

Leveraging Multispectral Sensors for Color Correction in Mobile Cameras

Supplementary Material

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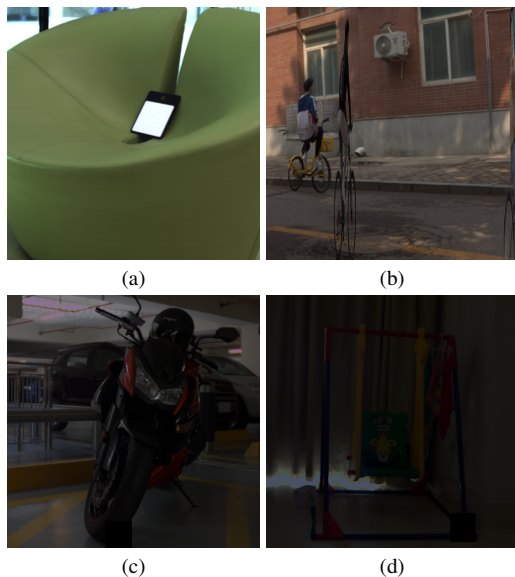


Figure 1. Examples of scenes that motivate the need for manual data preparation: (a) visible white reference patches, (b) geometric distortions during acquisition, (c) incorrect reflectance calibration, and (d) severe overexposure.

We provide additional material that complements our main submission. The supplementary document includes:

- Further details on the proposed dataset, including hyperspectral scenes, illuminants, camera sensors, and the applied geometric misalignments.
- Computational cost analysis of the proposed models.
- Qualitative results for the worst-case scenes.
- Per-camera quantitative results for both the aligned and misaligned versions of the dataset.
- Additional qualitative results for each camera.

A. Dataset Details

A.1. Hyperspectral Scenes

Our dataset is constructed from 1,144 hyperspectral reflectance scenes sourced from the KAUST [9] and BJTU-UVA [4] datasets. Both collections were acquired with a Specim IQ hyperspectral camera [12], which captures 512×512 spatial resolution data in the 400–1000 nm range with 3 nm spectral sampling. The KAUST dataset provides 400 scenes already resampled to the 400–700 nm range with

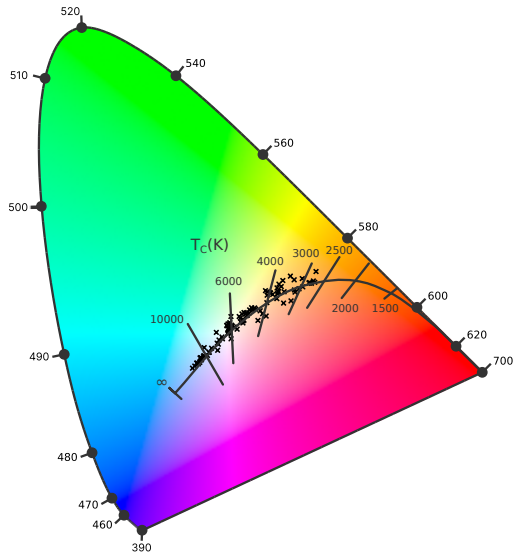


Figure 2. Distribution of the 102 considered illuminants from the dataset of Barnard et al. [2] in terms of CIE xy chromaticity.

10 nm intervals. The BJTU-UVA dataset instead preserves the original 3 nm sampling, which we resample to the same 400–700 nm and 10 nm intervals¹ for consistency.

Reflectance computation requires a white reference patch to be present in each scene. This reference must be removed from the final images to avoid introducing artificial cues to illuminant estimation methods. BJTU-UVA authors solve this by capturing two images per scene, one with and one without the reference, which allows a clean reflectance image to be obtained. Instead, KAUST authors perform a single capture and recommend cropping the central 256×256 region to remove the reference. This approach sometimes leaves the reference visible (see Figure 1a), and it also discards large portions of valid content. For this reason, we manually annotated and masked the location of the reference patch, thereby preserving the full scene content.

A number of scenes exhibit issues that prevent reliable rendering. These issues include geometric distortions caused by long exposures and scene motion, violations of the assumed global illuminant model that lead to incorrect calibration, and severe saturation or overexposure. All

¹All resampling operations are performed in accordance to CIE guidelines [11].

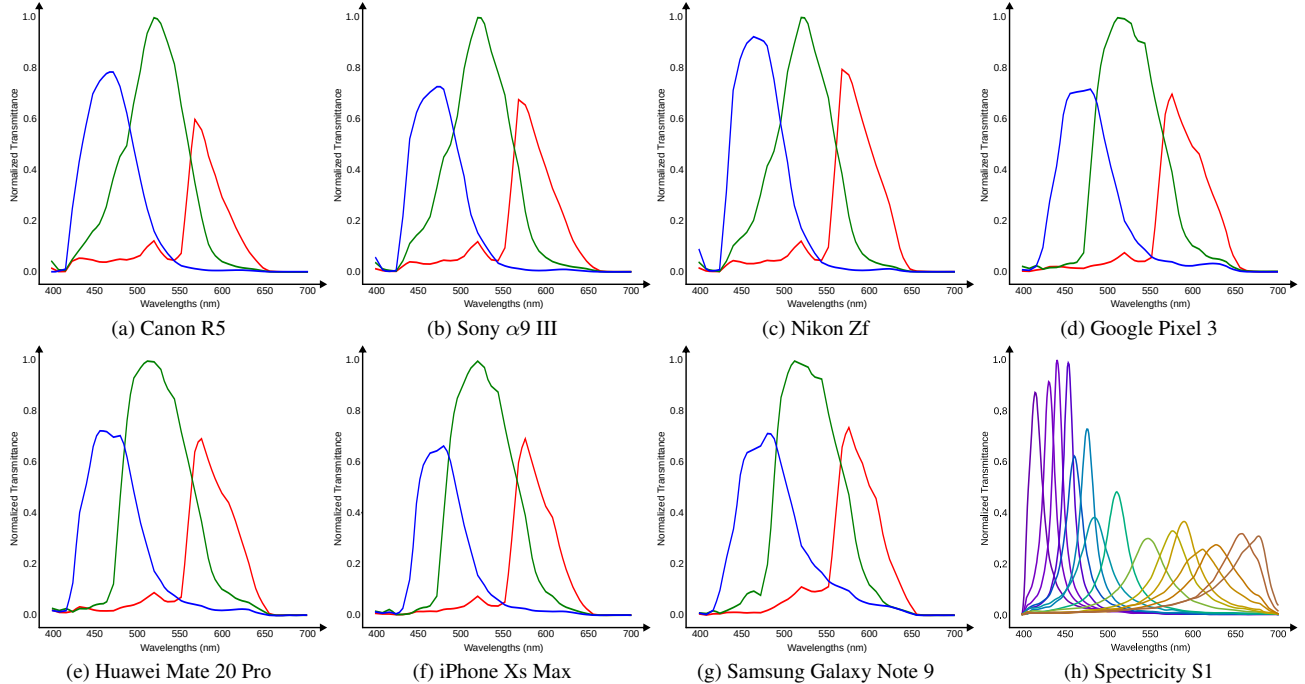


Figure 3. Spectral sensitivity functions for the RGB cameras (a–g) and the multispectral sensor (h) used in our dataset.

