Disentangle Nighttime Lens Flares: Self-supervised Generation-based Lens Flare Removal
Supplementary Material

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The supplementary material is organized into the following sections. Section 1 describes the OurSynDatasets synthesis process. Section 2 introduces more results from experiments on the Joint Task (glow and reflective/flare removal), Reflection Flare Removal Task, and Glow Suppression Task.

OurSynDatasets

The GTs without glow/reflective flares for OurSynDatasets are 23 outdoor images from test datasets of BracketFlare(Dai, Luo et al. 2023) dataset.

Glow Flare Synthesis: To synthesize glows similar in real-world nighttime, the Generative Network g_κ in (Ren et al. 2020) used to generate glows around light source, assisted by rotated glow mask in BracketFlare(Dai, Luo et al. 2023) to locate light source, to produce the glow impaired image I_g. This process better models random blur and color jitter around light source, which is also mentioned in BracketFlare(Dai, Luo et al. 2023).

Reflective Flare Synthesis: Then, we followed the Reflective Flare synthesis process in BracketFlare(Dai, Luo et al. 2023) to produce the final glow and reflective flare damaged image $I_{r/g}$, using the gamma correction $\gamma \sim$U(1.4,1.8) and its synthetic reflective flare stimulated via multiply opacity and rotation. Through these two steps, OurSynDatasets are featured in both glow and reflective flares in 23 pairs. This testing dataset will be publicly available soon.

More Results

Joint Task: We complement the quantitative results(Table 1 with both (c) CVPR2020(Kim, Huo et al. 2020) and (d) ICCV2021(Dong, Xu et al. 2021) are advanced reflection removal methods) of the combined glow and reflection flare methods to show our priority in joint glow/reflective flare removal. More visual validation of our method on both synthetic and real datasets are also shown in Fig. 1.

Reflective Flare Removal Task: Fig. 2 validates our approach on individual reflection removal task on the Bracketflare test datasets and the real-world dataset. Our approach gives good performance even though our approach is self-supervised without any training data.

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Glow Suppression Task: Fig. 3 validates our approach on individual glow suppression task on ECCV2022 and the real-world datasets. Our approach gives good performance even though our approach is self-supervised without any training data.

Table 1: Results on nighttime OurSynDatasets with glow and reflective flares with flare-free GTs, The best results are marked in red, and the second-best results are in blue.

Methods	Strategy	Pipeline	PSNR↑	SSIM↑
Glow Removal	Deglow → Deghost			
(1) ICCV2023	Supervised	(1)→(c)	26.87	0.936
		(1)→(d)	26.69	0.941
(2) Flare7K+ +	Supervised	(2)→(c)	26.52	0.941
		(2)→(d)	28.95	0.971
(a)ACM MM2023	Semi-Supervised	(a)→(c)	24.32	0.866
		(a)→(d)	25.42	0.890
(b) ECCV2022	Unsupervised	(b)→(c)	25.26	0.923
		(b)→(d)	26.34	0.944
(e) CVPR2024	Semi-Supervised	(3)→(e)	24.18	0.815
		(4)→(e)	24.63	0.826
Reflective Flare Removal	Deghost → Deglow			
(3) CVPR2018	Supervised	(3)→(a)	25.39	0.892
		(3)→(b)	26.21	0.936
(4) CVPR2023	Supervised	(4)→(a)	25.66	0.878
		(4)→(b)	26.92	0.942
Union task model				
Ours	Self-supervised	Ours	29.65	0.974

