LFIEM: Lightweight Filter-based Image Enhancement Model

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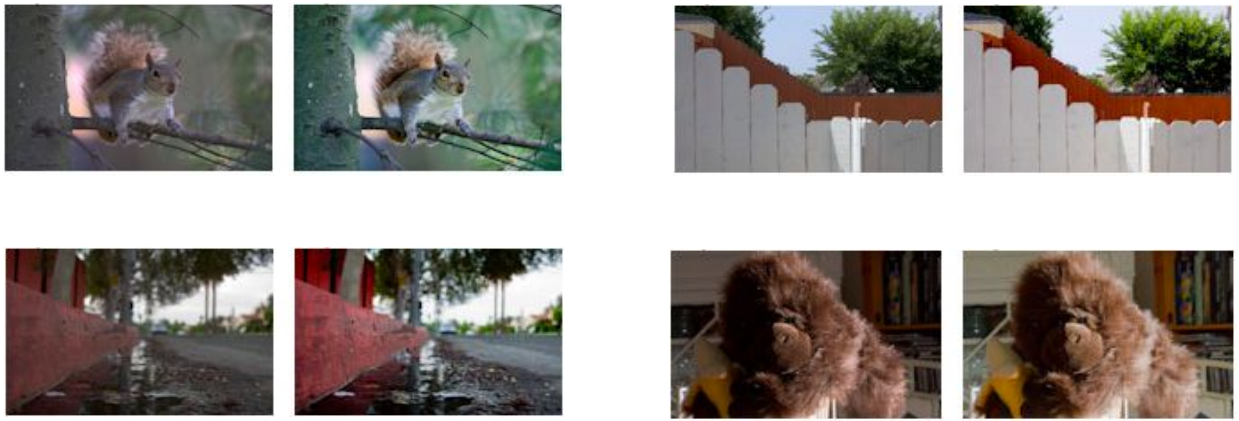
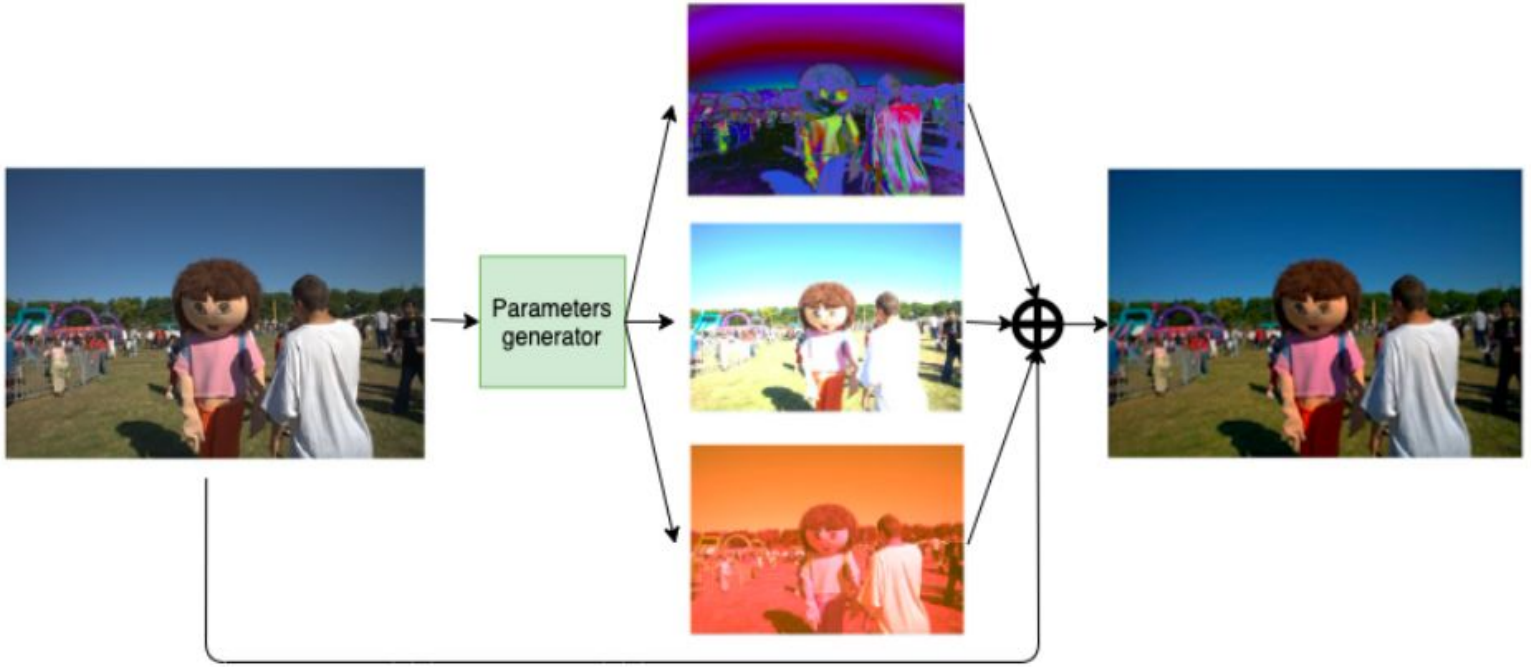
Image enhancement problem



