

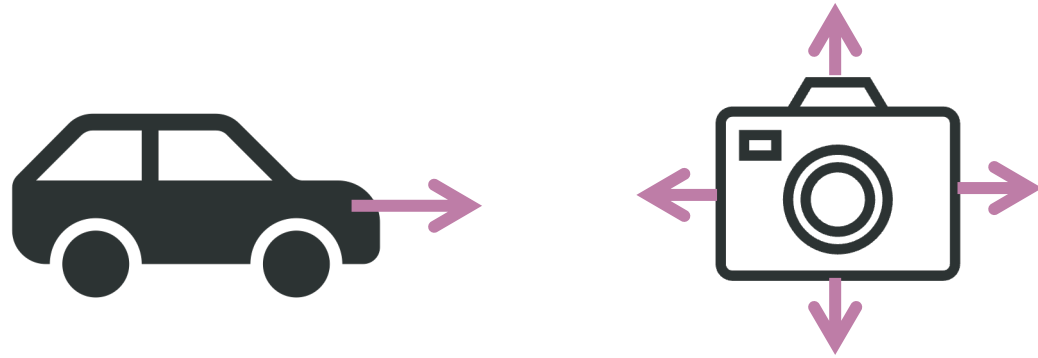
딥러닝 기반의 Single-Image Deblurring 기법

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부경대학교

소개

- 약력
 - 고려대학교 전기전자전파공학과, 박사 (~2019. 2)
 - 고려대학교 반도체기술연구소, 연구교수 (2019. 3 ~ 2019. 10)
 - 삼성전자 종합기술원, 전문연구원 (2020. 1 ~ 2022. 1)
 - 부경대학교 전자정보통신공학부, 조교수 (2022. 3~)
- E-mail: swkim@pknu.ac.kr

영상 블러 (Image Blur)



블러가 없는 영상

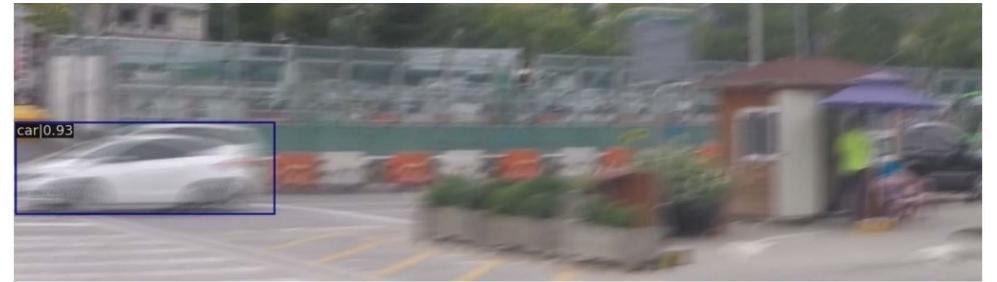


블러가 발생한 영상

영상 블러 (Image Blur)



영상 품질 저하



비전 알고리즘 성능 저하

해결 방법



셔터 스피드 증가



짐벌

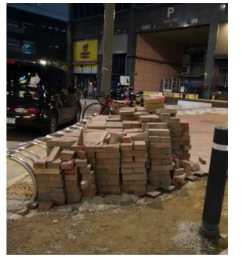
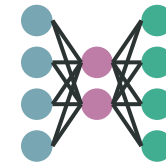
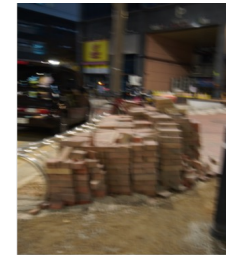