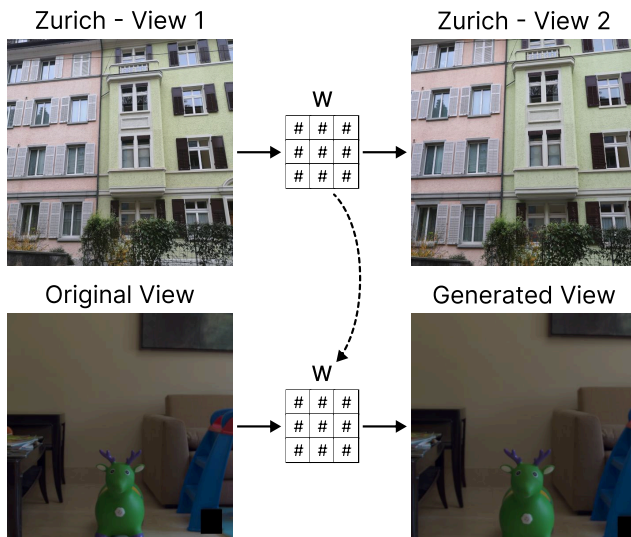


Figure 4. **Top:** Example image pair from the Zurich dataset [8]. A homography W is estimated to map View 1 onto View 2. **Bottom:** The same homography is applied to one of our scenes in order to simulate comparable misalignment. For illustration, the warped result is shown on an RGB rendering of the scene, although the transformation is applied to the multispectral images in the actual dataset.

problematic cases were manually removed. After this quality control stage, 1,144 high-quality reflectance scenes remain. Figures 1b to 1d present examples of discarded

scenes.

A.2. Illuminants Set

Each reflectance scene is re-illuminated using 102 spectral power distributions (SPDs) from the dataset of Barnard et al. [2]. The set includes 81 measured indoor and outdoor illuminants spanning diverse times of day and weather conditions. It also includes 21 additional SPDs corresponding to common artificial light sources such as tungsten bulbs, fluorescent lights, and daylight simulators. The SPDs are originally sampled from 380 to 780 nm with 4 nm spacing. For consistency with the reflectance data, all illuminants are resampled to the 400–700 nm range with 10 nm steps¹. Figure 2 illustrates how the illuminants are distributed in the CIE xy chromaticity diagram, covering temperatures from 2500°K to over 10000°K.

A.3. Camera Spectral Sensitivities

RGB and multispectral renderings are synthesized from the hyperspectral reflectance images using representative camera spectral sensitivity functions (SSFs) from both mobile and mirrorless devices. Specifically, RGB images are generated using the SSFs of four mobile cameras (Google Pixel 3, iPhone Xs Max, Huawei Mate 20 Pro, Samsung Galaxy Note 9), and three mirrorless cameras (Canon R5, Sony α 9 III, Nikon Zf). Multispectral images are rendered using the 15-band SSFs of the Spectricity S1 sensor [13]. All SSFs are resampled to the 400–700 nm and 10 nm steps¹

used by the reflectance data and illuminants. Figure 3 shows the spectral sensitivity profiles for both RGB and multispectral sensors.

A.4. Generation of Misaligned Data

To simulate realistic misregistration in dual-sensor imaging systems, we construct a misaligned version of the dataset. Misalignment parameters are obtained from the Zurich dataset [8], which includes 168 real image pairs captured simultaneously with a Huawei P20 and a Canon 5D Mark IV. For each pair, we estimate a homography using SIFT features [10] combined with RANSAC [5], obtaining a pool of realistic transformations. All homographies are manually verified to guarantee that no errors are made during the keypoints matching step.

For each scene in our dataset, we randomly sample one of the 168 homographies and apply it to the multispectral rendering. The resulting misalignments are moderate but introduce visible structural inconsistencies such as content lost near the image borders and shifted edges, thus mimicking realistic scenarios. These effects significantly increase the difficulty of the image-to-image mapping task. Figure 4 illustrates the process by showing an example Zurich pair and the corresponding misalignment applied to one of our scenes.

B. Computational Cost Report

We report in Table 1 the computational cost of the proposed models in terms of frames per second (FPS), GFLOPs, number of parameters, and memory requirements. Measurements were carried out on an NVIDIA RTX 3090 24GB GPU. The results, particularly GFLOPs, which are independent of the hardware, highlight the lightweight nature of the models and suggest that they could be deployed on mobile devices [1].

Table 1. Computational cost of our proposed methods in terms of FPS, GFLOPs, number of parameters, and memory requirements

Method	FPS \uparrow	GFLOPs \downarrow	Parameters \downarrow	Memory \downarrow
LPIENet	84	5.15	220K	0.02 GB
LPIENet-small	86	1.57	60K	0.08 GB
cmKAN-light	50	1.11	18K	0.56 GB

C. Worst-case scenes

In Figure 5, we present qualitative results from the worst-performing quartile of the test set, as measured by ΔE_{00} . We observe that the most challenging scenarios occur when semantic cues are insufficient to disentangle illuminant and reflectance. In these cases, although the models often produce plausible predictions, they can differ substantially from the ground-truth.

