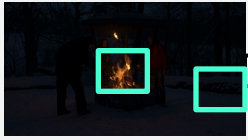# Learnable Histogram Feature Guided Color Restoration Network Using Feature-Adaptive Convolution Layers for Single-Image Low-Light HDR Reconstruction

李哲億　池永研究室　修士課程修了

➤ Background
- Low-Light areas widely exist

➤ Application
- Photography
- Night Security
- Outdoor Investigation
- ...

➤ Problem statement

Different areas need be processed differently

Different images need be brightened differently

➤ Proposed method

Overall framework

Input → Seg. → P2 → Features → UNet → HDR Output
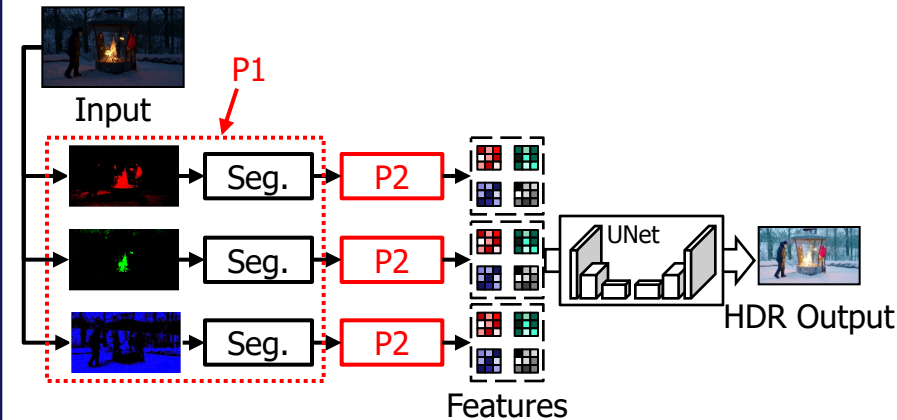
P1.1: Learnable Histogram Feature Guided Image Binning Method

RW: Input → Thresholds (Given and Fixed) → Segment → Conv. → Features

P1.1: Input → Histogram → Guide → Thresholds (Generated Thresholds) → Segment → Conv. → Features
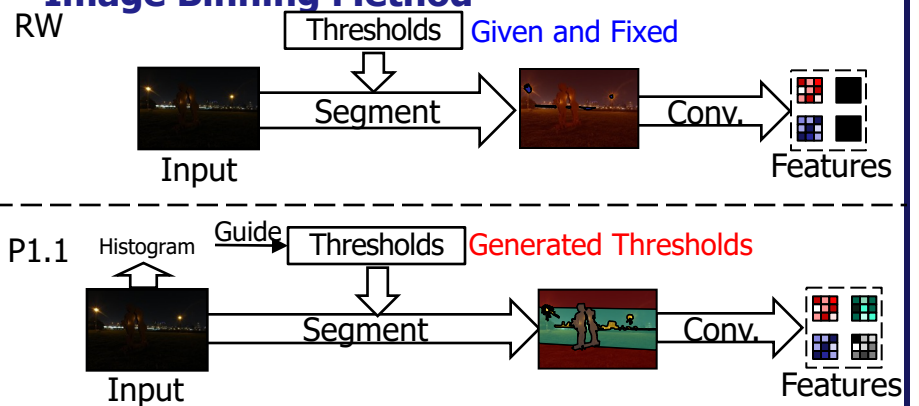
P1.2: Channel Separated Processing Method

RW: Input → All Same Thresholds and Convolutions → Seg. → Conv. → Features

P1.2: Input → Seg. → Conv. → Features

P2: Feature-Adaptive Convolution Layer

Image → Feature Extract → Brightness Feature → Full Connection → Weight → Weighted Average → Candidate Kernels → Actual Kernel → Repeat x k