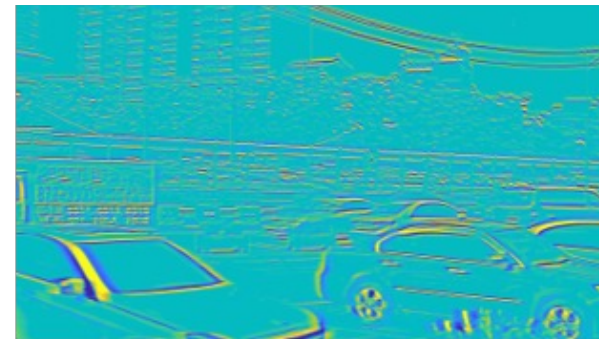
Image Deblurring

Image Deblurring



입력 영상

Network
Model

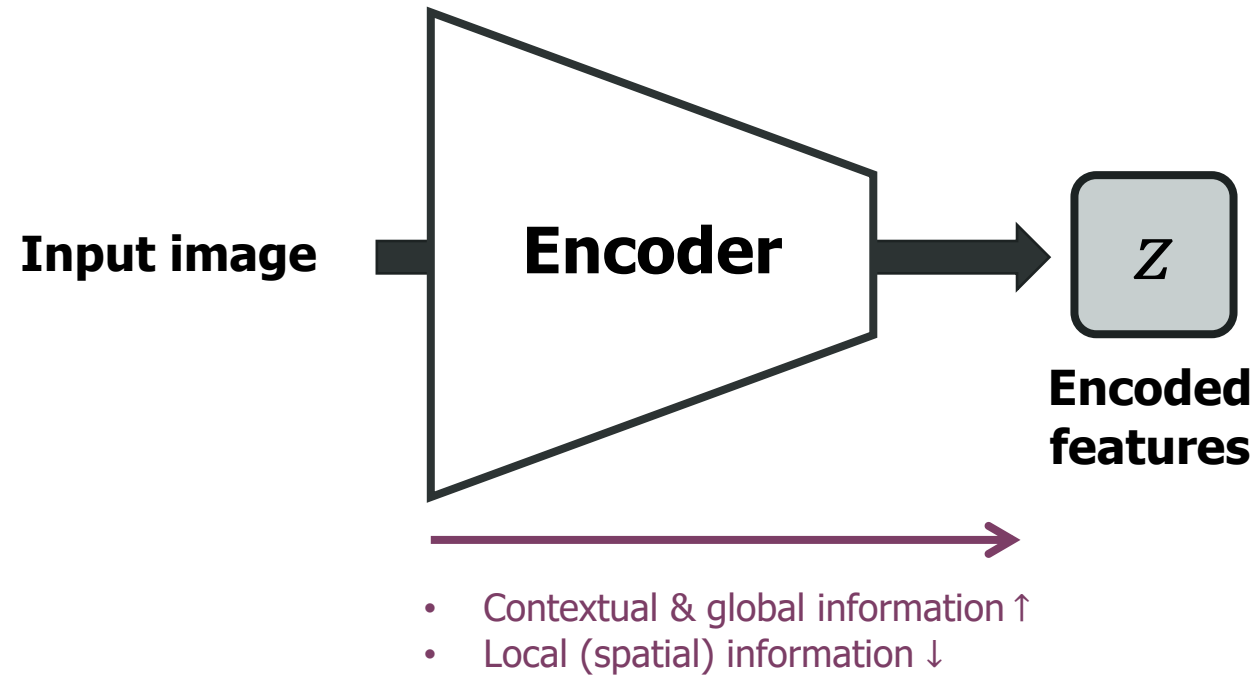


예측된 블러

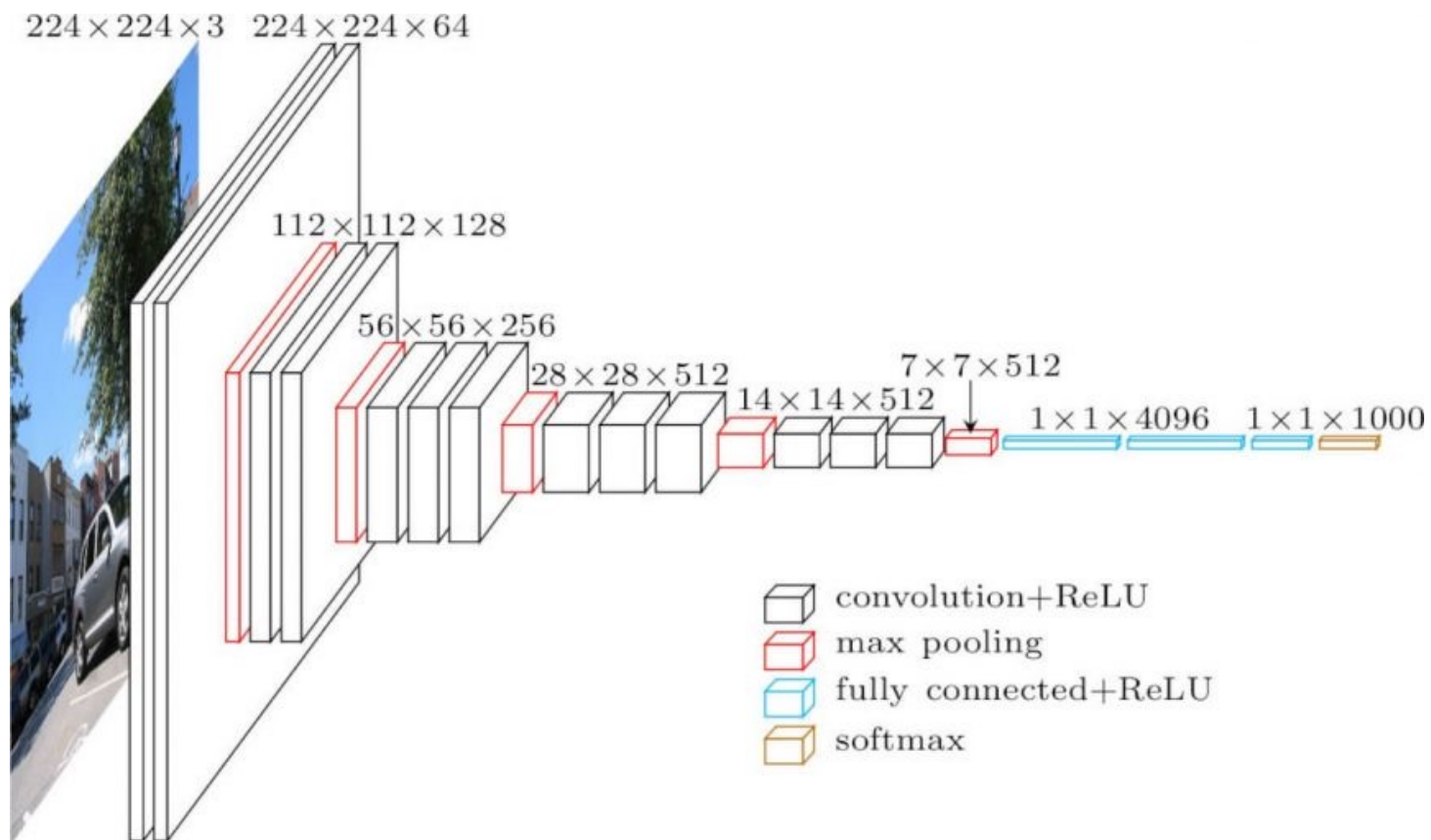


출력 영상

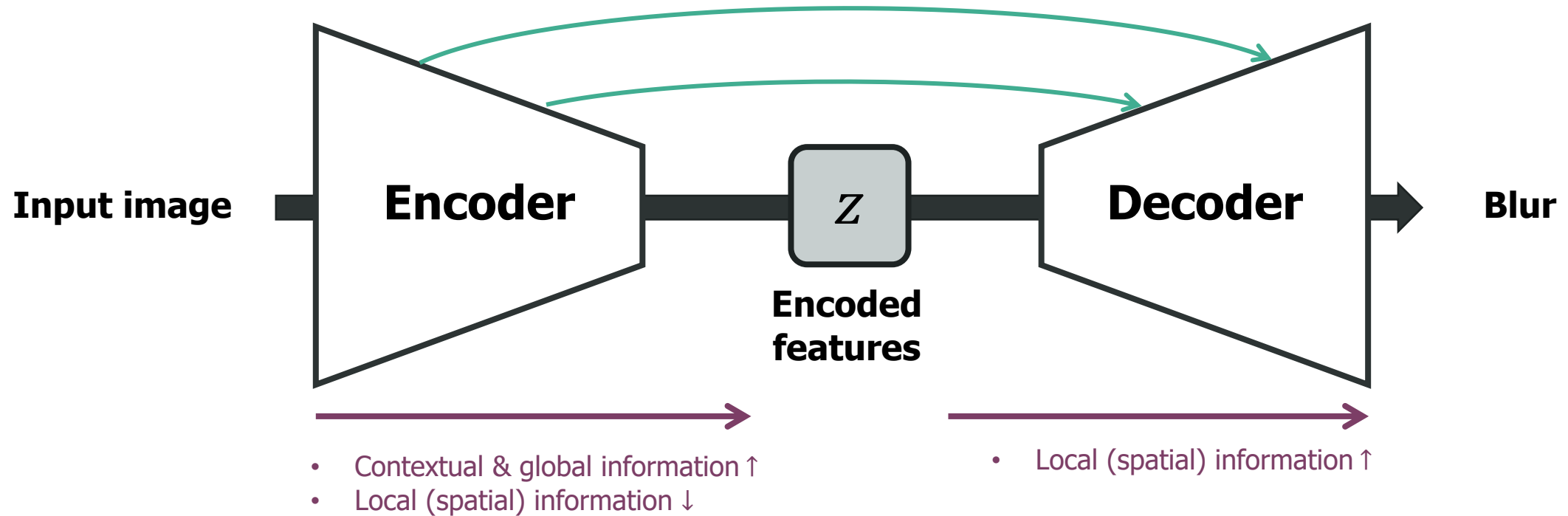
CNN (1Encoder)



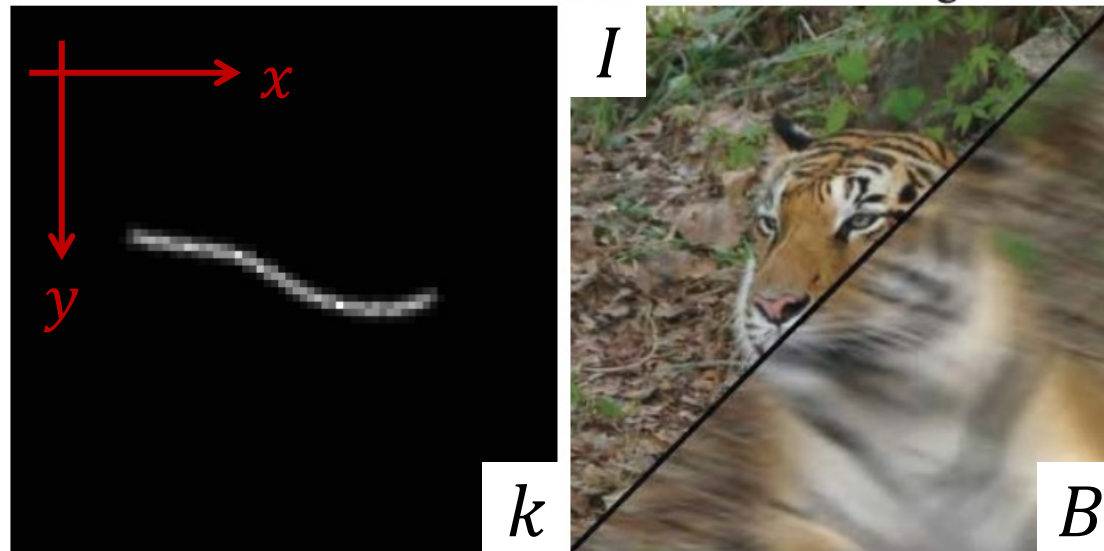
CNN (1Encoder)



U-Net (1 Encoder-1 Decoder)

