0.9073	0.9678	0.9652	0.9717	0.9697	0.9699	0.9720	0.9735
38	0.8023	0.9542	0.9171	0.9540	0.9517	0.9514	0.9577	0.9549
39	0.8296	0.9570	0.9339	0.9613	0.9582	0.9585	0.9629	0.9606
40	0.8635	0.9516	0.9441	0.9578	0.9554	0.9552	0.9585	0.9591
Avg	0.8673	0.9597	0.9473	0.9619	0.9587	0.9582	0.9617	0.9636

Table 6: Joint demosaicing and denoising: IW-SSIM for the dataset considered here, and the network trained on different cost functions. In bold, the best result for each image.

Image	Noisy	BM3DZ	ℓ_2	ℓ_1	1 - SSIM ₅	1 - SSIM ₉	1 - MS-SSIM	Mix
1	0.0934	0.0327	0.0342	0.0321	0.0308	0.0316	0.0299	0.0289
2	0.1566	0.0401	0.0522	0.0388	0.0435	0.0454	0.0395	0.0374
3	0.1089	0.0370	0.0368	0.0322	0.0369	0.0375	0.0328	0.0308
4	0.1968	0.0391	0.0655	0.0372	0.0379	0.0398	0.0361	0.0339
5	0.0991	0.0516	0.0460	0.0500	0.0490	0.0510	0.0498	0.0461
6	0.0788	0.0423	0.0352	0.0369	0.0393	0.0403	0.0358	0.0331
7	0.1501	0.0405	0.0496	0.0401	0.0388	0.0404	0.0392	0.0364
8	0.1368	0.0488	0.0514	0.0500	0.0562	0.0576	0.0577	0.0481
9	0.1259	0.0568	0.0569	0.0559	0.0604	0.0622	0.0570	0.0529
10	0.1089	0.0487	0.0448	0.0463	0.0453	0.0470	0.0448	0.0420
11	0.0946	0.0324	0.0335	0.0290	0.0297	0.0298	0.0275	0.0262
12	0.1310	0.0397	0.0459	0.0437	0.0439	0.0462	0.0426	0.0387
13	0.1132	0.0494	0.0547	0.0539	0.0579	0.0604	0.0562	0.0483
14	0.1615	0.0572	0.0779	0.0743	0.0755	0.0782	0.0748	0.0676
15	0.1218	0.0447	0.0422	0.0387	0.0395	0.0403	0.0385	0.0361
16	0.1398	0.0438	0.0528	0.0433	0.0479	0.0501	0.0446	0.0407
17	0.1132	0.0556	0.0495	0.0516	0.0519	0.0534	0.0494	0.0469
18	0.1383	0.0373	0.0464	0.0370	0.0378	0.0385	0.0381	0.0350
19	0.1110	0.0450	0.0425	0.0423	0.0417	0.0430	0.0413	0.0393
20	0.1394	0.0418	0.0522	0.0397	0.0458	0.0461	0.0402	0.0382
21	0.1026	0.0398	0.0374	0.0325	0.0324	0.0326	0.0314	0.0304
22	0.0894	0.0334	0.0333	0.0347	0.0338	0.0358	0.0344	0.0317
23	0.0985	0.0591	0.0478	0.0530	0.0528	0.0543	0.0492	0.0466
24	0.1309	0.0299	0.0417	0.0279	0.0278	0.0273	0.0256	0.0254
25	0.1569	0.0331	0.0487	0.0272	0.0293	0.0296	0.0277	0.0265
26	0.1117	0.0552	0.0580	0.0520	0.0570	0.0598	0.0560	0.0502
27	0.1097	0.0523	0.0549	0.0550	0.0548	0.0577	0.0578	0.0522
28	0.1398	0.0316	0.0436	0.0302	0.0306	0.0317	0.0295	0.0282
29	0.1397	0.0797	0.0624	0.0829	0.0747	0.0796	0.0749	0.0684
30	0.1557	0.0735	0.1059	0.0850	0.1067	0.1107	0.0994	0.0842
31	0.1284	0.0268	0.0376	0.0248	0.0246	0.0247	0.0238	0.0232
32	0.0802	0.0355	0.0512	0.0473	0.0512	0.0523	0.0501	0.0405
33	0.1278	0.0388	0.0471	0.0465	0.0489	0.0521	0.0477	0.0422
34	0.1012	0.0431	0.0401	0.0399	0.0396	0.0412	0.0403	0.0376
35	0.0940	0.0250	0.0323	0.0225	0.0244	0.0242	0.0225	0.0216
36	0.0830	0.0509	0.0458	0.0500	0.0483	0.0499	0.0465	0.0442
37	0.0778	0.0373	0.0350	0.0324	0.0334	0.0338	0.0323	0.0302
38	0.1902	0.0449	0.0649	0.0389	0.0397	0.0413	0.0386	0.0360
39	0.1579	0.0399	0.0549	0.0363	0.0410	0.0417	0.0384	0.0359
40	0.1236	0.0495	0.0463	0.0452	0.0456	0.0474	0.0448	0.0414
Avg	0.1229	0.0441	0.0490	0.0434	0.0452	0.0467	0.0437	0.0401

Table 7: Joint demosaicing and denoising: GMSD for the dataset considered here, and the network trained on different cost functions. In bold, the best result for each image.