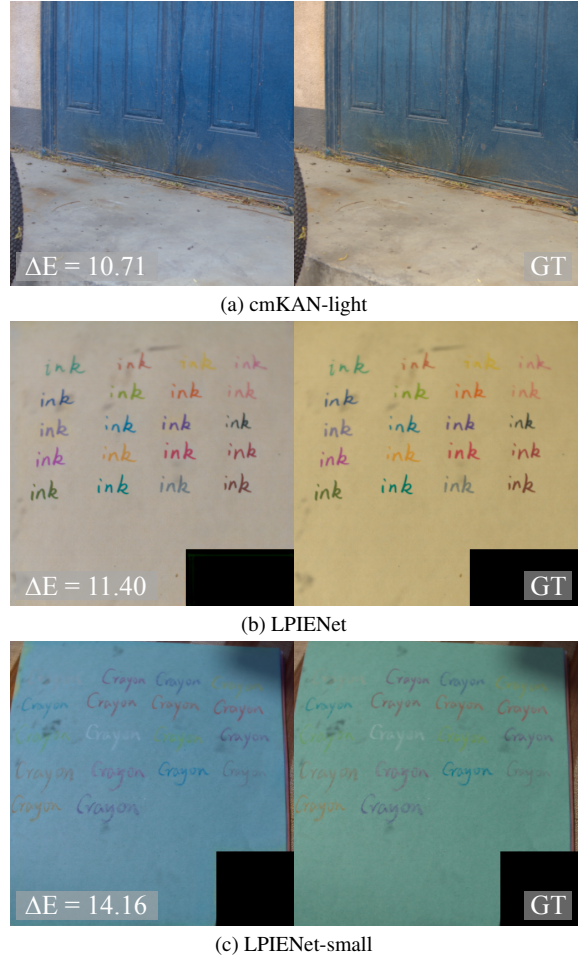


Figure 5. Examples of outputs from the proposed approaches, selected from the worst quartile.

D. Per-camera Results

Due to space constraints, the main submission reports results aggregated by camera type. Here, we provide full per-camera quantitative results for the aligned and misaligned versions of the dataset. The aligned per-camera results are reported in Tables 2 and 3. These results confirm the trends observed in the main manuscript: our proposed methods consistently achieve the best performance across all cameras.

We also report the corresponding per-camera results for the misaligned dataset in Tables 4 and 5. Although the additional geometric misalignment leads to a minor performance drop, our models remain clearly superior and retain a substantial margin over the baselines.

E. Additional Qualitative Results

We also include extended qualitative comparisons for each camera. Figure 6 presents results for the mirror-

Table 2. Results on the aligned version of the proposed dataset, for three mirrorless cameras (Canon R5, Nikon Zf, Sony α 9 III). We highlight **best**, **second best** and **third best** results for each metric.

Camera	Method	$\Delta E_{00} \downarrow$								Reproduction Error \downarrow							
		Mean	Med.	Tri.	B-25	W-25	95-P	99-P	Max	Mean	Med.	Tri.	B-25	W-25	95-P	99-P	Max
Canon R5	GW [14]	7.95	7.34	7.44	2.85	13.89	15.89	22.41	26.37	9.77	8.39	8.55	2.82	19.70	25.02	33.99	42.76
	WP [14]	5.12	4.25	4.59	1.83	9.81	11.14	14.68	23.61	6.11	4.60	5.03	1.42	13.20	16.03	20.39	39.05
	GGW [14]	6.21	5.61	5.72	1.99	11.80	14.42	19.65	24.03	7.64	5.96	6.08	1.78	16.45	21.73	30.66	40.79
	SoG [14]	6.01	5.39	5.51	2.00	11.32	13.89	17.49	22.08	7.36	5.80	5.89	1.68	15.91	20.55	27.43	40.78
	GE1 [14]	5.61	4.83	4.96	1.88	10.81	13.07	19.28	24.35	6.68	4.85	5.22	1.47	14.87	19.08	23.94	40.24
	GE2 [14]	5.55	5.01	5.06	1.98	10.21	12.25	15.26	23.68	6.61	5.05	5.45	1.48	14.36	18.02	22.41	40.91
	SqueezeNet-FC ⁴ [7]	3.18	2.75	2.86	1.39	5.70	6.64	9.32	21.32	4.40	2.84	3.20	0.92	10.52	14.13	18.39	37.76
	ConvMean [6]	3.43	2.86	2.97	1.39	6.46	7.63	12.07	18.77	4.68	2.98	3.38	0.97	11.31	14.24	20.66	40.27
	QU [3]	6.50	5.86	5.94	2.28	12.01	14.36	19.16	26.98	8.24	6.11	6.56	2.03	18.06	22.71	30.29	41.77
	QU+ft [3]	5.50	4.88	4.98	1.95	10.29	12.57	16.20	23.64	6.99	5.41	5.66	1.73	14.93	18.94	27.28	40.04
	SpectralFC ⁴ [7]	3.16	2.72	2.80	1.35	5.73	6.71	10.09	18.08	4.32	2.71	3.09	0.85	10.58	13.29	18.83	36.93
	SpectralConvMean [6]	3.09	2.75	2.75	1.32	5.62	6.41	10.16	23.71	4.12	2.71	3.03	0.86	9.79	12.13	18.40	41.31
	LPIENet (Ours)	1.98	1.77	1.81	1.13	3.17	3.58	5.12	16.85	3.42	1.68	2.15	0.76	9.05	11.60	17.53	39.79
	LPIENet-small (Ours)	1.49	1.32	1.35	0.83	2.47	2.81	4.32	19.91	3.04	1.43	1.85	0.60	8.25	10.00	16.33	36.71
	cmKAN-light (Ours)	1.51	1.22	1.27	0.64	2.90	3.47	5.57	22.56	2.87	1.17	1.65	0.38	8.21	10.27	16.84	38.43
Sony α 9 III	GW [14]	7.69	7.00	7.16	2.78	13.46	15.96	21.69	25.62	9.23	7.89	8.07	2.72	18.47	23.38	32.62	42.65
	WP [14]	5.07	4.21	4.56	1.94	9.53	11.09	14.58	22.58	5.86	4.42	4.85	1.45	12.52	15.42	21.22	39.06
	GGW [14]	6.07	5.34	5.53	2.10	11.37	13.11	19.54	23.33	7.15	5.87	5.95	1.82	15.01	18.81	28.45	40.83
	SoG [14]	5.89	5.23	5.36	2.13	10.94	12.97	17.93	22.72	6.91	5.65	5.72	1.74	14.56	18.29	25.49	40.82
	GE1 [14]	5.49	4.95	4.91	1.84	10.41	12.57	18.58	25.46	6.27	4.78	5.03	1.48	13.61	16.90	22.01	40.34
	GE2 [14]	5.47	5.07	5.02	2.01	9.89	12.15	14.65	26.02	6.23	4.97	5.22	1.52	13.28	15.77	22.56	40.99
	SqueezeNet-FC ⁴ [7]	3.38	2.95	3.06	1.49	5.97	6.74	10.60	17.19	4.37	2.66	3.10	0.92	10.77	13.71	18.61	38.19
	ConvMean [6]	3.84	3.22	3.35	1.53	7.25	8.69	12.73	21.76	4.77	3.03	3.51	1.01	11.42	14.07	18.94	39.96
	QU [3]	6.29	5.62	5.69	2.33	11.51	13.63	18.79	26.35	7.69	5.75	6.25	2.04	16.48	20.67	28.96	41.73
	QU+ft [3]	5.21	4.55	4.65	1.94	9.77	11.89	16.48	24.08	6.45	4.98	5.25	1.74	13.55	16.44	27.03	39.81
	SpectralFC ⁴ [7]	3.48	2.94	3.06	1.45	6.45	7.39	11.76	19.78	4.36	2.82	3.24	0.97	10.40	12.93	18.46	36.95
	SpectralConvMean [6]	3.26	2.76	2.88	1.36	5.99	6.83	11.11	28.17	4.35	2.69	3.09	0.88	10.63	13.66	18.98	40.90
	LPIENet (Ours)	1.70	1.50	1.55	0.98	2.73	3.11	4.29	13.25	3.17	1.42	1.91	0.64	8.70	10.60	18.14	37.28
	LPIENet-small (Ours)	1.98	1.78	1.82	1.20	3.13	3.55	5.22	23.08	3.42	1.80	2.25	0.85	8.81	10.95	17.00	38.82
	cmKAN-light (Ours)	1.57	1.27	1.33	0.70	2.99	3.51	5.79	20.47	2.88	1.19	1.68	0.41	8.19	10.27	16.46	37.42
Nikon Zf	GW [14]	7.75	7.10	7.24	2.80	13.54	15.90	21.58	26.45	9.26	7.92	8.10	2.71	18.55	23.28	32.59	42.66
	WP [14]	5.07	4.22	4.56	1.91	9.54	11.03	14.54	21.60	5.82	4.39	4.81	1.42	12.46	15.46	20.73	38.86
	GGW [14]	6.09	5.45	5.58	2.07	11.41	13.42	19.28	26.74	7.15	5.83	5.91	1.78	15.05	18.92	28.75	40.91
	SoG [14]	5.91	5.34	5.43	2.09	10.97	13.18	17.83	47.07	6.90	5.64	5.71	1.69	14.59	18.18	25.64	53.74
	GE1 [14]	5.48	4.94	4.91	1.81	10.42	12.53	18.50	24.88	6.24	4.74	4.99	1.45	13.61	16.97	21.86	40.44
	GE2 [14]	5.45	5.07	5.04	1.97	9.89	12.11	14.57	25.38	6.22	4.97	5.20	1.48	13.32	15.96	22.15	88.85
	SqueezeNet-FC ⁴ [7]	3.29	2.88	2.98	1.47	5.80	6.78	9.77	17.41	4.37	2.85	3.22	0.94	10.44	13.21	18.10	37.23
	ConvMean [6]	3.38	2.87	2.96	1.37	6.30	7.34	12.23	21.22	4.39	2.72	3.17	0.87	10.67	13.39	19.14	43.48
	QU [3]	6.32	5.70	5.73	2.31	11.59	13.71	18.58	26.21	7.71	5.79	6.27	2.00	16.57	20.87	29.03	41.74
	QU+ft [3]	5.18	4.53	4.64	1.95	9.61	11.26	17.17	25.53	6.34	4.98	5.14	1.71	13.49	17.16	26.82	39.46
	SpectralFC ⁴ [7]	3.13	2.72	2.78	1.26	5.75	6.61	10.15	23.40	4.24	2.67	3.08	0.82	10.38	12.80	18.93	36.87
	SpectralConvMean [6]	3.16	2.78	2.86	1.31	5.69	6.45	10.25	18.32	4.26	2.69	3.02	0.86	10.40	13.29	18.04	40.10
	LPIENet (Ours)	1.54	1.39	1.42	0.85	2.51	2.85	4.21	12.20	3.11	1.50	1.97	0.61	8.34	10.13	16.21	38.39
	LPIENet-small (Ours)	2.79	2.55	2.60	1.74	4.28	4.82	6.69	20.32	4.23	2.49	2.96	1.19	10.22	12.76	19.34	38.60
	cmKAN-light (Ours)	1.72	1.43	1.48	0.78	3.16	3.68	5.86	20.55	3.00	1.29	1.79	0.47	8.39	10.43	16.68	38.79