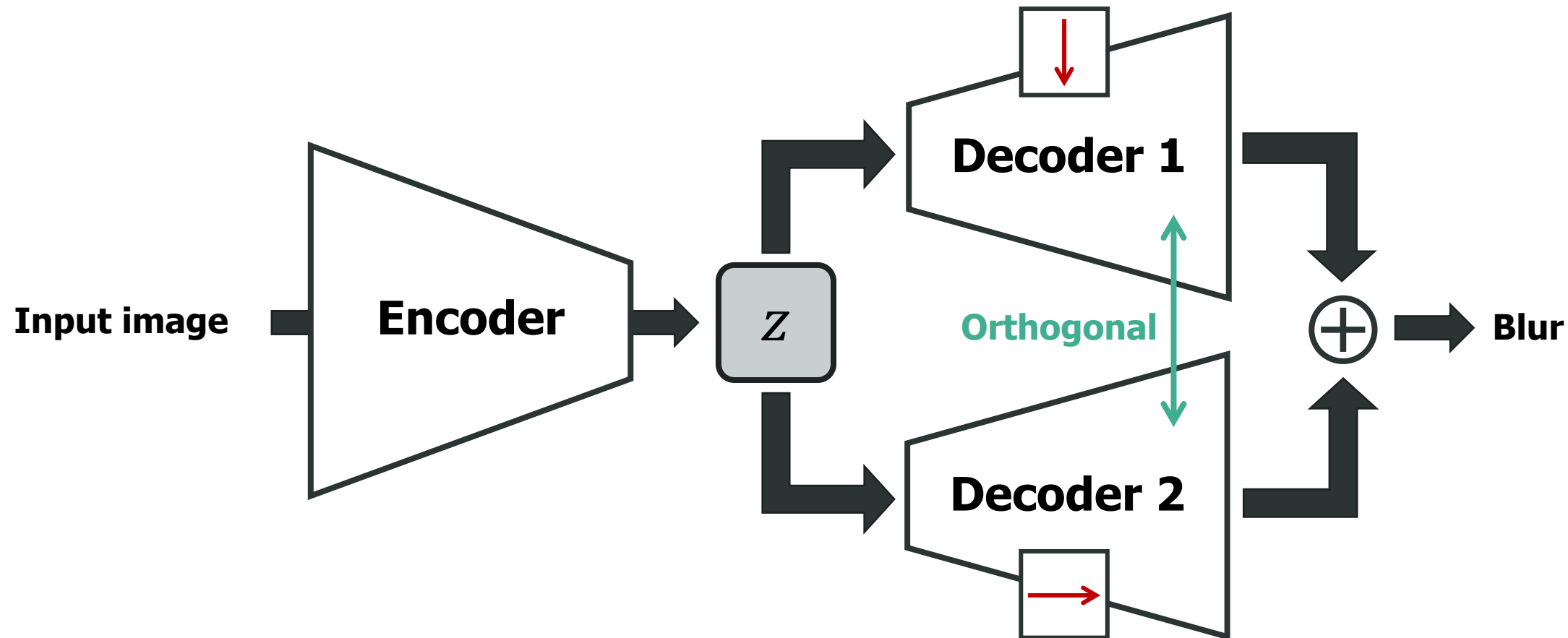


블러 모델

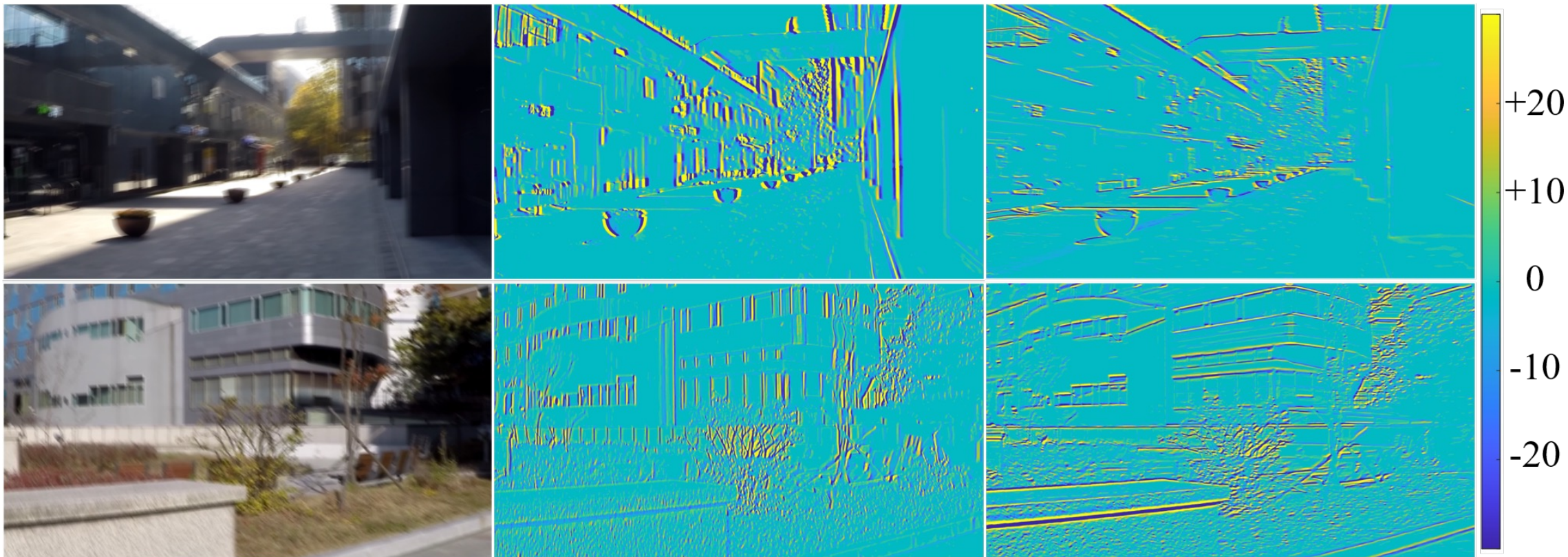


$$B = k * I + n$$

1Encoder-2Decoders



2 Decoders의 특징

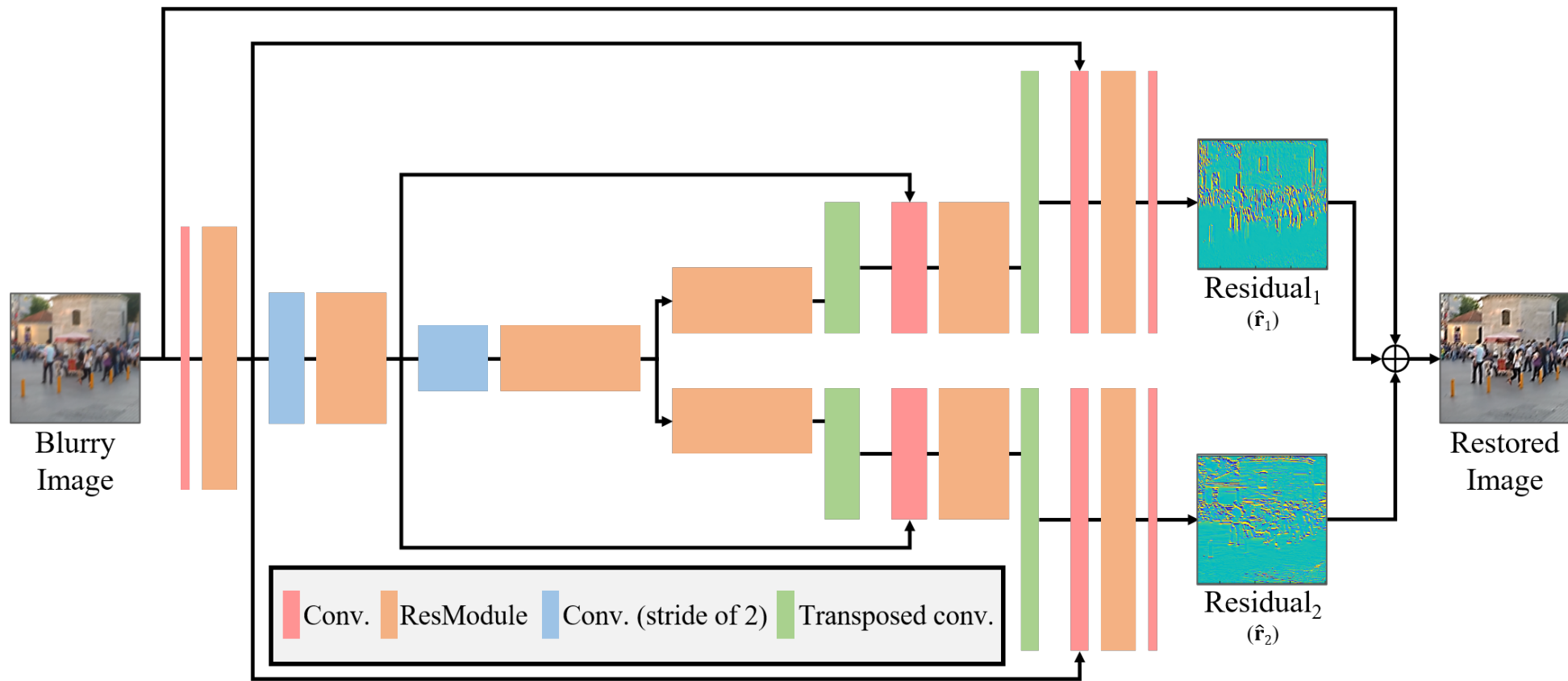


입력 영상

Decoder 1

Decoder 2

제안 기법



제안하는 구조

Self-Study 1: #Decoders

Performance of various number of decoders

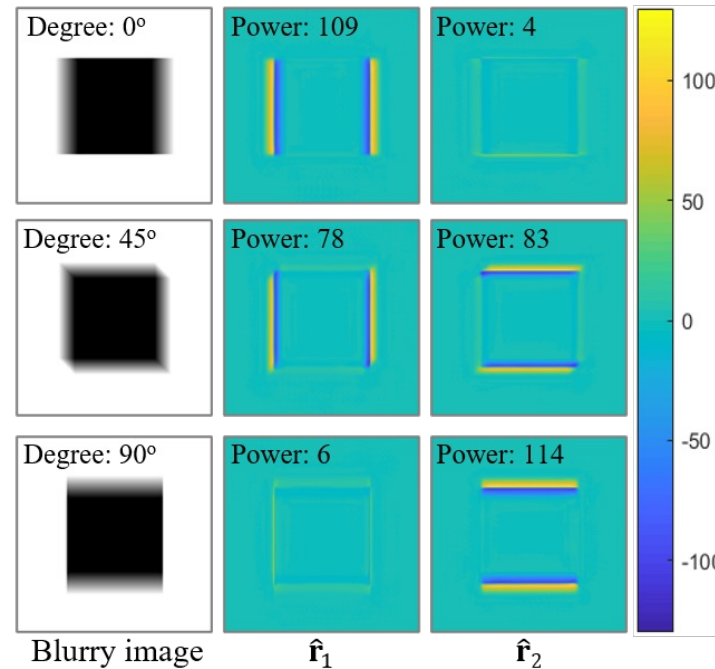
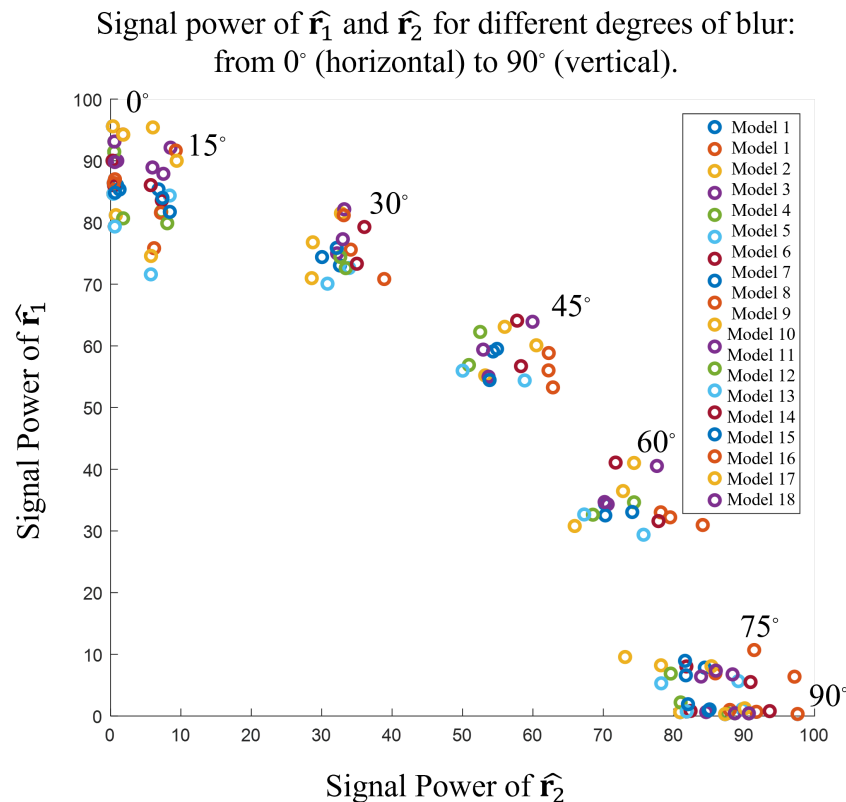
Method	GoPro		Complexity*	
	PSNR	SSIM	Params	GMACs
U-Net	30.61	0.9458	4.92	687.93
U-Net ^{2D}	30.90	0.9489	7.42	1059.77