Image	Noisy	BM3DZ	ℓ_2	ℓ_1	1 - SSIM ₅	1 - SSIM ₉	1 - MS-SSIM	Mix
1	0.9508	0.9788	0.9748	0.9798	0.9794	0.9797	0.9811	0.9818
2	0.9285	0.9822	0.9721	0.9846	0.9807	0.9796	0.9849	0.9852
3	0.9552	0.9807	0.9799	0.9847	0.9823	0.9821	0.9841	0.9850
4	0.8435	0.9673	0.9326	0.9749	0.9725	0.9730	0.9767	0.9764
5	0.9510	0.9693	0.9717	0.9712	0.9706	0.9698	0.9717	0.9736
6	0.9844	0.9828	0.9882	0.9875	0.9868	0.9861	0.9878	0.9888
7	0.9061	0.9644	0.9543	0.9713	0.9711	0.9707	0.9723	0.9737
8	0.9320	0.9655	0.9643	0.9675	0.9686	0.9661	0.9661	0.9705
9	0.9465	0.9693	0.9699	0.9748	0.9721	0.9714	0.9748	0.9770
10	0.9605	0.9730	0.9765	0.9763	0.9764	0.9756	0.9771	0.9785
11	0.9545	0.9774	0.9759	0.9808	0.9798	0.9800	0.9816	0.9825
12	0.9436	0.9740	0.9738	0.9737	0.9740	0.9727	0.9743	0.9770
13	0.9607	0.9750	0.9759	0.9759	0.9757	0.9745	0.9771	0.9790
14	0.9412	0.9779	0.9680	0.9763	0.9731	0.9727	0.9758	0.9780
15	0.9508	0.9753	0.9751	0.9795	0.9787	0.9782	0.9800	0.9811
16	0.9538	0.9808	0.9777	0.9827	0.9807	0.9794	0.9819	0.9833
17	0.9579	0.9736	0.9766	0.9780	0.9759	0.9758	0.9783	0.9800
18	0.9311	0.9747	0.9689	0.9785	0.9778	0.9781	0.9792	0.9801
19	0.9572	0.9699	0.9748	0.9744	0.9739	0.9733	0.9751	0.9763
20	0.9550	0.9809	0.9788	0.9834	0.9796	0.9796	0.9830	0.9840
21	0.9573	0.9734	0.9767	0.9809	0.9798	0.9800	0.9811	0.9819
22	0.9606	0.9781	0.9790	0.9795	0.9799	0.9789	0.9806	0.9814
23	0.9640	0.9671	0.9749	0.9732	0.9725	0.9718	0.9756	0.9770
24	0.9005	0.9671	0.9549	0.9786	0.9751	0.9783	0.9799	0.9791
25	0.9141	0.9733	0.9658	0.9806	0.9790	0.9790	0.9798	0.9812
26	0.9563	0.9751	0.9734	0.9774	0.9754	0.9750	0.9777	0.9791
27	0.9486	0.9728	0.9696	0.9732	0.9722	0.9716	0.9726	0.9747
28	0.9449	0.9791	0.9749	0.9811	0.9806	0.9799	0.9819	0.9826
29	0.9361	0.9508	0.9621	0.9510	0.9567	0.9525	0.9577	0.9619
30	0.9329	0.9726	0.9631	0.9716	0.9662	0.9642	0.9691	0.9724
31	0.9419	0.9814	0.9744	0.9835	0.9826	0.9829	0.9845	0.9848
32	0.9654	0.9812	0.9804	0.9820	0.9818	0.9823	0.9849	0.9856
33	0.9417	0.9793	0.9716	0.9755	0.9725	0.9709	0.9748	0.9777
34	0.9622	0.9758	0.9784	0.9790	0.9787	0.9779	0.9795	0.9806
35	0.9605	0.9832	0.9805	0.9862	0.9849	0.9855	0.9867	0.9871
36	0.9699	0.9695	0.9751	0.9735	0.9742	0.9735	0.9768	0.9776
37	0.9677	0.9801	0.9810	0.9830	0.9822	0.9824	0.9844	0.9849
38	0.8946	0.9746	0.9553	0.9803	0.9777	0.9779	0.9806	0.9816
39	0.9273	0.9752	0.9689	0.9786	0.9772	0.9768	0.9781	0.9794
40	0.9453	0.9740	0.9733	0.9768	0.9762	0.9753	0.9774	0.9787
Avg	0.9439	0.9744	0.9716	0.9775	0.9764	0.9759	0.9782	0.9795

Table 8: Joint demosaicing and denoising: FSIM for the dataset considered here, and the network trained on different cost functions. In bold, the best result for each image.

Image	Noisy	BM3DZ	ℓ_2	ℓ_1	1 - SSIM ₅	1 - SSIM ₉	1 - MS-SSIM	Mix
1	0.9478	0.9785	0.9744	0.9796	0.9790	0.9793	0.9806	0.9815
2	0.9209	0.9814	0.9710	0.9837	0.9794	0.9783	0.9837	0.9842
3	0.9436	0.9795	0.9782	0.9831	0.9804	0.9802	0.9822	0.9835
4	0.8361	0.9668	0.9318	0.9743	0.9720	0.9724	0.9761	0.9759
5	0.9454	0.9687	0.9709	0.9701	0.9692	0.9682	0.9700	0.9729
6	0.9774	0.9823	0.9874	0.9865	0.9856	0.9848	0.9867	0.9880
7	0.9016	0.9639	0.9535	0.9708	0.9704	0.9698	0.9714	0.9732
8	0.9269	0.9646	0.9632	0.9665	0.9670	0.9643	0.9642	0.9695
9	0.9364	0.9679	0.9681	0.9732	0.9695	0.9685	0.9722	0.9754
10	0.9533	0.9724	0.9756	0.9756	0.9756	0.9747	0.9763	0.9779
11	0.9490	0.9770	0.9753	0.9803	0.9790	0.9792	0.9808	0.9821
12	0.9370	0.9735	0.9730	0.9732	0.9732	0.9719	0.9733	0.9766
13	0.9561	0.9742	0.9747	0.9749	0.9737	0.9722	0.9749	0.9781
14	0.9351	0.9770	0.9668	0.9750	0.9714	0.9710	0.9738	0.9769
15	0.9452	0.9746	0.9743	0.9789	0.9779	0.9774	0.9791	0.9805
16	0.9473	0.9795	0.9758	0.9812	0.9785	0.9771	0.9799	0.9819
17	0.9467	0.9726	0.9754	0.9770	0.9746	0.9745	0.9771	0.9789
18	0.9269	0.9742	0.9683	0.9780	0.9768	0.9768	0.9781	0.9797
19	0.9511	0.9694	0.9741	0.9739	0.9732	0.9726	0.9743	0.9758
20	0.9447	0.9797	0.9770	0.9819	0.9777	0.9777	0.9811	0.9825
21	0.9531	0.9731	0.9763	0.9806	0.9794	0.9795	0.9807	0.9815
22	0.9582	0.9779	0.9786	0.9792	0.9793	0.9782	0.9798	0.9811
23	0.9577	0.9664	0.9739	0.9724	0.9714	0.9705	0.9746	0.9762
24	0.8967	0.9668	0.9545	0.9784	0.9748	0.9781	0.9792	0.9789
25	0.9083	0.9730	0.9653	0.9803	0.9786	0.9784	0.9794	0.9809
26	0.9516	0.9739	0.9717	0.9762	0.9730	0.9719	0.9752	0.9780
27	0.9460	0.9724	0.9690	0.9727	0.9715	0.9709	0.9717	0.9743
28	0.9401	0.9786	0.9742	0.9806	0.9800	0.9793	0.9812	0.9821
29	0.9280	0.9501	0.9610	0.9503	0.9559	0.9517	0.9566	0.9612
30	0.9254	0.9708	0.9589	0.9690	0.9611	0.9584	0.9649	0.9697
31	0.9385	0.9811	0.9740	0.9832	0.9820	0.9822	0.9838	0.9845
32	0.9634	0.9809	0.9790	0.9811	0.9801	0.9804	0.9828	0.9849
33	0.9356	0.9786	0.9704	0.9746	0.9713	0.9696	0.9735	0.9768
34	0.9560	0.9754	0.9777	0.9786	0.9780	0.9772	0.9788	0.9802
35	0.9575	0.9830	0.9801	0.9859	0.9845	0.9850	0.9862	0.9868
36	0.9641	0.9686	0.9741	0.9725	0.9731	0.9724	0.9757	0.9767
37	0.9647	0.9798	0.9806	0.9826	0.9816	0.9817	0.9834	0.9846
38	0.8903	0.9741	0.9547	0.9798	0.9770	0.9771	0.9799	0.9811
39	0.9206	0.9744	0.9678	0.9778	0.9763	0.9758	0.9771	0.9786
40	0.9401	0.9734	0.9724	0.9761	0.9753	0.9745	0.9761	0.9780
Avg	0.9381	0.9737	0.9706	0.9767	0.9752	0.9746	0.9769	0.9788

Table 9: Joint demosaicing and denoising: FSIM_C for the dataset considered here, and the network trained on different cost functions. In bold, the best result for each image.