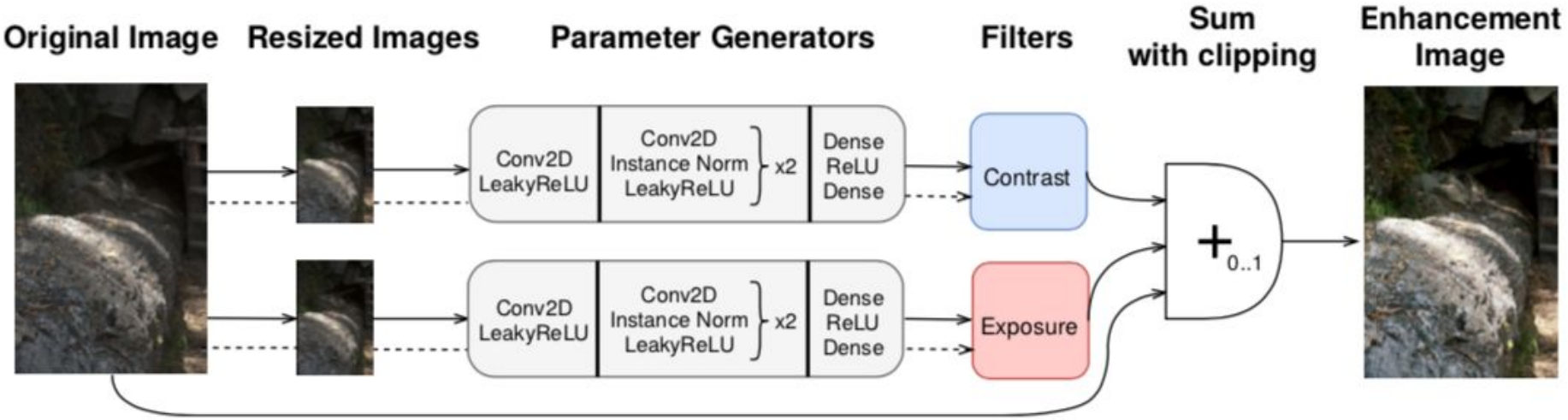
Dataset

- MIT Adobe FiveK
- RANDOM250

Proposed pipeline



Parameters generator



Filters investigation

Filters analysis

Selected Filters	SSIM
saturation, sharp, c-w color	0.9049 (±0.0013)
exposure, contrast, c-w color	0.9056 (±0.0008)
c-w color	0.9058 (±0.0017)
contrast, c-w color	0.9059 (±0.0007)
saturation, u-kernel, c-w color	0.9062 (±0.0012)
exposure, saturation, c-w color	0.9064 (±0.0017)
w-balance, c-w color	0.9066 (±0.0007)
saturation, c-w color	0.9071 (±0.0005)
u-kernel, linear, c-w color	0.9076 (±0.0012)
saturation, c-w color, w-balance	0.9081 (±0.0010)
saturation, contrast, c-w color	0.9081 (±0.0008)
linear, c-w color	0.9082 (±0.0005)
linear, c-w color, w-balance	0.9083 (±0.0012)
contrast, linear, c-w color	0.9086 (±0.0015)
exposure, linear, c-w color	0.9087 (±0.0008)

Impact of Consistency Regularization

Selected Filters	CR	SSIM
linear, c-w color	✗	0.9082 (±0.0005)
linear, c-w color	✓	**0.9092** (±0.0008)
linear, c-w color, w-balance	✗	0.9083 (±0.0012)
linear, c-w color, w-balance	✓	**0.9091** (±0.0010)
contrast, linear, c-w color	✗	0.9086 (±0.0015)
contrast, linear, c-w color	✓	**0.9103** (±0.0005)
exposure, linear, c-w color	✗	0.9087 (±0.0008)
exposure, linear, c-w color	✓	**0.9093** (±0.0004)

Results #1

Method	# params	PSNR	SSIM	Train-test split
Pix2Pix	54M	-	0.857	4750-250
Distort-and-Recover	153M	-	0.905	4750-250
DPED	-	21.76	0.871	2250-500
8RESBLK	-	23.42	0.875	2250-500
CRN	-	22.38	0.877	2250-500
HDRNet	-	21.96	0.866	4500-500
SULPCE	>1M	23.93	**0.920**	4000-1000
U-Net	1.3M	22.24	0.850	4500-500
DeepUPE	1.0M	23.04	0.893	4500-500
DeepLPF	800K	24.48	0.887	4500-500
DPE	2.2M	23.89	0.906	4750-250
CE+PRNL	>30M	24.19	0.915	4750-250
LFIEM (ours)	**101K**	**24.77**	0.911	4750-250

Results #2

Results #3

Summary

- Lightweight interpretable filter-based image enhancement approach
- High performance
- High inference speed
- Suitable for mobile devices
- The absence of local artifacts and global color distortions

Thank you!