U-Net ^{3D}	30.99	0.9496	9.92	1431.61
U-Net ^{4D}	31.04	0.9506	12.42	1803.45

* The number of parameters is measured in million.

* GMACs is estimated for the input size of 720P.

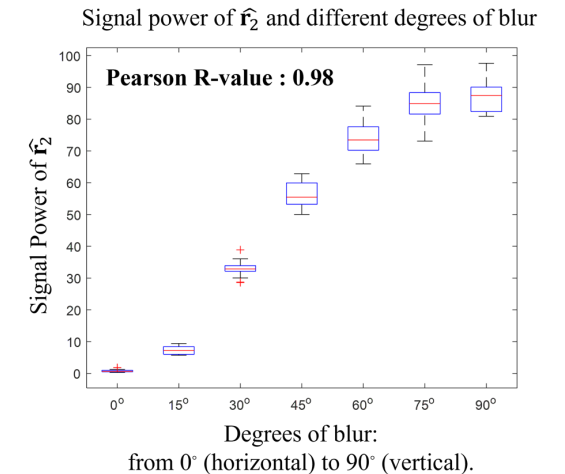
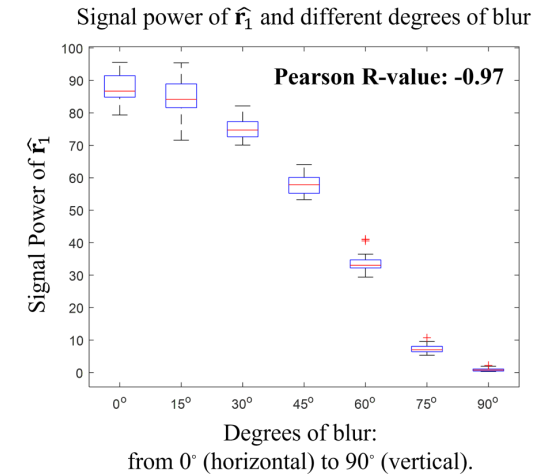
Self-Study 2: Consistency

- **Randomly divided the GoPro training DB** into three and trained 18 models (six models for each divided DB) for 900 epochs **using random initial weights** **with different seeds**