2 Super-resolution



Fig. 2: Testing dataset for superresolution.

Image	Bilinear	ℓ_2	ℓ_2	1 - MS-SSIM	Mix
1	0.9730	0.6804	0.6656	0.7156	0.6631
2	0.7247	0.2851	0.2049	0.4181	0.2020
3	4.3408	1.3806	0.8401	1.5590	0.8169
4	3.1047	2.1231	2.1130	2.1709	2.1072
5	0.7581	0.2062	0.1815	0.2456	0.1638
6	0.9666	0.5196	0.4875	0.6010	0.4913
7	1.4450	0.4829	0.3431	0.5655	0.3396
8	2.4291	1.2840	1.3012	1.3622	1.2765
9	6.8793	4.8695	4.7270	4.8820	4.7328
10	6.0170	2.7701	2.3676	2.8371	2.3901
11	0.8754	0.5417	0.4944	0.6114	0.4886
12	1.5626	0.5319	0.4531	0.6721	0.4385
13	5.3167	1.9593	1.4750	2.0792	1.5108
14	2.4408	1.3608	1.2336	1.4243	1.2203
15	2.5868	1.1283	0.9762	1.1551	0.9577
16	2.7442	0.7354	0.7040	0.8362	0.6503
17	0.5209	0.2337	0.2379	0.3431	0.2332
Avg	2.5697	1.2407	1.1062	1.3223	1.0990

Table 10: Superresolution: mean squared error ($1000 \cdot \ell_2$) for the dataset considered here, and the network trained on different cost functions. In bold, the best result for each image.

Image	Bilinear	ℓ_2	ℓ_2	1 - MS-SSIM	Mix
1	30.12	31.67	31.77	31.45	31.78
2	31.40	35.45	36.89	33.79	36.95
3	23.62	28.60	30.76	28.07	30.88
4	25.08	26.73	26.75	26.63	26.76
5	31.20	36.86	37.41	36.10	37.86
6	30.15	32.84	33.12	32.21	33.09
7	28.40	33.16	34.65	32.48	34.69
8	26.15	28.91	28.86	28.66	28.94
9	21.62	23.13	23.25	23.11	23.25
10	22.21	25.58	26.26	25.47	26.22
11	30.58	32.66	33.06	32.14	33.11
12	28.06	32.74	33.44	31.73	33.58
13	22.74	27.08	28.31	26.82	28.21
14	26.12	28.66	29.09	28.46	29.14
15	25.87	29.48	30.10	29.37	30.19
16	25.62	31.33	31.52	30.78	31.87
17	32.83	36.31	36.24	34.65	36.32
Avg	27.16	30.66	31.26	30.11	31.34

Table 11: Superresolution: PSNR for the dataset considered here, and the network trained on different cost functions. In bold, the best result for each image.

Image	Bilinear	ℓ_2	ℓ_2	1 - MS-SSIM	Mix
1	21.8027	18.6226	18.2717	18.9575	18.2252
2	13.6349	10.0035	8.7655	14.8288	8.6687
3	39.1538	24.2141	18.3801	27.0570	17.9286
4	34.0408	25.8028	25.7174	27.2784	25.3782
5	15.6560	8.7901	8.3538	10.0286	7.9348
6	20.2193	16.0461	15.5400	18.3332	15.5675
7	17.4873	11.5555	10.2269	13.9874	10.0133
8	34.8285	25.7945	25.9261	26.7987	25.6885
9	59.9837	50.3361	49.3582	50.6691	49.3829
10	52.1553	35.6674	31.7437	36.4626	31.8767
11	19.3067	16.4838	15.9379	18.1553	15.8427
12	20.9636	13.1604	12.4062	17.4378	12.0814
13	29.6557	18.3035	13.5003	19.7644	13.7533
14	30.7379	23.4217	22.1053	24.3145	21.9724
15	30.2729	21.2693	19.4779	21.7067	19.2593
16	35.1580	18.7188	18.3661	20.5776	17.8573
17	14.1426	9.8509	10.0159	14.3878	9.8401
Avg	28.7764	20.4730	19.0643	22.3968	18.8983

Table 12: Superresolution: mean absolute ($1000 \cdot \ell_1$) error for the dataset considered here, and the network trained on different cost functions. In bold, the best result for each image.

Image	Bilinear	ℓ_2	ℓ_2	1 - MS-SSIM	Mix
1	0.7461	0.8177	0.8197	0.8223	0.8214
2	0.9171	0.9503	0.9558	0.9510	0.9564
3	0.8359	0.9171	0.9441	0.9190	0.9463
4	0.8651	0.8980	0.8998	0.8987	0.8998
5	0.9252	0.9683	0.9704	0.9691	0.9730
6	0.9370	0.9658	0.9666	0.9667	0.9668
7	0.9654	0.9859	0.9880	0.9854	0.9882
8	0.6542	0.8273	0.8192	0.8281	0.8239
9	0.8003	0.8938	0.8965	0.8956	0.8978
10	0.7341	0.8758	0.8944	0.8806	0.8937
11	0.9547	0.9710	0.9718	0.9712	0.9723
12	0.9039	0.9519	0.9550	0.9518	0.9570
13	0.9421	0.9759	0.9834	0.9759	0.9827
14	0.9051	0.9544	0.9607	0.9565	0.9611
15	0.8154	0.8960	0.9064	0.9035	0.9085
16	0.8177	0.9347	0.9346	0.9357	0.9374
17	0.9559	0.9815	0.9818	0.9817	0.9823
Avg	0.8632	0.9274	0.9322	0.9290	0.9334

Table 13: Superresolution: SSIM for the dataset considered here, and the network trained on different cost functions. In bold, the best result for each image.

Image	Bilinear	ℓ_2	ℓ_2	1 - MS-SSIM	Mix
1	0.9632	0.9791	0.9793	0.9794	0.9796
2	0.9862	0.9937	0.9946	0.9933	0.9946
3	0.9677	0.9900	0.9938	0.9897	0.9941
4	0.9407	0.9594	0.9600	0.9596	0.9601
5	0.9841	0.9955	0.9960	0.9954	0.9963
6	0.9684	0.9826	0.9831	0.9830	0.9831
7	0.9834	0.9934	0.9942	0.9930	0.9944
8	0.9001	0.9506	0.9492	0.9507	0.9501
9	0.9014	0.9490	0.9503	0.9499	0.9508
10	0.9418	0.9800	0.9832	0.9802	0.9830
11	0.9752	0.9831	0.9836	0.9833	0.9838
12	0.9807	0.9935	0.9942	0.9931	0.9944
13	0.9741	0.9903	0.9929	0.9900	0.9928
14	0.9554	0.9796	0.9812	0.9796	0.9814
15	0.9627	0.9857	0.9870	0.9863	0.9874
16	0.9598	0.9902	0.9901	0.9899	0.9905
17	0.9797	0.9920	0.9918	0.9918	0.9921
Avg	0.9603	0.9816	0.9826	0.9817	0.9829

Table 14: Superresolution: MS-SSIM for the dataset considered here, and the network trained on different cost functions. In bold, the best result for each image.