less devices (Canon R5, Nikon Zf, and Sony α 9 III), while Figure 7 reports results for the mobile devices (Google Pixel 3, iPhone Xs Max, Huawei Mate 20 Pro, and Samsung Galaxy Note 9). These visual examples support the quantitative findings reported in the tables and show that our methods provide consistently better color accuracy across all camera models.

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Table 3. Results on the aligned version of the proposed dataset, for four mobile cameras (Google Pixel 3, Huawei Mate 20 Pro, iPhone Xs Max, Samsung Galaxy Note). We highlight **best**, **second best** and **third best** results for each metric.

Camera	Method	$\Delta E_{00} \downarrow$								Reproduction Error \downarrow							
		Mean	Med.	Tri.	B-25	W-25	95-P	99-P	Max	Mean	Med.	Tri.	B-25	W-25	95-P	99-P	Max
Google Pixel 3	GW [14]	7.78	7.16	7.29	2.81	13.59	16.12	21.56	26.43	9.55	8.24	8.41	2.84	18.95	23.77	33.74	42.91
	WP [14]	5.05	4.18	4.49	1.94	9.49	10.91	14.90	18.92	6.11	4.68	5.03	1.54	12.96	15.64	20.29	40.10
	GGW [14]	6.19	5.52	5.67	2.09	11.57	13.56	18.89	24.83	7.60	6.03	6.16	1.90	15.97	20.75	29.46	41.77
	SoG [14]	6.01	5.37	5.52	2.11	11.14	13.40	17.40	23.14	7.34	5.97	6.01	1.80	15.50	19.44	27.41	41.76
	GE1 [14]	5.52	4.90	4.93	1.86	10.50	12.71	17.92	21.61	6.57	4.90	5.21	1.51	14.42	18.03	23.56	42.18
	GE2 [14]	5.47	4.96	5.00	2.00	9.94	12.32	14.90	22.24	6.49	4.99	5.29	1.50	13.88	16.72	22.15	42.38
	Squeezenet-FC ⁴ [7]	2.99	2.58	2.67	1.30	5.38	6.51	9.11	15.48	4.27	2.55	3.02	0.85	10.63	13.31	18.19	38.08
	ConvMean [6]	3.57	2.99	3.10	1.51	6.64	7.80	13.08	23.33	4.58	2.87	3.33	0.97	11.07	13.90	19.34	41.11
	QU [3]	6.42	5.85	5.92	2.31	11.76	14.41	19.42	21.72	8.15	6.33	6.70	2.05	17.38	21.74	30.37	42.11
	QU+ft [3]	5.57	4.93	5.02	2.08	10.24	11.58	17.76	21.10	7.17	5.78	5.99	1.99	14.80	18.88	28.95	40.62
	SpectralFC ⁴ [7]	3.19	2.72	2.79	1.31	5.92	6.65	11.50	22.64	4.37	2.74	3.12	0.88	10.61	13.32	19.03	36.71
	SpectralConvMean [6]	3.12	2.68	2.77	1.36	5.61	6.35	10.56	22.01	4.23	2.82	3.15	0.90	9.98	12.16	18.38	40.50
	LPIENet (Ours)	1.86	1.67	1.71	1.06	2.98	3.39	4.87	12.68	3.36	1.73	2.15	0.71	8.83	10.85	17.19	38.54
	LPIENet-small (Ours)	1.85	1.64	1.68	0.99	3.07	3.51	4.95	20.53	3.17	1.52	1.97	0.67	8.51	10.52	16.59	37.59
cmKAN-light (Ours)	1.29	1.02	1.06	0.55	2.53	3.03	5.29	21.83	2.67	0.95	1.46	0.33	7.92	9.93	16.02	37.09	
Huawei Mate 20 Pro	GW [14]	7.80	7.18	7.30	2.75	13.67	15.87	21.67	25.85	9.70	8.44	8.58	2.87	19.23	24.17	33.87	42.97
	WP [14]	5.03	4.18	4.48	1.81	9.58	10.97	14.90	19.84	6.18	4.76	5.12	1.52	13.17	15.70	20.41	40.04
	GGW [14]	6.18	5.54	5.65	1.98	11.64	13.79	19.41	24.26	7.71	6.11	6.19	1.86	16.27	21.16	30.17	41.49
	SoG [14]	5.99	5.38	5.49	2.00	11.20	13.55	17.80	22.62	7.44	6.05	6.06	1.77	15.80	20.57	27.47	41.49
	GE1 [14]	5.50	4.81	4.89	1.79	10.59	12.74	18.49	21.72	6.67	4.96	5.29	1.48	14.72	18.59	23.92	41.84
	GE2 [14]	5.46	4.88	4.97	1.92	10.05	12.25	15.01	22.12	6.59	5.07	5.39	1.46	14.18	17.49	22.37	42.05
	Squeezenet-FC ⁴ [7]	3.08	2.65	2.74	1.28	5.64	6.62	9.87	19.09	4.41	2.75	3.14	0.84	10.83	13.89	19.15	39.82
	ConvMean [6]	3.50	2.92	3.04	1.35	6.69	8.04	11.78	19.32	4.69	3.04	3.46	0.97	11.24	14.09	18.79	39.44
	QU [3]	6.44	5.85	5.94	2.22	11.86	14.47	19.53	22.07	8.29	6.42	6.79	2.04	17.74	22.23	30.47	42.10
	QU+ft [3]	5.36	4.78	4.82	1.82	10.14	12.22	17.28	20.55	7.05	5.65	5.85	1.66	14.85	19.02	29.15	40.53
	SpectralFC ⁴ [7]	2.95	2.52	2.61	1.29	5.38	6.33	9.95	18.80	4.20	2.57	2.97	0.83	10.29	13.31	17.76	37.72