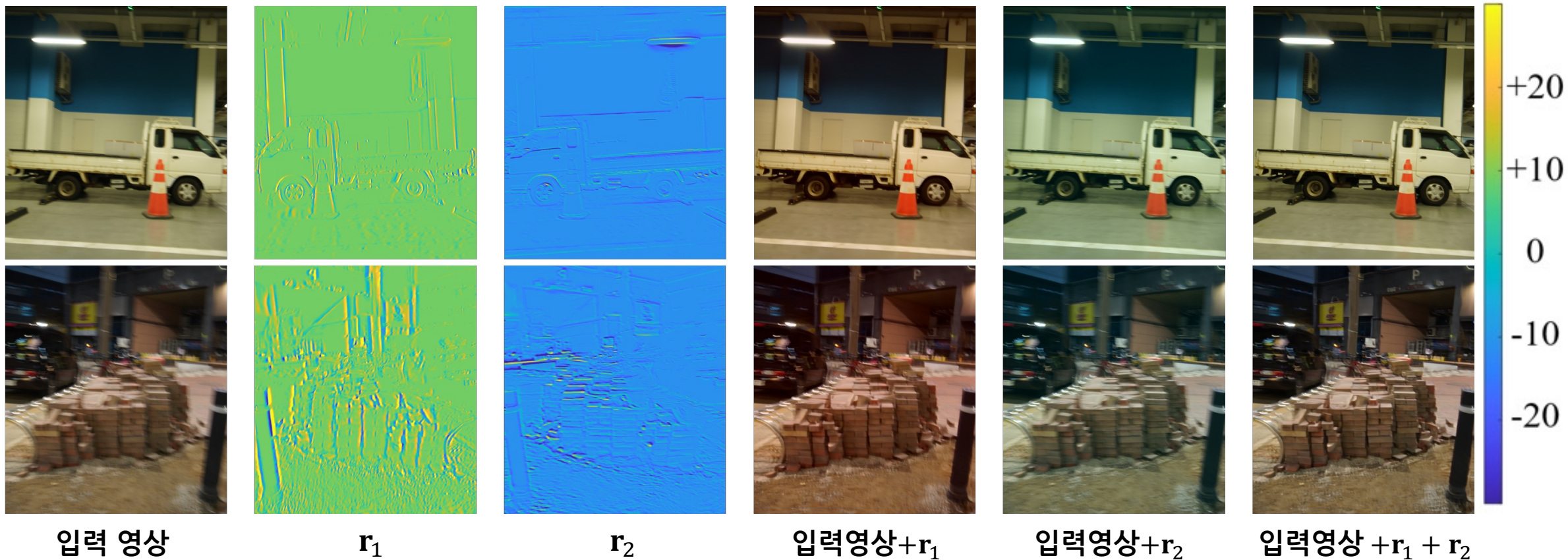


$$Power = \frac{1}{M} \|s\|_2^2$$

M : the number of elements in s
 s : vector/matrix form of discrete signal



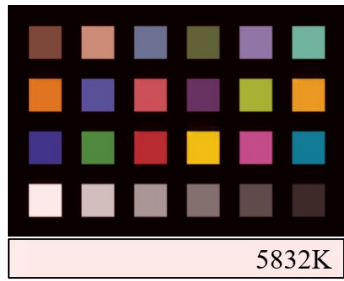
Self-Study 3: Color Shift



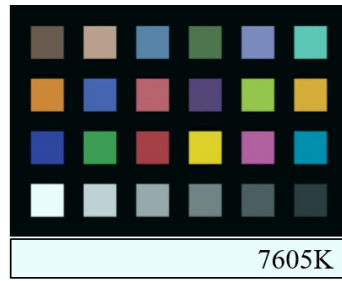
Self-Study 3: Color Shift



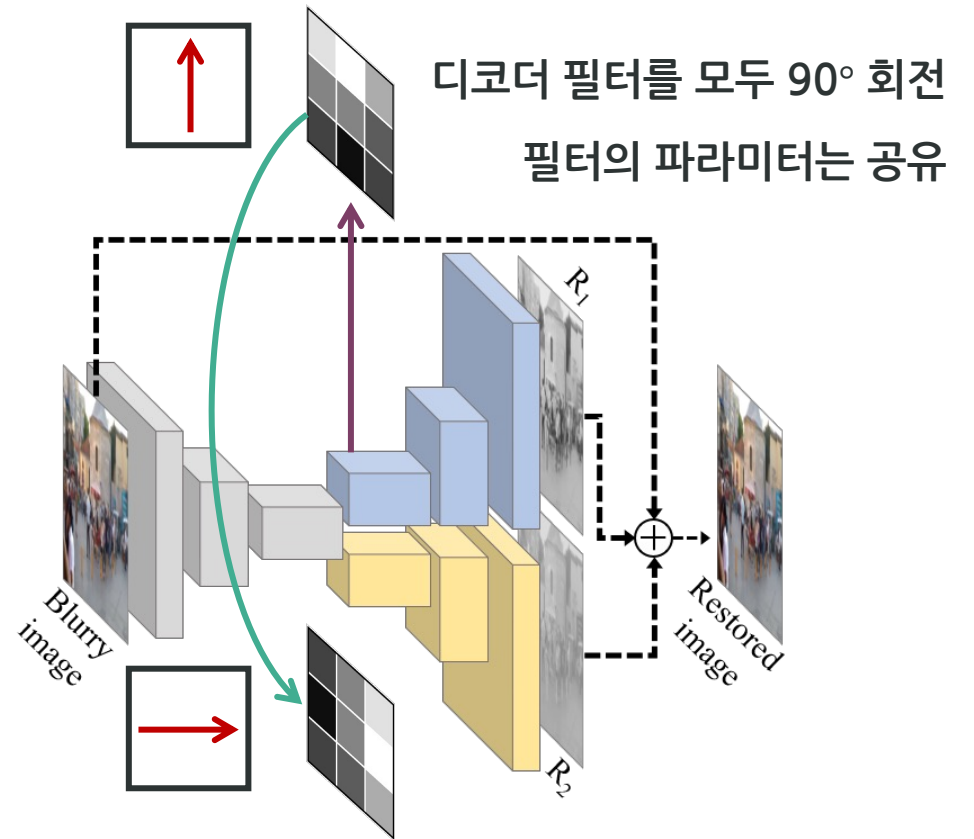
Input image



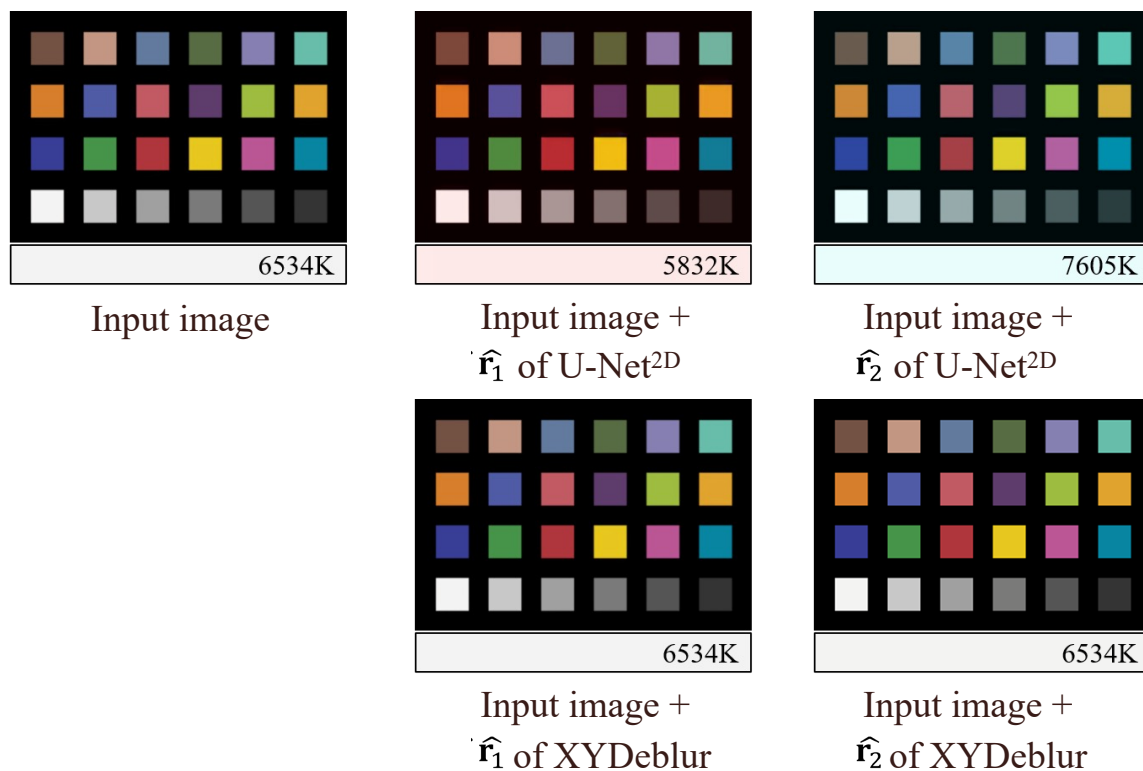
Input image +
 $\hat{\mathbf{r}}_1$ of U-Net^{2D}



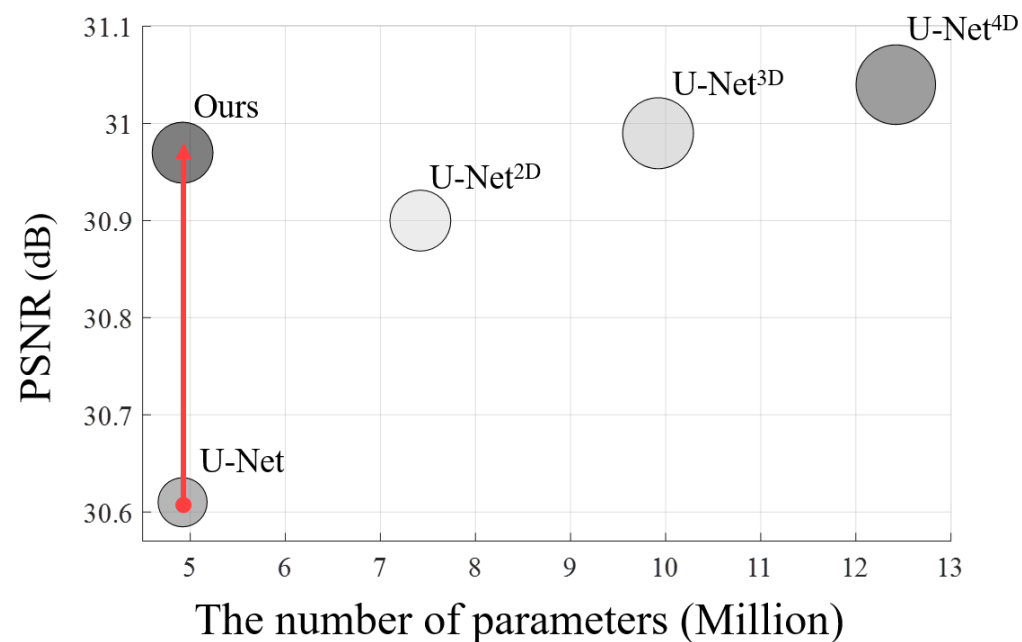
Input image +
 $\hat{\mathbf{r}}_2$ of U-Net^{2D}