References

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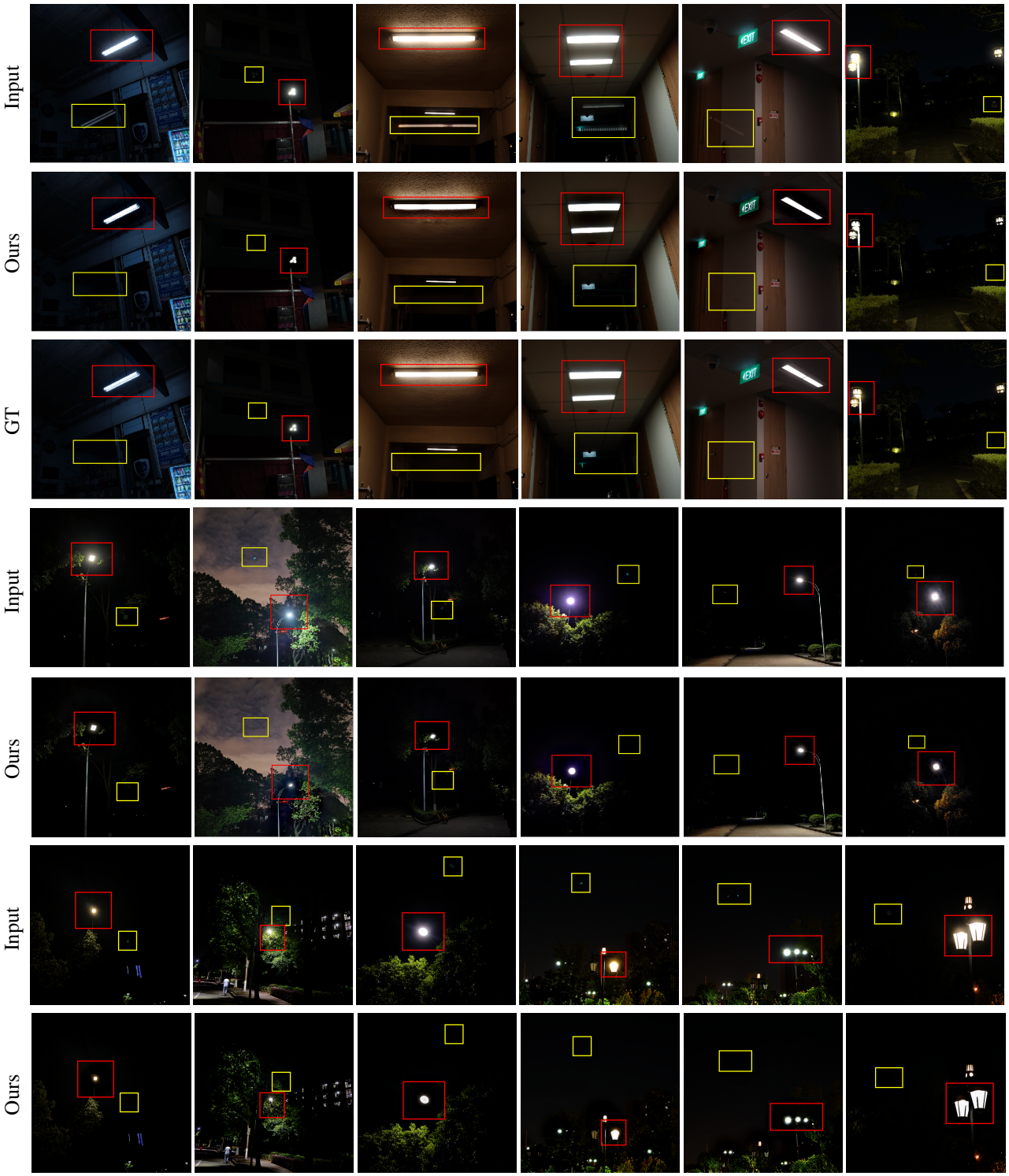

Figure 1: **Joint Task.** Visual validation of our SGLFR-Net on OurSynDatasets with GT (Rows 1-3) and real-world datasets (Rows 4-7), to show our good performance in joint glow and reflective (ghost) flares removal.

Figure 2: **Reflective Flare Removal Task.** Visual validation of our SGLFR-Net on the BracketFlare test dataset (Rows 1-3) and the real world dataset (Rows 4-7).

Figure 3: **Glow Suppression Task.** Visual validation of our SGLFR-Net on the ECCV 2022 dataset (Rows 1-2) and the real world dataset (Rows 3-6).