	SpectralConvMean [6]	3.06	2.61	2.70	1.31	5.61	6.45	10.59	24.64	4.15	2.71	3.04	0.87	9.90	12.31	18.54	41.04
	LPIENet (Ours)	1.78	1.60	1.63	1.03	2.82	3.20	4.70	13.31	3.30	1.69	2.14	0.77	8.56	10.67	16.56	38.35
	LPIENet-small (Ours)	1.90	1.71	1.74	1.15	3.00	3.38	5.12	21.10	3.37	1.81	2.24	0.82	8.63	10.53	17.00	37.85
cmKAN-light (Ours)	1.48	1.19	1.25	0.64	2.81	3.29	5.72	21.10	2.80	1.12	1.60	0.38	8.10	10.13	16.18	39.00	
iPhone Xs Max	GW [14]	7.54	6.81	6.96	2.78	13.23	15.77	21.17	25.63	9.07	7.68	7.90	2.75	18.07	21.67	32.71	42.56
	WP [14]	4.95	4.11	4.42	2.05	9.17	10.88	14.63	18.76	5.97	4.48	4.86	1.57	12.74	15.32	21.72	39.66
	GGW [14]	6.00	5.23	5.45	2.17	11.18	12.95	19.16	23.82	7.18	5.81	5.95	1.94	14.97	18.38	27.74	41.02
	SoG [14]	5.83	5.08	5.30	2.19	10.77	12.87	17.17	21.97	6.96	5.57	5.71	1.86	14.55	18.08	26.04	41.02
	GE1 [14]	5.40	4.89	4.84	1.90	10.20	12.41	17.63	22.78	6.29	4.83	5.09	1.57	13.63	16.63	22.19	41.08
	GE2 [14]	5.34	4.94	4.90	2.04	9.63	12.30	14.74	24.00	6.22	4.88	5.20	1.60	13.21	15.28	22.14	41.35
	Squeezenet-FC ⁴ [7]	3.20	2.76	2.85	1.46	5.70	6.71	10.15	18.68	4.58	2.96	3.35	1.05	10.88	13.62	18.92	38.29
	ConvMean [6]	3.52	2.94	3.07	1.41	6.65	7.89	11.72	23.03	4.80	2.97	3.46	1.01	11.61	14.16	19.13	39.96
	QU [3]	6.20	5.58	5.61	2.34	11.35	14.08	19.03	22.08	7.65	5.90	6.37	2.08	16.23	20.29	29.04	41.80
	QU+ft [3]	5.10	4.49	4.59	1.98	9.38	10.92	16.85	20.32	6.52	4.99	5.25	1.81	13.65	16.25	26.86	40.68
	SpectralFC ⁴ [7]	3.40	2.97	3.06	1.46	6.09	7.11	10.09	20.37	4.47	2.74	3.25	1.01	10.75	13.61	19.89	37.31
	SpectralConvMean [6]	3.25	2.82	2.91	1.39	5.85	6.59	10.56	20.99	4.54	2.82	3.20	0.99	11.06	14.50	19.19	40.39
	LPIENet (Ours)	1.44	1.29	1.32	0.79	2.35	2.72	3.82	12.10	2.85	1.21	1.70	0.55	7.96	9.56	16.06	36.50
	LPIENet-small (Ours)	1.90	1.73	1.75	1.13	2.98	3.34	5.00	29.46	3.38	1.79	2.24	0.81	8.66	10.67	16.65	37.84
cmKAN-light (Ours)	1.62	1.33	1.38	0.75	2.99	3.52	5.78	19.95	2.99	1.27	1.76	0.49	8.40	10.67	16.82	37.38	
Samsung Galaxy Note 9	GW [14]	7.73	7.09	7.21	2.85	13.46	15.94	21.41	25.56	9.59	8.31	8.51	2.98	18.79	23.62	33.57	42.95
	WP [14]	5.14	4.33	4.61	2.01	9.59	11.09	14.91	17.48	6.40	5.11	5.37	1.73	13.22	16.06	20.89	40.66
	GGW [14]	6.22	5.57	5.68	2.14	11.52	13.44	18.64	23.95	7.80	6.42	6.55	2.07	16.11	20.69	29.79	41.88
	SoG [14]	6.04	5.44	5.55	2.16	11.12	13.32	17.25	22.27	7.57	6.15	6.27	2.00	15.69	19.70	27.90	41.87
	GE1 [14]	5.56	4.86	4.94	1.95	10.56	12.96	17.76	21.87	6.82	5.24	5.53	1.73	14.69	17.99	24.69	42.28
	GE2 [14]	5.49	4.87	4.99	2.06	10.00	12.53	14.99	20.77	6.70	5.23	5.55	1.67	14.06	16.98	22.50	42.46
	Squeezenet-FC ⁴ [7]	3.37	3.00	3.07	1.57	5.81	6.77	8.76	25.78	4.76	3.23	3.64	1.17	10.86	13.68	18.57	37.38
	ConvMean [6]	3.57	2.95	3.07	1.50	6.73	8.18	12.56	18.95	4.98	3.31	3.71	1.16	11.70	14.50	20.87	40.31
	QU [3]	6.44	5.92	6.02	2.38	11.64	14.19	19.16	21.88	8.30	6.70	6.99	2.18	17.33	21.31	30.81	42.29
	QU+ft [3]	5.60	4.98	5.06	1.99	10.39	12.77	17.42	21.53	7.39	5.79	6.08	1.93	15.51	19.95	29.37	40.91
	SpectralFC ⁴ [7]	3.24	2.87	2.93	1.50	5.65	6.62	9.62	17.40	4.50	2.99	3.34	1.12	10.44	13.28	19.53	39.06
	SpectralConvMean [6]	3.22	2.80	2.89	1.51	5.63	6.32	10.10	21.86	4.49	3.09	3.44	1.14	10.19	12.13	18.95	40.88
	LPIENet (Ours)	1.59	1.40	1.45	0.89	2.59	2.95	4.14	12.82	3.02	1.44	1.86	0.62	8.17	9.87	16.32	37.39
	LPIENet-small (Ours)	1.70	1.48	1.52	1.00	2.79	3.24	4.93	13.72	3.19	1.52	1.98	0.69	8.54	10.68	16.49	36.43
cmKAN-light (Ours)	1.51	1.23	1.28	0.68	2.84	3.35	5.64	20.24	2.87	1.18	1.64	0.41	8.18	10.27	16.37	36.77	