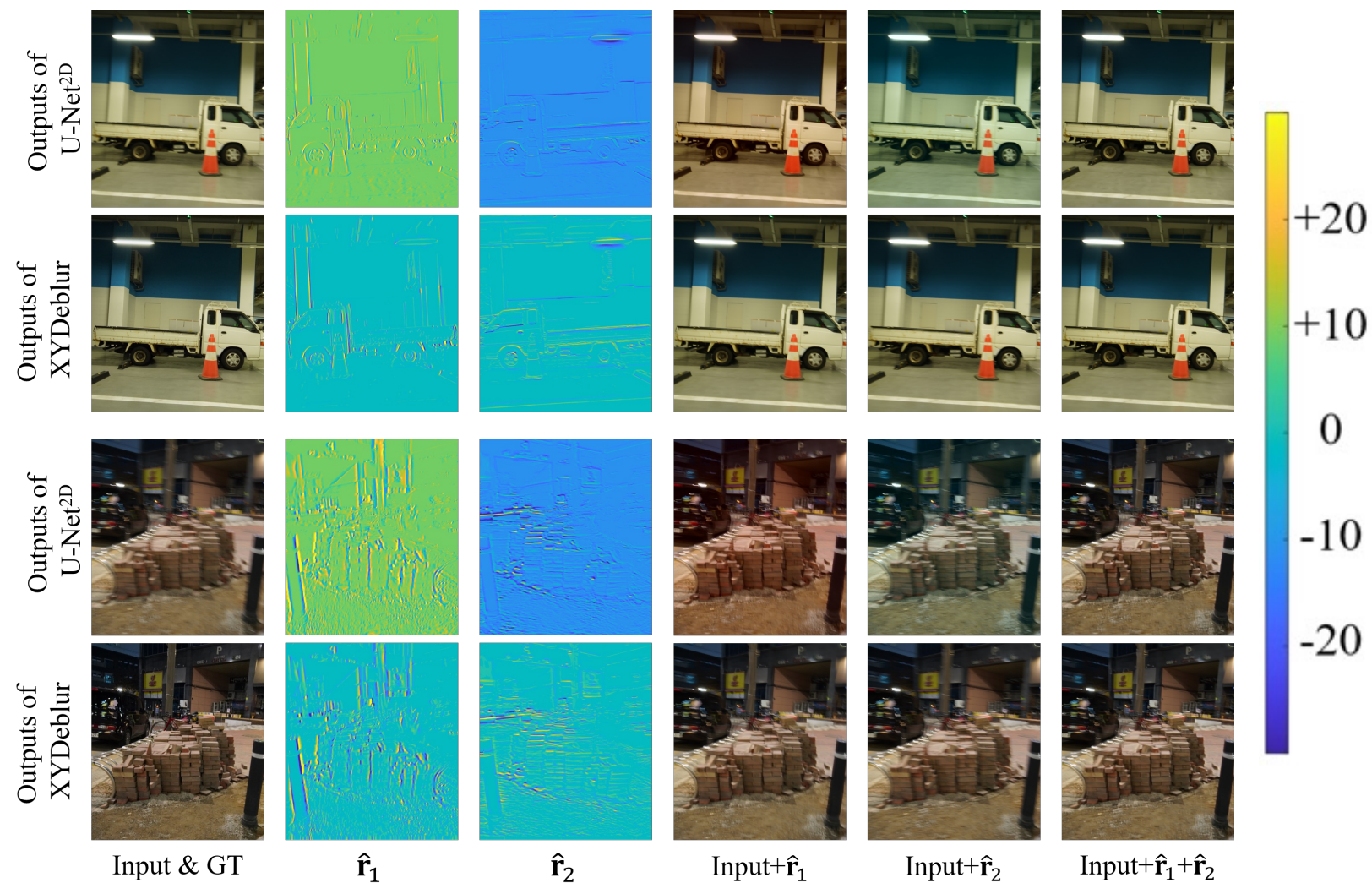
Self-Study 3: Color Shift



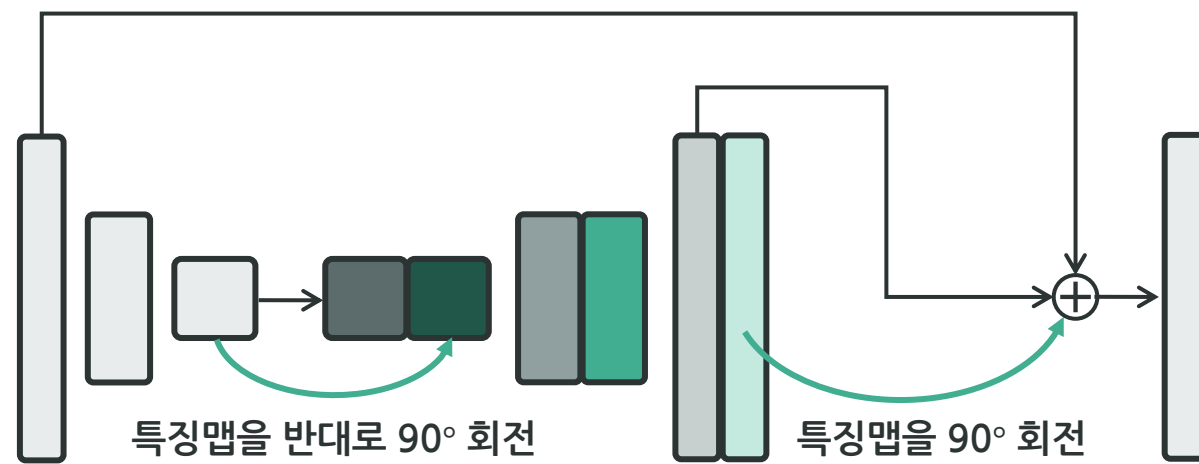
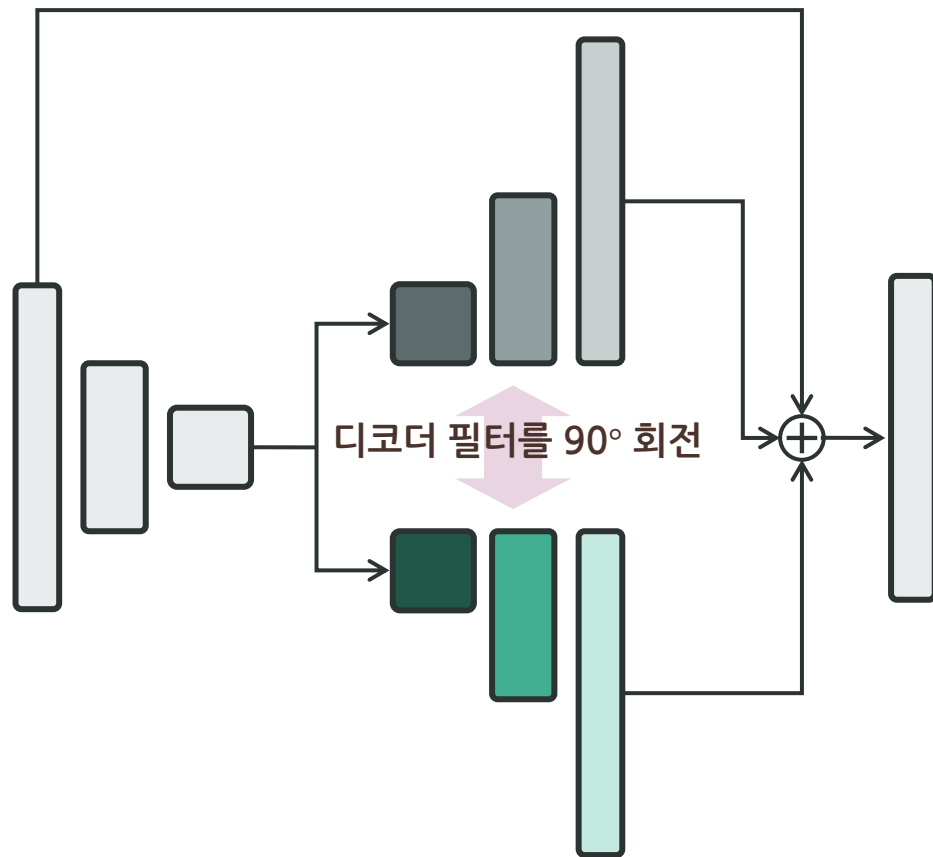
✓ **Various number of decoders and their performance.**
(The radius of the circle indicates GMACs of the network.)