Image	Bilinear	ℓ_2	ℓ_2	1 - MS-SSIM	Mix
1	0.9530	0.9810	0.9815	0.9812	0.9817
2	0.9711	0.9934	0.9945	0.9927	0.9945
3	0.9543	0.9914	0.9946	0.9907	0.9948
4	0.9417	0.9761	0.9767	0.9762	0.9765
5	0.9727	0.9950	0.9956	0.9949	0.9959
6	0.9630	0.9872	0.9879	0.9873	0.9878
7	0.9704	0.9937	0.9948	0.9931	0.9949
8	0.9245	0.9799	0.9791	0.9796	0.9797
9	0.9117	0.9685	0.9699	0.9690	0.9701
10	0.9341	0.9856	0.9880	0.9855	0.9879
11	0.9673	0.9849	0.9860	0.9851	0.9860
12	0.9660	0.9928	0.9936	0.9922	0.9938
13	0.9486	0.9892	0.9918	0.9886	0.9921
14	0.9477	0.9845	0.9857	0.9842	0.9859
15	0.9519	0.9879	0.9895	0.9884	0.9898
16	0.9550	0.9924	0.9926	0.9920	0.9930
17	0.9716	0.9927	0.9925	0.9922	0.9927
Avg	0.9532	0.9868	0.9879	0.9866	0.9881

Table 15: Superresolution: IW-SSIM for the dataset considered here, and the network trained on different cost functions. In bold, the best result for each image.

Image	Bilinear	ℓ_2	ℓ_2	1 - MS-SSIM	Mix
1	0.0402	0.0145	0.0140	0.0147	0.0140
2	0.0440	0.0109	0.0079	0.0119	0.0083
3	0.0990	0.0307	0.0176	0.0339	0.0173
4	0.0843	0.0564	0.0562	0.0557	0.0563
5	0.0454	0.0110	0.0080	0.0124	0.0074
6	0.0505	0.0162	0.0157	0.0165	0.0160
7	0.0590	0.0186	0.0125	0.0199	0.0123
8	0.1010	0.0587	0.0583	0.0594	0.0574
9	0.0980	0.0607	0.0599	0.0605	0.0602
10	0.0953	0.0393	0.0354	0.0410	0.0355
11	0.0453	0.0166	0.0139	0.0175	0.0137
12	0.0584	0.0192	0.0154	0.0222	0.0149
13	0.1368	0.0668	0.0479	0.0782	0.0445
14	0.0721	0.0306	0.0267	0.0331	0.0265
15	0.0681	0.0246	0.0228	0.0253	0.0220
16	0.0755	0.0205	0.0183	0.0240	0.0171
17	0.0402	0.0111	0.0104	0.0111	0.0105
Avg	0.0714	0.0298	0.0259	0.0316	0.0255

Table 16: Superresolution: GMSD for the dataset considered here, and the network trained on different cost functions. In bold, the best result for each image.

Image	Bilinear	ℓ_2	ℓ_2	1 - MS-SSIM	Mix
1	0.8876	0.9492	0.9488	0.9507	0.9500
2	0.9265	0.9644	0.9733	0.9642	0.9731
3	0.8411	0.8995	0.9439	0.8993	0.9480
4	0.9469	0.9789	0.9791	0.9789	0.9794
5	0.9366	0.9772	0.9804	0.9774	0.9816
6	0.9702	0.9943	0.9947	0.9940	0.9945
7	0.9642	0.9928	0.9956	0.9922	0.9958
8	0.7596	0.8970	0.8932	0.8974	0.8961
9	0.9250	0.9732	0.9736	0.9729	0.9737
10	0.8152	0.9050	0.9285	0.9082	0.9284
11	0.9758	0.9941	0.9954	0.9936	0.9955
12	0.9151	0.9604	0.9665	0.9599	0.9670
13	0.9127	0.9717	0.9826	0.9678	0.9845
14	0.9485	0.9849	0.9878	0.9844	0.9880
15	0.8608	0.9348	0.9453	0.9359	0.9468
16	0.8564	0.9478	0.9556	0.9494	0.9582
17	0.9765	0.9954	0.9963	0.9958	0.9963
Avg	0.9070	0.9600	0.9671	0.9601	0.9680

Table 17: Superresolution: FSIM for the dataset considered here, and the network trained on different cost functions. In bold, the best result for each image.

Image	Bilinear	ℓ_2	ℓ_2	1 - MS-SSIM	Mix
1	0.8865	0.9480	0.9477	0.9495	0.9489
2	0.9263	0.9642	0.9731	0.9640	0.9730
3	0.8408	0.8993	0.9437	0.8992	0.9478
4	0.9468	0.9788	0.9790	0.9788	0.9793
5	0.9361	0.9770	0.9802	0.9772	0.9814
6	0.9700	0.9942	0.9946	0.9939	0.9944
7	0.9641	0.9927	0.9955	0.9922	0.9958
8	0.7595	0.8969	0.8930	0.8972	0.8959
9	0.9229	0.9715	0.9720	0.9713	0.9721
10	0.8137	0.9039	0.9277	0.9072	0.9276
11	0.9753	0.9939	0.9952	0.9934	0.9953
12	0.9151	0.9603	0.9664	0.9598	0.9670
13	0.9117	0.9712	0.9816	0.9674	0.9840
14	0.9485	0.9849	0.9878	0.9844	0.9880
15	0.8587	0.9334	0.9441	0.9346	0.9456
16	0.8562	0.9476	0.9554	0.9492	0.9580
17	0.9765	0.9954	0.9962	0.9957	0.9962
Avg	0.9064	0.9596	0.9667	0.9597	0.9677

Table 18: Superresolution: FSIM_C for the dataset considered here, and the network trained on different cost functions. In bold, the best result for each image.