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Table 4. Results on the misaligned version of the proposed dataset, for three mirrorless cameras (Canon R5, Nikon Zf, Sony α 9 III). We highlight **best**, **second best** and **third best** results for each metric.

Camera	Method	$\Delta E_{00} \downarrow$								Reproduction Error \downarrow							
		Mean	Med.	Tri.	B-25	W-25	95-P	99-P	Max	Mean	Med.	Tri.	B-25	W-25	95-P	99-P	Max
Canon R5	SpectralFC ⁴ [7]	3.07	2.66	2.74	1.32	5.54	6.41	9.89	25.79	4.14	2.63	2.97	0.85	9.99	12.72	17.93	40.24
	SpectralConvMean [6]	3.09	2.68	2.76	1.33	5.57	6.44	9.64	21.12	4.08	2.66	2.98	0.86	9.72	12.31	18.06	41.13
	LPIENet (Ours)	1.97	1.77	1.81	1.14	3.15	3.65	4.9	15.22	3.51	1.87	2.33	0.84	9.06	11.02	17.03	39.71
	LPIENet-small (Ours)	1.91	1.72	1.75	1.05	3.1	3.56	5.06	16.09	3.51	1.91	2.36	0.82	8.97	10.96	17	40.18
	cmKAN-light (Ours)	1.81	1.47	1.54	0.79	3.43	4.08	6.29	22.03	3.17	1.50	1.94	0.49	8.67	10.86	16.86	41.73
Sony α 9 III	SpectralFC ⁴ [7]	3.39	2.91	3.01	1.38	6.23	7.21	11.05	21.76	4.46	2.78	3.22	0.95	10.71	13.92	18.99	39.84
	SpectralConvMean [6]	3.21	2.80	2.88	1.34	5.79	6.69	10.36	19.06	4.39	2.74	3.12	0.92	10.71	13.80	18.29	40.71
	LPIENet (Ours)	1.81	1.63	1.67	1.00	2.92	3.36	4.53	10.90	3.40	1.72	2.19	0.73	9.01	10.93	17.74	38.85
	LPIENet-small (Ours)	2.37	2.16	2.20	1.44	3.68	4.20	5.86	17.74	3.87	2.19	2.66	1.04	9.59	11.84	17.52	39.16
	cmKAN-light (Ours)	1.81	1.47	1.55	0.81	3.39	3.97	6.28	20.08	3.16	1.45	1.93	0.50	8.71	10.83	17.25	38.76
Nikon Zf	SpectralFC ⁴ [7]	3.28	2.81	2.90	1.37	6.01	7.12	10.46	21.95	4.41	2.79	3.19	0.90	10.70	13.94	18.92	38.63
	SpectralConvMean [6]	3.25	2.86	2.94	1.35	5.81	6.69	9.99	20.20	4.30	2.74	3.06	0.88	10.46	13.52	18.35	40.44
	LPIENet (Ours)	1.74	1.55	1.59	0.91	2.90	3.36	4.56	14.11	3.26	1.64	2.13	0.66	8.69	10.49	16.35	38.27
	LPIENet-small (Ours)	2.75	2.53	2.57	1.69	4.20	4.73	6.41	26.02	4.21	2.52	2.99	1.21	10.12	12.40	17.90	38.93
	cmKAN-light (Ours)	1.91	1.60	1.66	0.85	3.52	4.15	6.22	20.70	3.27	1.55	2.02	0.53	8.88	11.62	16.88	38.16

Table 5. Results on the misaligned version of the proposed dataset, for four mobile cameras (Google Pixel 3, Huawei Mate 20 Pro, iPhone Xs Max, Samsung Galaxy Note). We highlight **best**, **second best** and **third best** results for each metric.