Self-Study 3: Color Shift



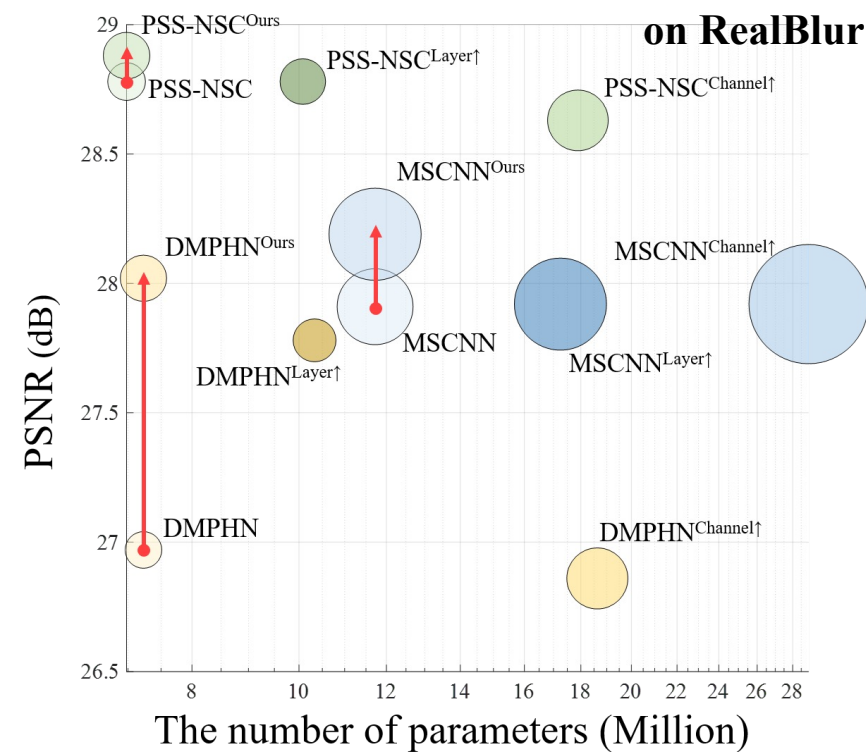
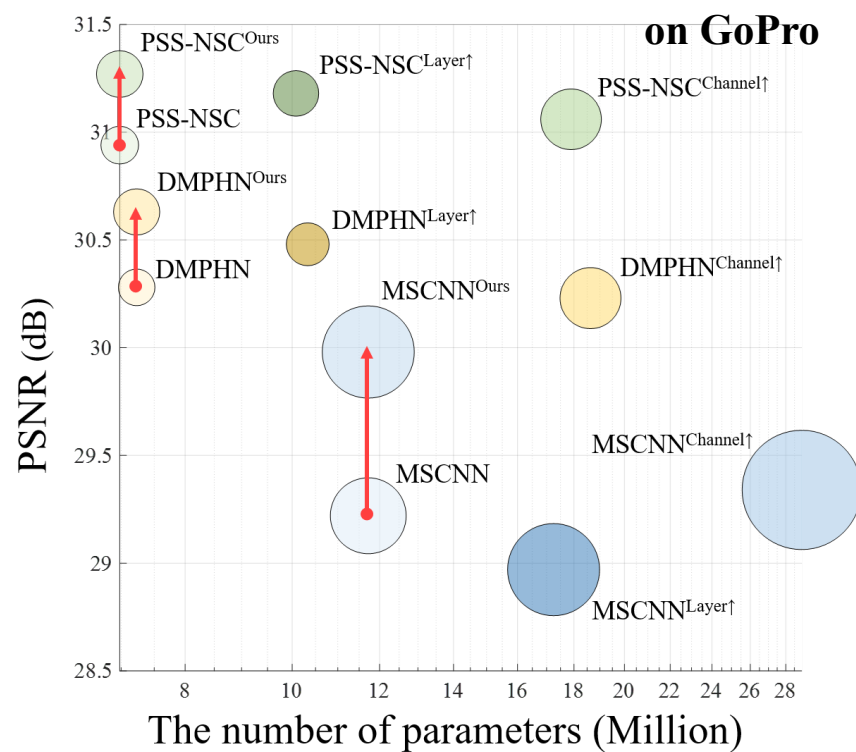
구현



실험 결과

Effectiveness of the proposed approach on the state-of-the-art network

(The radius of the circle indicates GMACs of the network.)



PSS-NSC: Gao et al., "Dynamic scene deblurring with parameter selective sharing and nested skip connections," CVPR 2019.

DMPHN: Zhang et al., "Deep stacked hierarchical multi-patch network for image deblurring," CVPR 2021.

MSCNN: Nah et al., "Deep multi-scale convolutional neural network for dynamic scene deblurring," CVPR 2017.

실험 결과



Input



GT



Input



GT

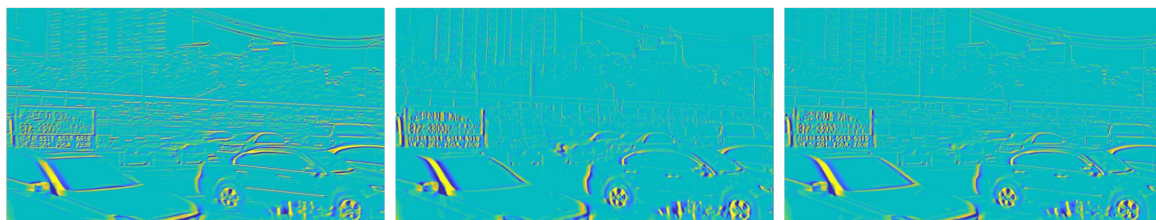
w/o Ours



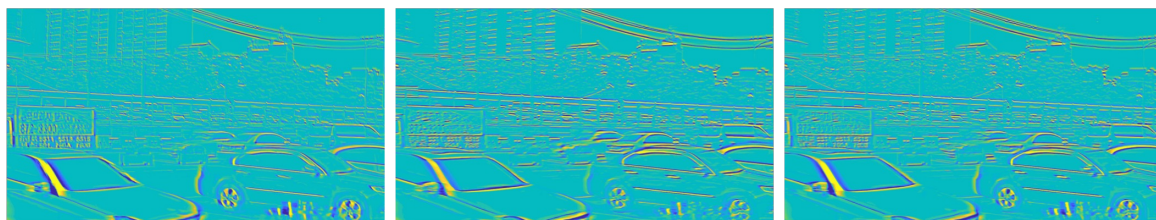
w/ Ours



$\hat{f}_1$



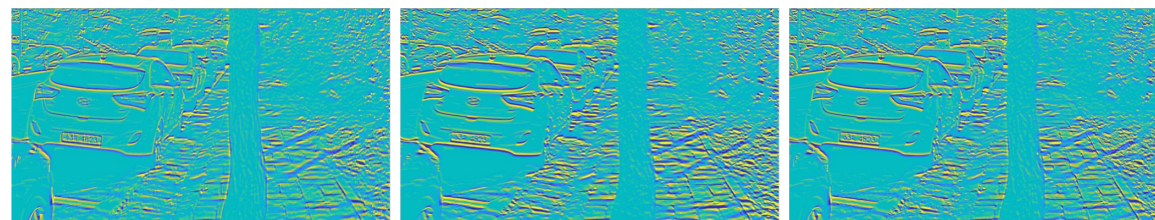
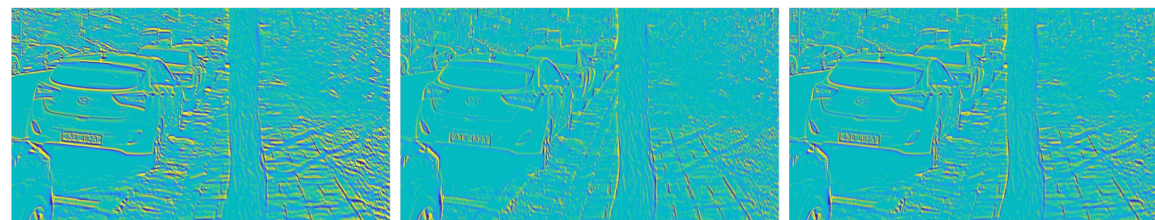
$\hat{f}_2$