3 Deblocking

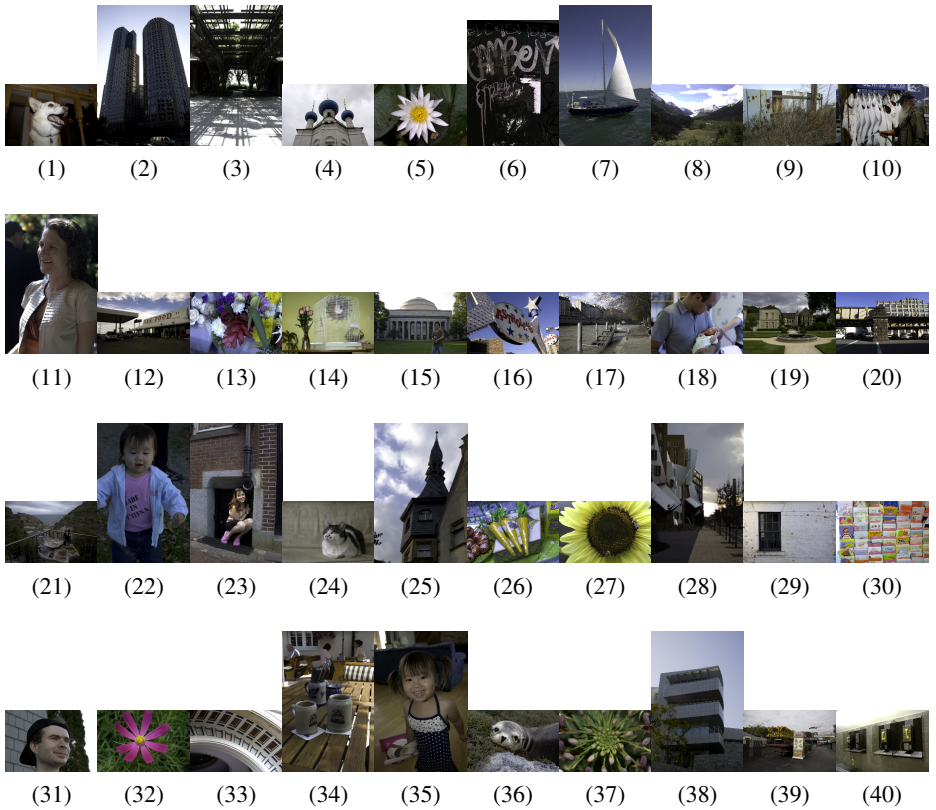


Fig. 3: Testing dataset for deblocking.

Image	Noisy	ℓ_2	ℓ_1	1 - MS-SSIM	Mix
1	0.2082	0.1848	0.1860	0.6667	0.1831
2	0.8250	0.8306	0.7977	2.1748	0.7350
3	1.0601	1.2051	0.9052	1.7554	0.8741
4	0.4175	0.4313	0.4238	3.0499	0.3921
5	0.5292	0.5292	0.5126	1.5013	0.4894
6	0.9472	0.9839	0.8056	1.1703	0.7625
7	0.3059	0.3005	0.3090	2.0351	0.2962
8	0.7395	0.7603	0.7270	2.6058	0.7023
9	1.8153	1.8459	1.6608	3.1704	1.5641
10	0.5966	0.5460	0.5287	1.6757	0.4888
11	0.3415	0.3418	0.3040	0.8597	0.2912
12	0.3806	0.3774	0.3351	1.6762	0.3046
13	0.6541	0.6328	0.6731	3.2637	0.5824
14	0.7217	0.7049	0.7363	2.5978	0.7046
15	0.6376	0.5997	0.5452	1.2551	0.5480
16	0.9536	0.9362	0.8622	3.3410	0.7685
17	1.5258	1.8068	1.4213	2.4486	1.3160
18	0.4029	0.3678	0.4168	2.2142	0.3787
19	0.6995	0.7047	0.6348	1.4687	0.6076
20	1.0434	1.1013	0.8451	2.7245	0.7728
21	0.3951	0.3476	0.3575	1.0718	0.3297
22	0.2653	0.2320	0.2377	1.6195	0.2223
23	0.7250	0.6735	0.6504	1.3056	0.6254
24	0.1761	0.1549	0.1401	0.9302	0.1365
25	0.3215	0.3150	0.3505	2.3008	0.3048
26	1.1029	1.1425	1.1300	3.3609	0.9478
27	0.6505	0.5707	0.5688	2.1358	0.5325
28	0.3587	0.3279	0.3016	1.1348	0.2960
29	0.5992	0.5795	0.6220	2.6602	0.5991
30	1.8241	2.1320	1.9754	4.5025	1.7192
31	0.1884	0.1721	0.1774	0.7983	0.1889
32	0.4276	0.4599	0.4562	2.8519	0.3868
33	0.5571	0.5230	0.4499	1.5139	0.3953
34	0.4339	0.3806	0.3246	0.8791	0.2946
35	0.2458	0.2057	0.1825	0.5212	0.1743
36	0.6466	0.5792	0.5720	1.3929	0.5593
37	0.4088	0.3464	0.3516	1.0342	0.3360
38	0.4220	0.3935	0.4582	2.2273	0.3947
39	0.7434	0.7918	0.6821	1.9698	0.6369
40	0.5533	0.5261	0.4883	1.1828	0.4783
Avg	0.6463	0.6511	0.6027	1.9262	0.5580

Table 19: Deblocking: mean squared error ($1000 \cdot \ell_2$) for the dataset considered here, and the network trained on different cost functions. In bold, the best result for each image.

Image	Noisy	ℓ_2	ℓ_1	1 - MS-SSIM	Mix
1	36.82	37.33	37.31	31.76	37.37
2	30.84	30.81	30.98	26.63	31.34
3	29.75	29.19	30.43	27.56	30.58
4	33.79	33.65	33.73	25.16	34.07
5	32.76	32.76	32.90	28.24	33.10
6	30.24	30.07	30.94	29.32	31.18
7	35.14	35.22	35.10	26.91	35.28
8	31.31	31.19	31.38	25.84	31.53
9	27.41	27.34	27.80	24.99	28.06
10	32.24	32.63	32.77	27.76	33.11
11	34.67	34.66	35.17	30.66	35.36
12	34.19	34.23	34.75	27.76	35.16
13	31.84	31.99	31.72	24.86	32.35
14	31.42	31.52	31.33	25.85	31.52
15	31.95	32.22	32.63	29.01	32.61
16	30.21	30.29	30.64	24.76	31.14
17	28.16	27.43	28.47	26.11	28.81
18	33.95	34.34	33.80	26.55	34.22
19	31.55	31.52	31.97	28.33	32.16
20	29.82	29.58	30.73	25.65	31.12
21	34.03	34.59	34.47	29.70	34.82
22	35.76	36.34	36.24	27.91	36.53
23	31.40	31.72	31.87	28.84	32.04
24	37.54	38.10	38.53	30.31	38.65
25	34.93	35.02	34.55	26.38	35.16
26	29.57	29.42	29.47	24.74	30.23
27	31.87	32.44	32.45	26.70	32.74
28	34.45	34.84	35.21	29.45	35.29
29	32.22	32.37	32.06	25.75	32.22
30	27.39	26.71	27.04	23.47	27.65
31	37.25	37.64	37.51	30.98	37.24
32	33.69	33.37	33.41	25.45	34.13
33	32.54	32.81	33.47	28.20	34.03
34	33.63	34.19	34.89	30.56	35.31
35	36.09	36.87	37.39	32.83	37.59
36	31.89	32.37	32.43	28.56	32.52
37	33.89	34.60	34.54	29.85	34.74
38	33.75	34.05	33.39	26.52	34.04
39	31.29	31.01	31.66	27.06	31.96
40	32.57	32.79	33.11	29.27	33.20
Avg	32.60	32.73	32.96	27.66	33.25

Table 20: Deblocking: PSNR for the dataset considered here, and the network trained on different cost functions. In bold, the best result for each image.