Camera	Method	$\Delta E_{00} \downarrow$								Reproduction Error \downarrow							
		Mean	Med.	Tri.	B-25	W-25	95-P	99-P	Max	Mean	Med.	Tri.	B-25	W-25	95-P	99-P	Max
Google Pixel 3	SpectralFC ⁴ [7]	3.23	2.76	2.84	1.40	5.90	7.00	10.14	24.42	4.44	2.84	3.21	0.92	10.65	13.94	19.30	8.56
	SpectralConvMean [6]	3.06	2.63	2.72	1.33	5.53	6.42	10.07	19.98	4.13	2.68	3.00	0.88	9.88	12.42	18.11	40.76
	LPIENet (Ours)	1.91	1.73	1.76	1.12	3.03	3.48	4.80	14.25	3.43	1.79	2.27	0.84	8.87	11.04	17.08	38.64
	LPIENet-small (Ours)	2.21	1.98	2.02	1.26	3.57	4.13	5.84	1.81	3.71	2.05	2.51	0.95	9.29	1.54	7.26	38.04
	cmKAN-light (Ours)	1.64	1.31	1.37	0.70	3.16	3.81	6.18	23.65	3.02	1.32	1.80	0.43	8.48	10.60	16.82	37.51
Huawei Mate 20 Pro	SpectralFC ⁴ [7]	3.09	2.59	2.68	1.31	5.75	6.86	10.52	21.52	4.44	2.90	3.18	0.92	10.69	14.35	19.32	8.61
	SpectralConvMean [6]	3.00	2.56	2.66	1.29	5.47	6.31	9.87	26.44	4.19	2.79	3.09	0.88	9.93	12.63	18.21	40.55
	LPIENet (Ours)	1.89	1.71	1.74	1.08	3.02	3.45	4.82	13.38	3.46	1.86	2.32	0.81	8.87	10.75	16.86	39.40
	LPIENet-small (Ours)	2.28	2.07	2.11	1.31	3.60	4.12	5.82	18.32	3.76	2.13	2.58	0.98	9.35	1.34	7.62	38.20
	cmKAN-light (Ours)	1.68	1.35	1.41	0.74	3.21	3.78	6.14	1.22	3.07	1.31	1.79	0.45	8.62	11.30	16.60	37.97
iPhone Xs Max	SpectralFC ⁴ [7]	3.19	2.71	2.79	1.45	5.80	6.71	11.07	22.25	4.56	2.77	3.22	1.04	11.10	13.79	21.72	8.97
	SpectralConvMean [6]	3.20	2.79	2.88	1.38	5.70	6.52	10.01	17.98	4.50	2.81	3.19	0.99	10.96	14.49	18.87	40.49
	LPIENet (Ours)	1.70	1.49	1.54	0.89	2.87	3.37	4.48	9.98	3.23	1.58	2.07	0.67	8.65	10.37	16.56	37.61
	LPIENet-small (Ours)	2.35	2.13	2.17	1.39	3.69	4.21	5.97	26.70	3.93	2.28	2.74	1.08	9.63	2.01	7.42	38.73
	cmKAN-light (Ours)	1.93	1.62	1.68	0.90	3.51	4.11	6.61	0.45	3.31	1.56	2.06	0.61	8.93	11.38	17.26	39.00
Samsung Galaxy Note 9	SpectralFC ⁴ [7]	3.36	2.88	2.98	1.56	6.00	6.97	10.90	9.54	4.80	3.35	3.63	1.26	10.92	13.35	19.25	40.57
	SpectralConvMean [6]	3.19	2.75	2.85	1.49	5.63	6.43	9.68	21.01	4.53	3.13	3.45	1.18	10.26	12.64	18.37	41.16
	LPIENet (Ours)	1.75	1.56	1.60	0.97	2.87	3.30	4.59	11.39	3.28	1.62	2.12	0.72	8.72	10.50	16.70	38.01
	LPIENet-small (Ours)	2.16	1.94	1.98	1.27	3.44	3.94	5.60	14.98	3.69	2.04	2.51	0.96	9.30	1.52	7.24	8.66
	cmKAN-light (Ours)	1.77	1.46	1.52	0.80	3.27	3.83	6.30	20.47	3.15	1.45	1.92	0.51	8.65	11.28	16.86	37.08

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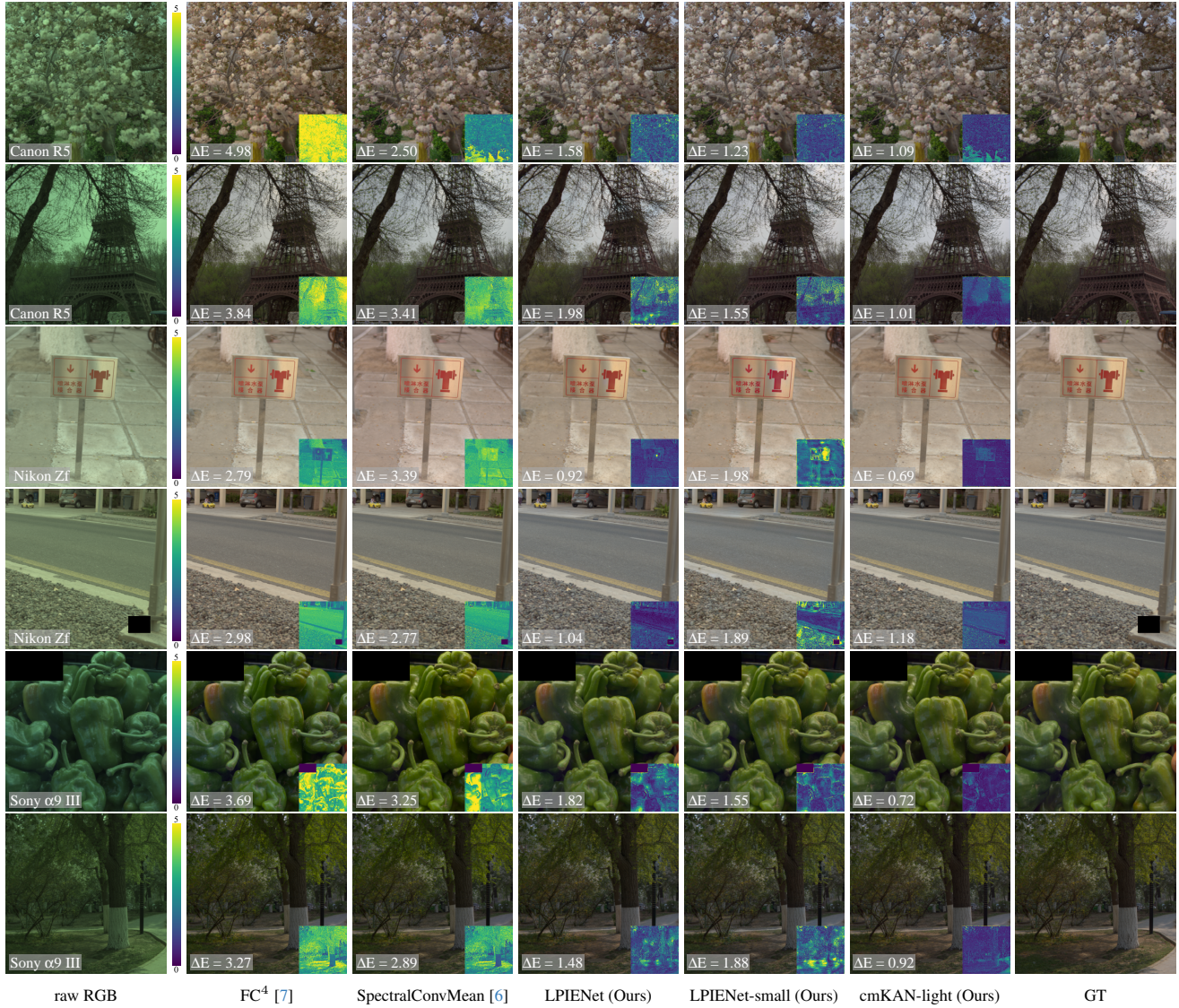