Different Input ⇒ Different Kernel ⇒ Adaptive Process to Images

➤ Experiments Result

Input — HDRUNet — Proposed

-10EV / -7EV / +3EV
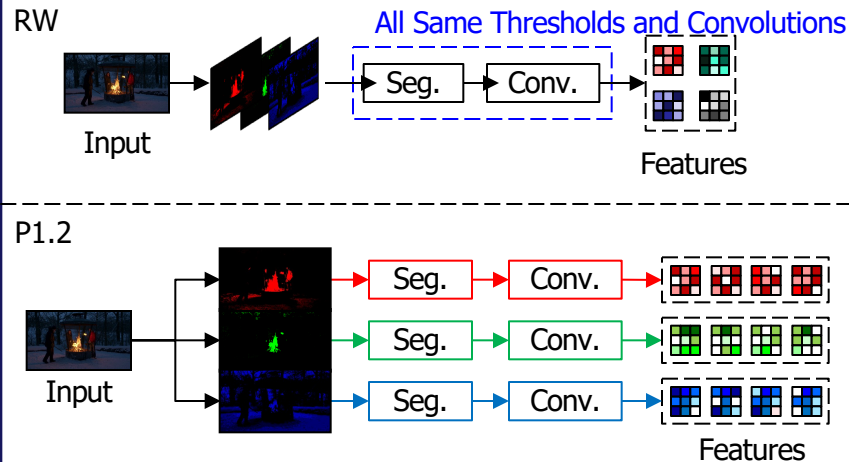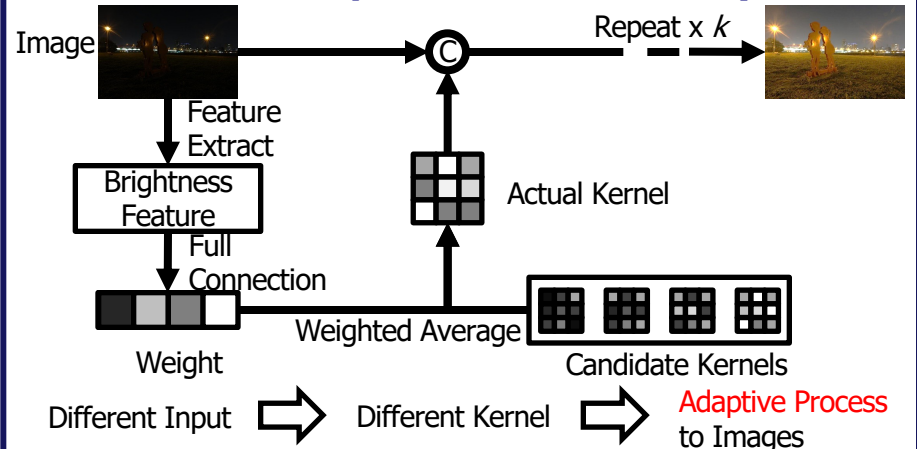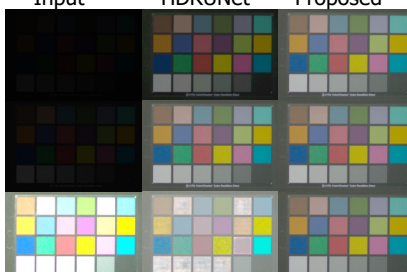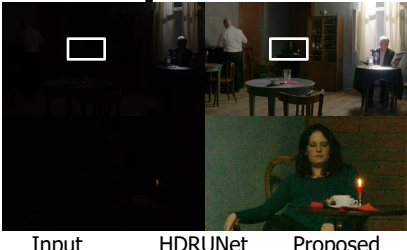
	EV	PU21(dB)	SSIM	PSNR(dB)
HDRUNet	-4	47.0535	0.6469	32.8323
P1+P2		46.5009	0.6753	32.0832
HDRUNet	-5	45.2808	0.5958	31.1675
P1+P2		45.8617	0.6767	31.5311
HDRUNet	-6	47.7825	0.7276	33.5142
P1+P2		49.4206	0.7794	35.1342
HDRUNet	-7	55.7590	0.8294	41.5928
P1+P2		59.3591	0.8737	45.1534

	EV	PU21(dB)	SSIM	PSNR(dB)
HDRUNet	3	39.2212	0.3906	25.0495
P1+P2		44.7518	0.6588	30.1600
HDRUNet	0	44.8810	0.6109	30.3101
P1+P2		44.7518	0.6588	30.1600
HDRUNet	-1	45.3149	0.6291	31.0092
P1+P2		45.8569	0.6939	31.3362
HDRUNet	-10	44.2330	0.3845	30.3106
P1+P2		44.3508	0.3921	30.3711

➤ Conclusion
- All metrics on proposed method shows higher on most scenes compared with conventional work.
- Visualized result of proposed is better than other works.

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