

Invertible Image Signal Processing

Supplementary Material

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1. Result without pre-processing white balance

As a supplement of our method, we also evaluate our method on the RAW with post-processed white balance. As shown in Table 2, our model can still recover better RAW data and comparable sRGB images compared to the baselines. Please note that the result is based on JPEG with quality 75 (Q=75).

2. Additional quantitative results

Evaluation Metrics We use PNSR and SSIM to evaluate rendered RGB images and use PSNR for recovered RAW data. Note that our model aims at both rendering good-quality RGB images and realistic RGB images. Thus, to evaluate the overall performance of our results, we leverage the idea from the F1 score, which is a commonly used evaluation metric for binary classification [1], and take the harmonic mean of RGB PSNR and RAW PSNR, denoted as H score.

$$H = 2 * \frac{\text{PSNR}_{RAW} * \text{PSNR}_{RGB}}{\text{PSNR}_{RAW} + \text{PSNR}_{RGB}}. \quad (1)$$

We calculate H score for Table 1 in main paper.

Method	NIKON D700	Canon EOS 5D
InvGrayscale [3]	27.98	32.39
U-net [2]	38.68	36.89
Ours	40.99	39.73

Table 1: The H score of baselines’ results and ours. Note that CycleISP [4] is not included in this table because it only targets synthesizing RAW data.

We should note that the H score emphasizes the importance of a smaller value, which provides a better metric

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to evaluate RAW and RGB than the arithmetic mean. As listed in Table 1, although the U-net baseline obtains higher PSNR for RGB reconstruction, its relatively poor performance for RAW recovering restricts H score. Our model can reconstruct good quality RGB and RAW images and thus achieves the highest H score compared with baselines.

References

- [1] Steven M Beitzel. *On understanding and classifying web queries*. Citeseer, 2006. 1
- [2] Chen Chen, Qifeng Chen, Jia Xu, and Vladlen Koltun. Learning to see in the dark. In *CVPR*, 2018. 1, 2
- [3] Menghan Xia, Xueting Liu, and Tien-Tsin Wong. Invertible grayscale. *ACM Transactions on Graphics (TOG)*, 37(6):1–10, 2018. 1, 2
- [4] Syed Waqas Zamir, Aditya Arora, Salman Khan, Munawar Hayat, Fahad Shahbaz Khan, Ming-Hsuan Yang, and Ling Shao. Cycleisp: Real image restoration via improved data synthesis. In *CVPR*, 2020. 1, 2

Method	NIKON D700			Canon EOS 5D		
	RGB		RAW	RGB		RAW
	PSNR	SSIM	PSNR	PSNR	SSIM	PSNR
InvGrayscale [3]	25.93	0.8820	33.34	28.69	0.8314	34.21
CycleISP [4]	-	-	29.40	-	-	31.71
U-net [2]	37.20	0.9169	38.24	38.59	0.8839	41.52
Ours (w/o JPEG)	37.26	0.9233	43.29	35.30	0.8854	45.72
Ours (with JPEG Fourier)	37.34	0.9245	44.42	37.78	0.8844	46.78

Table 2: Quantitative evaluation among our model and baseline methods without white balance. Overall, various perceptual metrics show that our proposed ISP model outperforms the rest baselines.