Figure 6. Qualitative results on mirrorless cameras for the best performing methods: FC⁴ [7], SpectralConvMean [6], and our three proposed models. We show two visual results for each mirrorless camera, with ΔE_{00} map reported in the bottom-right corner and average ΔE_{00} reported in the bottom-left one. For visualization purposes, we gamma correct the RAW visualization and convert the results (columns two to six) to sRGB.

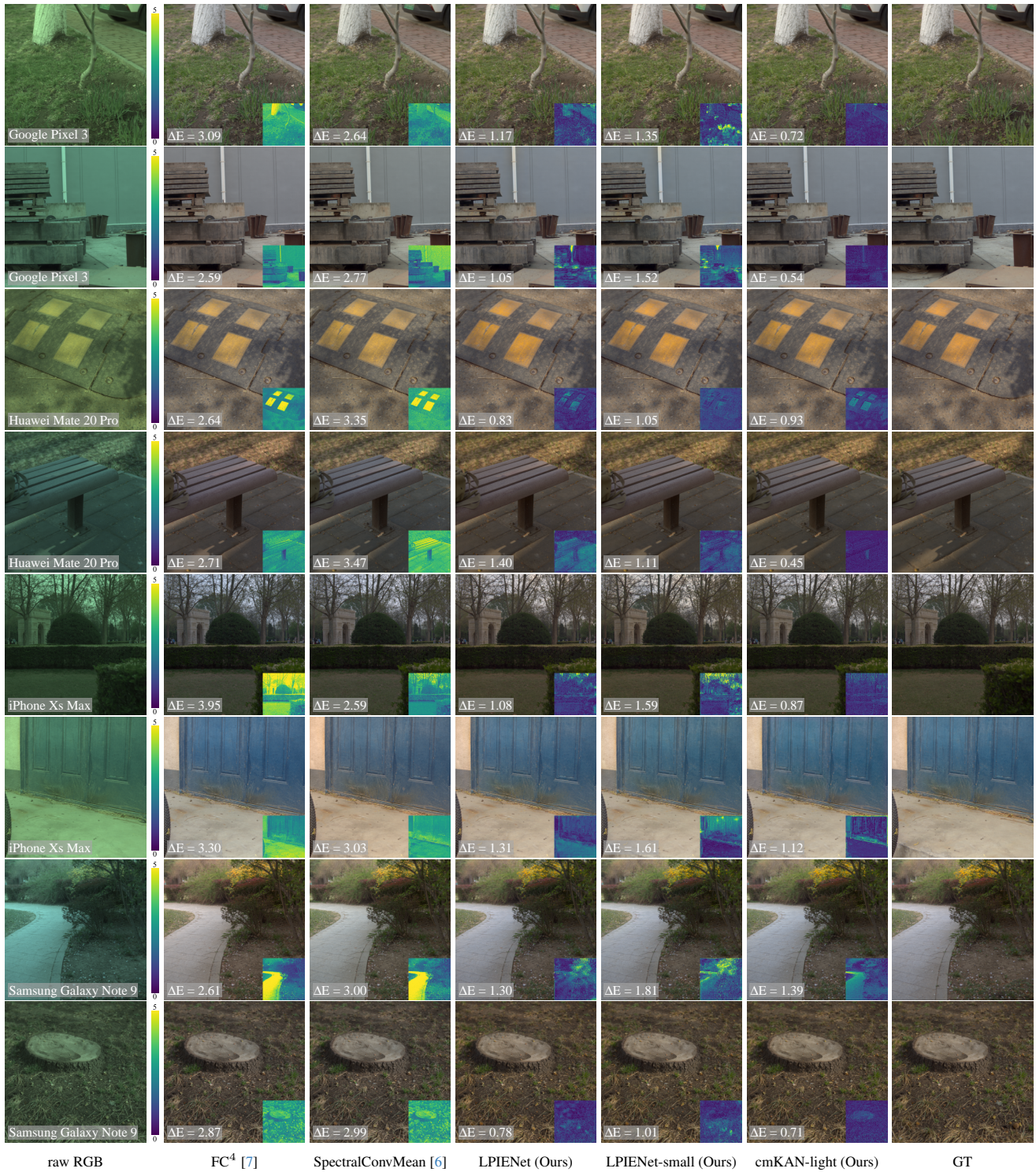


Figure 7. Qualitative results on mobile cameras for the best performing methods: FC⁴ [7], SpectralConvMean [6], and our three proposed models. We show two visual results for each mobile camera, with ΔE_{00} map reported in the bottom-right corner and average ΔE_{00} reported in the bottom-left one. For visualization purposes, we gamma correct the RAW visualization and convert the results (columns two to six) to sRGB.