Image	Noisy	ℓ_2	ℓ_1	1 - MS-SSIM	Mix
1	9.9888	9.8089	9.4108	18.7414	9.3056
2	18.5025	18.9121	19.5689	35.5590	18.5888
3	19.3603	19.6679	17.3204	27.5528	17.4169
4	12.2413	12.6192	14.6030	50.0543	13.6096
5	15.8541	15.7226	15.4413	30.4850	15.1691
6	20.3233	19.8514	18.1133	23.1755	17.7020
7	11.4903	11.4966	12.0332	39.1404	11.5812
8	16.6074	17.1459	17.7436	36.2191	17.7536
9	31.3576	31.2121	30.2907	44.6430	29.6791
10	17.3898	16.6201	16.3837	32.8911	15.8922
11	11.9467	11.6885	11.0456	21.3038	10.8361
12	13.0453	12.8893	12.5545	31.3322	11.9430
13	17.1613	16.7166	17.6294	46.3313	16.4976
14	17.9127	17.3051	17.7071	43.1960	17.5859
15	16.0331	15.8311	15.3686	26.8060	15.7783
16	20.6987	20.1516	19.8097	46.4293	18.6381
17	26.6661	27.4896	25.2856	37.5548	24.4307
18	14.4928	13.8484	15.1730	39.1883	14.4325
19	18.6134	18.3576	17.6128	30.9389	17.3381
20	19.7271	19.6712	18.1362	37.2320	17.2340
21	14.5546	13.6851	13.9956	25.8259	13.3425
22	12.0482	11.2506	11.3227	29.4751	11.0070
23	19.7780	18.8635	18.4005	27.5439	18.0180
24	10.2336	9.5065	8.7082	26.1721	8.4859
25	12.1710	12.1538	13.7176	40.4659	12.5646
26	21.9851	21.7934	21.9068	46.4587	20.3431
27	17.8791	16.8871	16.8010	36.6599	16.3115
28	12.9369	12.4881	12.2152	27.0475	12.0559
29	17.9018	17.6472	18.2764	45.0135	18.0005
30	27.5088	29.8056	28.6927	55.1499	27.0819
31	9.1794	9.1611	9.2393	21.8532	9.8705
32	13.9275	14.3368	14.0087	38.3824	12.8969
33	15.8241	15.4567	14.5801	30.5722	13.8823
34	14.7877	13.6515	12.4763	22.9982	11.9556
35	11.4688	10.5918	9.6685	18.3358	9.3856
36	18.6486	17.5128	17.4689	29.0281	17.3286
37	14.2164	13.0353	12.6925	24.7527	12.5257
38	13.3394	12.9271	15.2979	39.6241	13.7186
39	17.0213	17.2967	16.8841	35.0856	16.4679
40	15.6923	15.4745	15.1632	25.3169	15.3024
Avg	16.5129	16.2633	16.0687	33.6134	15.5489

Table 21: Deblocking: mean absolute ($1000 \cdot \ell_1$) error for the dataset considered here, and the network trained on different cost functions. In bold, the best result for each image.

Image	Noisy	ℓ_2	ℓ_1	1 - MS-SSIM	Mix
1	0.9414	0.9358	0.9508	0.9081	0.9543
2	0.9305	0.9289	0.9322	0.9103	0.9368
3	0.9589	0.9609	0.9657	0.9546	0.9665
4	0.9682	0.9679	0.9723	0.9689	0.9753
5	0.9162	0.9127	0.9186	0.8987	0.9212
6	0.9381	0.9386	0.9411	0.9240	0.9432
7	0.9544	0.9547	0.9582	0.9485	0.9610
8	0.9306	0.9328	0.9385	0.9230	0.9417
9	0.9207	0.9227	0.9267	0.9222	0.9297
10	0.9511	0.9530	0.9544	0.9467	0.9573
11	0.9595	0.9615	0.9665	0.9570	0.9689
12	0.9584	0.9579	0.9660	0.9513	0.9684
13	0.9390	0.9414	0.9418	0.9257	0.9467
14	0.9403	0.9392	0.9418	0.9344	0.9462
15	0.9469	0.9494	0.9527	0.9479	0.9545
16	0.9326	0.9383	0.9431	0.9337	0.9482
17	0.9411	0.9399	0.9425	0.9393	0.9456
18	0.9273	0.9320	0.9354	0.9316	0.9399
19	0.9301	0.9309	0.9363	0.9257	0.9400
20	0.9636	0.9661	0.9715	0.9629	0.9739
21	0.9343	0.9359	0.9365	0.9309	0.9400
22	0.9399	0.9467	0.9507	0.9325	0.9523
23	0.9219	0.9257	0.9240	0.9181	0.9276
24	0.9620	0.9628	0.9688	0.9676	0.9708
25	0.9549	0.9572	0.9637	0.9557	0.9674
26	0.9150	0.9190	0.9216	0.9130	0.9275
27	0.9159	0.9257	0.9300	0.9183	0.9335
28	0.9559	0.9590	0.9643	0.9592	0.9658
29	0.9201	0.9217	0.9158	0.9048	0.9207
30	0.9036	0.8939	0.9018	0.8892	0.9138
31	0.9617	0.9630	0.9671	0.9550	0.9690
32	0.9335	0.9372	0.9412	0.9174	0.9462
33	0.9598	0.9623	0.9662	0.9584	0.9701
34	0.9468	0.9527	0.9606	0.9563	0.9635
35	0.9537	0.9577	0.9644	0.9503	0.9667
36	0.9410	0.9435	0.9419	0.9386	0.9440
37	0.9474	0.9522	0.9574	0.9476	0.9600
38	0.9432	0.9451	0.9477	0.9437	0.9510
39	0.9448	0.9455	0.9509	0.9480	0.9539
40	0.9337	0.9371	0.9391	0.9351	0.9421
Avg	0.9410	0.9427	0.9467	0.9364	0.9501

Table 22: Deblocking: SSISM for the dataset considered here, and the network trained on different cost functions. In bold, the best result for each image.