MSCNN

DMPHN

PSS-NSC

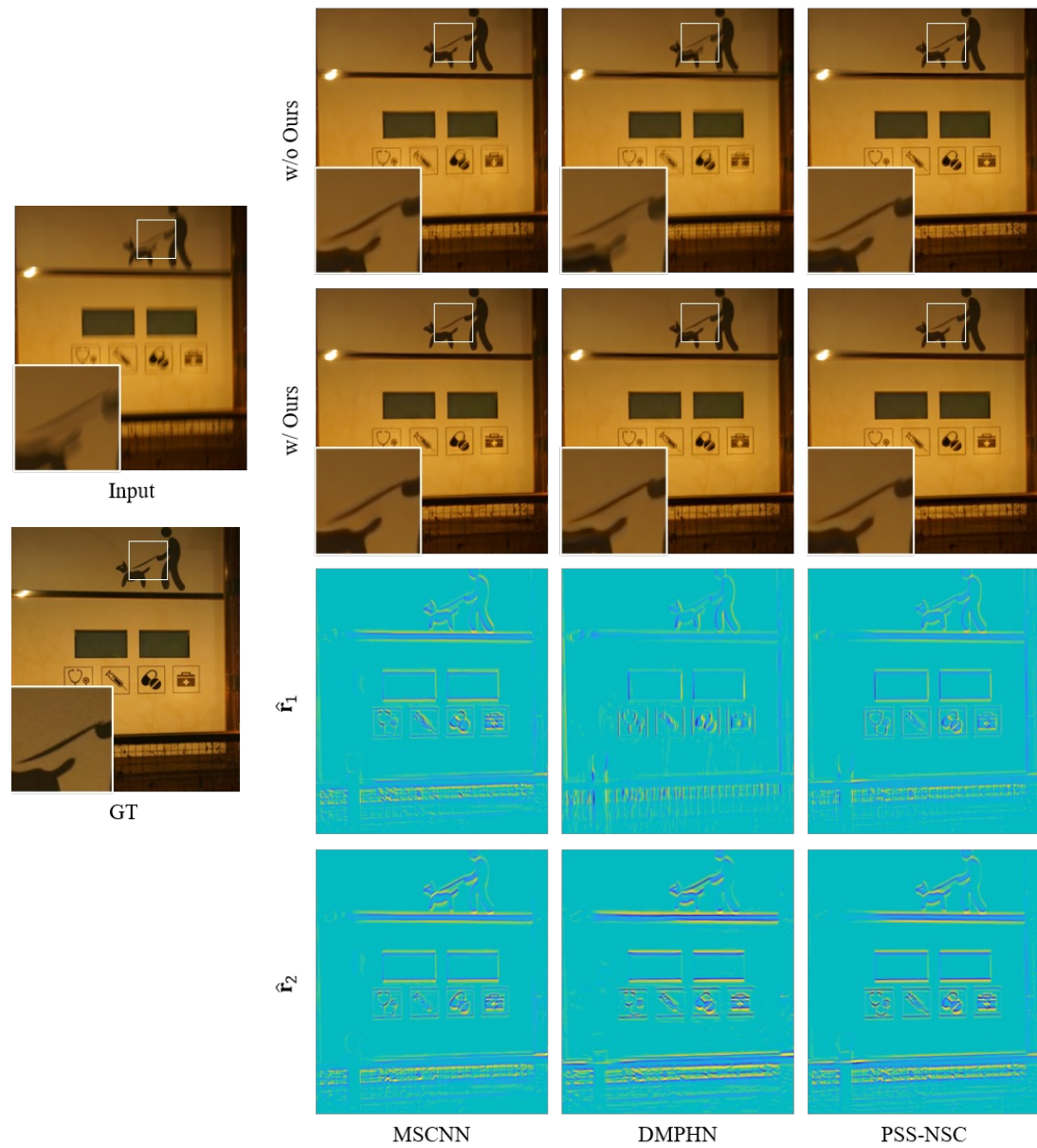
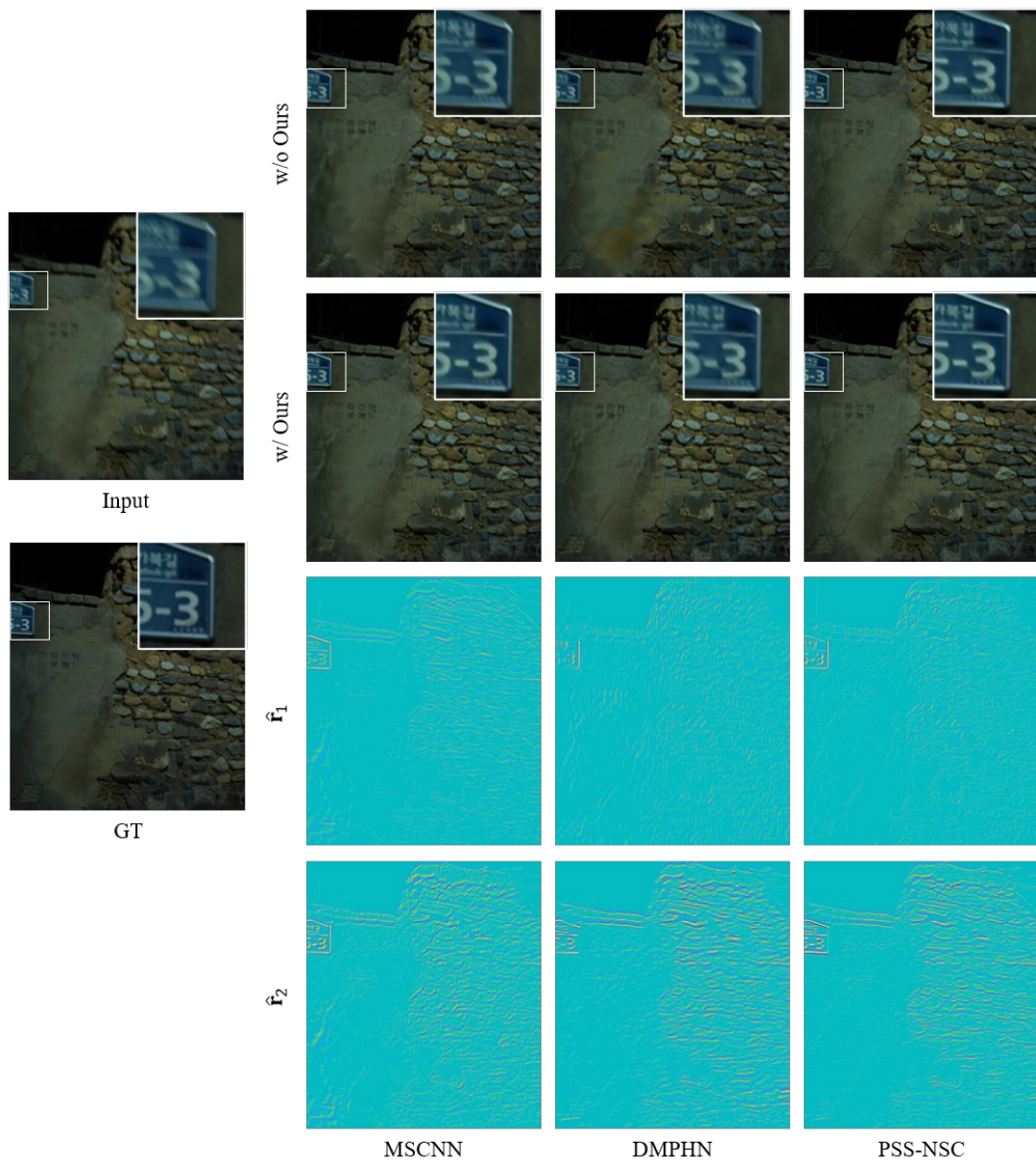


MSCNN

DMPHN

PSS-NSC

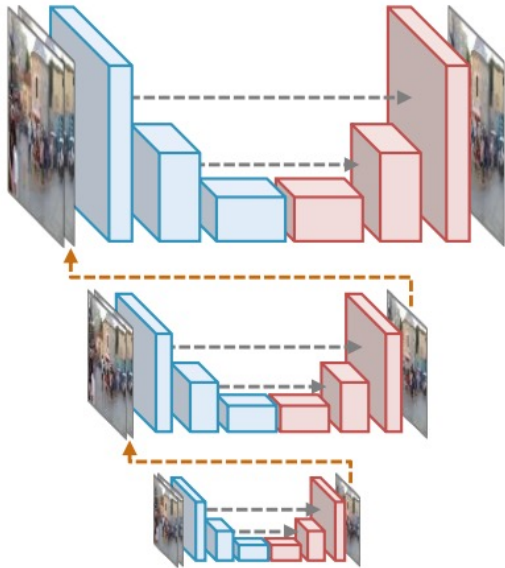
실험 결과



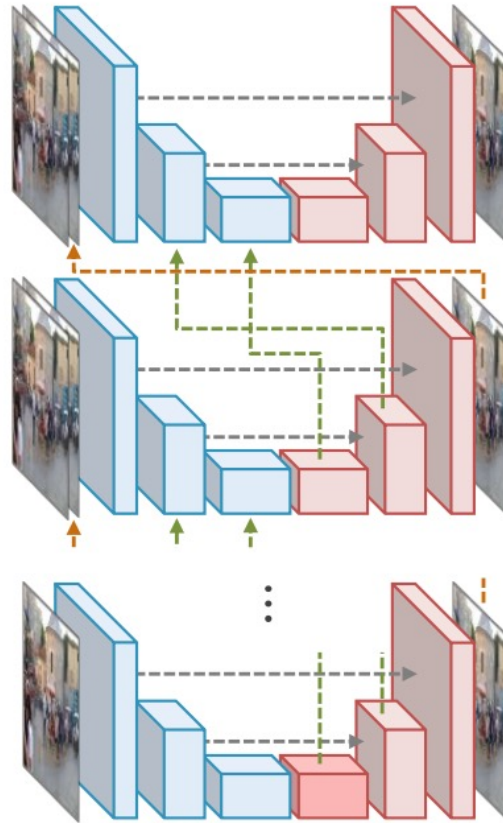
감사합니다.

E-mail: swkim@pknu.ac.kr

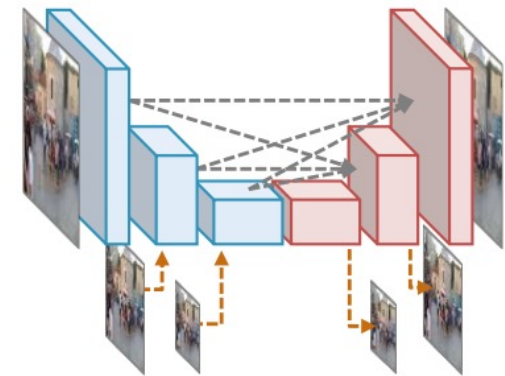
기존 기법



Gao et al., "Dynamic scene deblurring with parameter selective sharing and nested skip connections," CVPR 2019.



Park et al., "Multi-temporal recurrent neural networks for progressive non-uniform single image deblurring with incremental temporal training," ECCV 2020.



Cho et al., "Rethinking coarse-to-fine approach in single image deblurring," ICCV 2021.

U-Net