Image	Noisy	ℓ_2	ℓ_1	1 - MS-SSIM	Mix
1	0.9749	0.9779	0.9799	0.9778	0.9808
2	0.9588	0.9600	0.9627	0.9611	0.9650
3	0.9788	0.9802	0.9830	0.9794	0.9836
4	0.9815	0.9817	0.9845	0.9817	0.9863
5	0.9564	0.9587	0.9590	0.9578	0.9603
6	0.9708	0.9714	0.9730	0.9713	0.9740
7	0.9710	0.9723	0.9748	0.9734	0.9769
8	0.9584	0.9605	0.9635	0.9441	0.9666
9	0.9547	0.9565	0.9592	0.9563	0.9611
10	0.9754	0.9773	0.9776	0.9761	0.9791
11	0.9751	0.9772	0.9805	0.9797	0.9821
12	0.9765	0.9785	0.9818	0.9793	0.9834
13	0.9668	0.9683	0.9687	0.9583	0.9713
14	0.9631	0.9635	0.9643	0.9591	0.9665
15	0.9698	0.9720	0.9742	0.9721	0.9754
16	0.9635	0.9664	0.9702	0.9654	0.9732
17	0.9670	0.9669	0.9688	0.9674	0.9705
18	0.9589	0.9627	0.9655	0.9625	0.9683
19	0.9656	0.9680	0.9693	0.9692	0.9710
20	0.9802	0.9819	0.9852	0.9828	0.9866
21	0.9655	0.9675	0.9675	0.9681	0.9693
22	0.9671	0.9711	0.9733	0.9684	0.9743
23	0.9582	0.9609	0.9614	0.9598	0.9633
24	0.9743	0.9760	0.9797	0.9809	0.9814
25	0.9740	0.9760	0.9803	0.9764	0.9825
26	0.9549	0.9571	0.9588	0.9527	0.9622
27	0.9500	0.9572	0.9599	0.9521	0.9620
28	0.9734	0.9758	0.9796	0.9785	0.9809
29	0.9526	0.9554	0.9546	0.9499	0.9568
30	0.9510	0.9449	0.9486	0.9273	0.9555
31	0.9787	0.9806	0.9826	0.9819	0.9839
32	0.9636	0.9652	0.9673	0.9424	0.9706
33	0.9782	0.9804	0.9828	0.9793	0.9849
34	0.9691	0.9734	0.9782	0.9757	0.9801
35	0.9729	0.9765	0.9804	0.9789	0.9821
36	0.9663	0.9683	0.9675	0.9660	0.9685
37	0.9731	0.9779	0.9786	0.9775	0.9802
38	0.9667	0.9684	0.9706	0.9704	0.9727
39	0.9674	0.9686	0.9720	0.9722	0.9739
40	0.9640	0.9663	0.9682	0.9644	0.9704
Avg	0.9672	0.9692	0.9714	0.9674	0.9734

Table 23: Deblocking: MSSSIM for the dataset considered here, and the network trained on different cost functions. In bold, the best result for each image.

Image	Noisy	ℓ_2	ℓ_1	1 - MS-SSIM	Mix
1	0.9484	0.9563	0.9587	0.9575	0.9611
2	0.9451	0.9468	0.9500	0.9478	0.9525
3	0.9766	0.9777	0.9812	0.9770	0.9820
4	0.9664	0.9674	0.9714	0.9659	0.9748
5	0.9406	0.9445	0.9443	0.9441	0.9471
6	0.9712	0.9714	0.9737	0.9716	0.9750
7	0.9392	0.9428	0.9459	0.9441	0.9497
8	0.9347	0.9382	0.9413	0.9168	0.9471
9	0.9568	0.9572	0.9605	0.9575	0.9626
10	0.9702	0.9727	0.9732	0.9718	0.9754
11	0.9543	0.9599	0.9650	0.9650	0.9683
12	0.9622	0.9666	0.9715	0.9695	0.9748
13	0.9489	0.9512	0.9513	0.9405	0.9562
14	0.9464	0.9482	0.9490	0.9424	0.9522
15	0.9590	0.9620	0.9651	0.9625	0.9671
16	0.9558	0.9592	0.9642	0.9585	0.9690
17	0.9675	0.9669	0.9694	0.9679	0.9712
18	0.9313	0.9397	0.9463	0.9457	0.9519
19	0.9596	0.9630	0.9645	0.9647	0.9670
20	0.9746	0.9762	0.9809	0.9776	0.9826
21	0.9563	0.9593	0.9587	0.9602	0.9614
22	0.9481	0.9557	0.9591	0.9540	0.9610
23	0.9539	0.9570	0.9578	0.9563	0.9601
24	0.9459	0.9515	0.9571	0.9600	0.9606
25	0.9539	0.9590	0.9659	0.9608	0.9698
26	0.9389	0.9418	0.9442	0.9385	0.9511
27	0.9317	0.9414	0.9430	0.9344	0.9461
28	0.9566	0.9615	0.9671	0.9661	0.9696
29	0.9457	0.9496	0.9503	0.9448	0.9527
30	0.9377	0.9263	0.9299	0.9125	0.9405
31	0.9561	0.9618	0.9649	0.9656	0.9678
32	0.9366	0.9374	0.9389	0.9090	0.9462
33	0.9723	0.9756	0.9785	0.9744	0.9812
34	0.9587	0.9651	0.9709	0.9683	0.9738
35	0.9539	0.9614	0.9671	0.9660	0.9700
36	0.9574	0.9602	0.9593	0.9578	0.9607
37	0.9556	0.9641	0.9637	0.9647	0.9666
38	0.9401	0.9442	0.9464	0.9467	0.9499
39	0.9499	0.9520	0.9565	0.9575	0.9599
40	0.9508	0.9549	0.9580	0.9536	0.9618
Avg	0.9527	0.9562	0.9591	0.9550	0.9625

Table 24: Deblocking: IW-SSIM for the dataset considered here, and the network trained on different cost functions. In bold, the best result for each image.

Image	Noisy	ℓ_2	ℓ_1	1 - MS-SSIM	Mix
1	0.0339	0.0276	0.0278	0.0288	0.0282
2	0.0540	0.0531	0.0500	0.0523	0.0499
3	0.0407	0.0375	0.0324	0.0489	0.0318
4	0.0318	0.0297	0.0269	0.0305	0.0256
5	0.0490	0.0465	0.0466	0.0489	0.0473
6	0.0370	0.0353	0.0350	0.0397	0.0349
7	0.0432	0.0405	0.0401	0.0418	0.0400
8	0.0532	0.0504	0.0483	0.0773	0.0469
9	0.0575	0.0539	0.0520	0.0573	0.0528
10	0.0411	0.0364	0.0378	0.0412	0.0362
11	0.0330	0.0284	0.0256	0.0346	0.0248
12	0.0388	0.0355	0.0317	0.0420	0.0310
13	0.0586	0.0563	0.0566	0.0652	0.0549
14	0.0636	0.0620	0.0630	0.0677	0.0613
15	0.0470	0.0424	0.0391	0.0441	0.0395
16	0.0594	0.0504	0.0458	0.0504	0.0428
17	0.0439	0.0432	0.0420	0.0451	0.0415
18	0.0415	0.0348	0.0325	0.0350	0.0323
19	0.0432	0.0387	0.0393	0.0384	0.0379
20	0.0537	0.0480	0.0394	0.0460	0.0364
21	0.0390	0.0367	0.0399	0.0371	0.0383
22	0.0393	0.0336	0.0324	0.0351	0.0337
23	0.0488	0.0444	0.0450	0.0467	0.0441
24	0.0260	0.0230	0.0208	0.0213	0.0211
25	0.0334	0.0293	0.0259	0.0345	0.0251
26	0.0633	0.0595	0.0582	0.0607	0.0548
27	0.0584	0.0526	0.0496	0.0733	0.0490
28	0.0365	0.0302	0.0273	0.0320	0.0277
29	0.0449	0.0426	0.0479	0.0554	0.0475
30	0.1107	0.1089	0.1078	0.1090	0.0962
31	0.0294	0.0255	0.0237	0.0263	0.0238
32	0.0576	0.0549	0.0562	0.0623	0.0518
33	0.0442	0.0376	0.0346	0.0533	0.0332
34	0.0479	0.0405	0.0359	0.0427	0.0347
35	0.0348	0.0283	0.0254	0.0268	0.0251
36	0.0456	0.0432	0.0457	0.0458	0.0453
37	0.0419	0.0345	0.0349	0.0353	0.0344
38	0.0472	0.0441	0.0441	0.0445	0.0440
39	0.0498	0.0462	0.0438	0.0448	0.0428
40	0.0450	0.0413	0.0405	0.0491	0.0402
Avg	0.0467	0.0427	0.0413	0.0468	0.0402

Table 25: Deblocking: GMSD for the dataset considered here, and the network trained on different cost functions. In bold, the best result for each image.

Image	Noisy	ℓ_2	ℓ_1	1 - MS-SSIM	Mix
1	0.9820	0.9820	0.9837	0.9828	0.9836
2	0.9760	0.9755	0.9798	0.9791	0.9813
3	0.9826	0.9826	0.9863	0.9770	0.9865
4	0.9760	0.9756	0.9814	0.9792	0.9836
5	0.9787	0.9786	0.9791	0.9762	0.9791
6	0.9762	0.9770	0.9773	0.9730	0.9779
7	0.9709	0.9702	0.9735	0.9714	0.9742
8	0.9792	0.9794	0.9797	0.9610	0.9803
9	0.9792	0.9798	0.9812	0.9792	0.9823
10	0.9825	0.9829	0.9828	0.9801	0.9829
11	0.9813	0.9807	0.9839	0.9796	0.9841
12	0.9807	0.9800	0.9822	0.9755	0.9825
13	0.9843	0.9841	0.9845	0.9796	0.9847
14	0.9841	0.9844	0.9859	0.9824	0.9869
15	0.9811	0.9814	0.9829	0.9805	0.9830
16	0.9827	0.9828	0.9862	0.9817	0.9872
17	0.9805	0.9798	0.9819	0.9797	0.9823
18	0.9811	0.9810	0.9844	0.9838	0.9843
19	0.9781	0.9780	0.9781	0.9777	0.9783
20	0.9824	0.9811	0.9852	0.9808	0.9858
21	0.9786	0.9790	0.9797	0.9799	0.9803
22	0.9812	0.9809	0.9827	0.9811	0.9820
23	0.9786	0.9794	0.9794	0.9787	0.9800
24	0.9774	0.9759	0.9831	0.9839	0.9838
25	0.9805	0.9803	0.9839	0.9759	0.9844
26	0.9848	0.9841	0.9855	0.9812	0.9860
27	0.9829	0.9828	0.9833	0.9725	0.9843
28	0.9804	0.9807	0.9830	0.9808	0.9834
29	0.9762	0.9765	0.9757	0.9705	0.9756
30	0.9820	0.9803	0.9845	0.9746	0.9857
31	0.9832	0.9828	0.9857	0.9845	0.9857
32	0.9847	0.9835	0.9867	0.9851	0.9866
33	0.9801	0.9808	0.9837	0.9771	0.9852
34	0.9833	0.9834	0.9847	0.9802	0.9851
35	0.9823	0.9824	0.9859	0.9852	0.9863
36	0.9827	0.9833	0.9823	0.9811	0.9829
37	0.9854	0.9852	0.9875	0.9868	0.9876
38	0.9777	0.9778	0.9803	0.9797	0.9813
39	0.9780	0.9774	0.9797	0.9792	0.9797
40	0.9807	0.9807	0.9820	0.9762	0.9824
Avg	0.9805	0.9803	0.9825	0.9789	0.9830

Table 26: Deblocking: FSIM for the dataset considered here, and the network trained on different cost functions. In bold, the best result for each image.

Image	Noisy	ℓ_2	ℓ_1	1 - MS-SSIM	Mix
1	0.9814	0.9815	0.9830	0.9803	0.9830
2	0.9745	0.9739	0.9778	0.9661	0.9794
3	0.9810	0.9808	0.9843	0.9682	0.9842
4	0.9753	0.9748	0.9802	0.9627	0.9824
5	0.9775	0.9774	0.9775	0.9679	0.9777
6	0.9750	0.9759	0.9760	0.9680	0.9767
7	0.9699	0.9694	0.9725	0.9617	0.9733
8	0.9779	0.9781	0.9780	0.9478	0.9786
9	0.9767	0.9773	0.9782	0.9603	0.9795
10	0.9813	0.9817	0.9814	0.9724	0.9816
11	0.9804	0.9798	0.9828	0.9747	0.9831
12	0.9799	0.9793	0.9814	0.9675	0.9816
13	0.9825	0.9821	0.9823	0.9640	0.9828
14	0.9823	0.9825	0.9837	0.9755	0.9846
15	0.9798	0.9801	0.9815	0.9746	0.9815
16	0.9799	0.9802	0.9836	0.9717	0.9848
17	0.9793	0.9785	0.9806	0.9715	0.9810
18	0.9802	0.9802	0.9832	0.9708	0.9833
19	0.9771	0.9770	0.9770	0.9733	0.9772
20	0.9800	0.9790	0.9833	0.9748	0.9839
21	0.9779	0.9784	0.9788	0.9732	0.9796
22	0.9804	0.9802	0.9820	0.9754	0.9813
23	0.9770	0.9777	0.9776	0.9729	0.9784
24	0.9767	0.9754	0.9826	0.9818	0.9834
25	0.9799	0.9797	0.9828	0.9603	0.9834
26	0.9823	0.9812	0.9825	0.9685	0.9836
27	0.9817	0.9816	0.9823	0.9706	0.9834
28	0.9794	0.9797	0.9820	0.9758	0.9824
29	0.9749	0.9751	0.9741	0.9597	0.9741
30	0.9777	0.9747	0.9787	0.9549	0.9807
31	0.9825	0.9822	0.9849	0.9797	0.9848
32	0.9834	0.9816	0.9849	0.9776	0.9850
33	0.9783	0.9791	0.9817	0.9683	0.9832
34	0.9820	0.9823	0.9835	0.9761	0.9841
35	0.9815	0.9817	0.9852	0.9827	0.9856
36	0.9811	0.9818	0.9807	0.9744	0.9812
37	0.9845	0.9845	0.9867	0.9837	0.9868
38	0.9766	0.9768	0.9789	0.9664	0.9801
39	0.9765	0.9760	0.9781	0.9710	0.9781
40	0.9795	0.9796	0.9808	0.9733	0.9812
Avg	0.9791	0.9790	0.9809	0.9705	0.9815

Table 27: Deblocking: FSIM_C for the dataset considered here, and the network trained on different cost functions. In bold, the best result for each image.