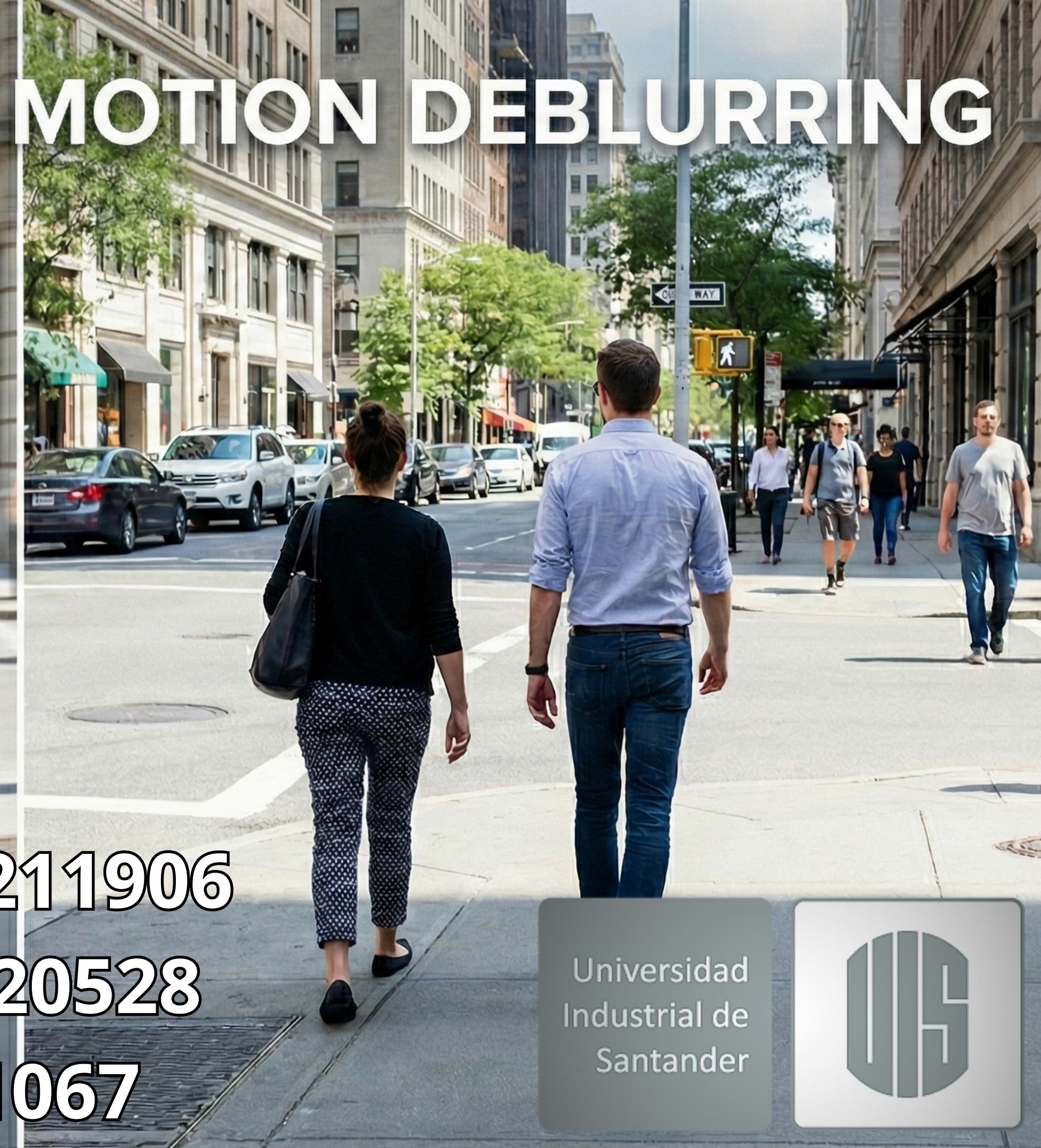


DEEP LEARNING FOR MOTION DEBLURRING



Cristian Alberto Solano - 2211906

Oscar Miguel Ortega - 2220528

Juan David Toloza - 2221067

Universidad
Industrial de
Santander



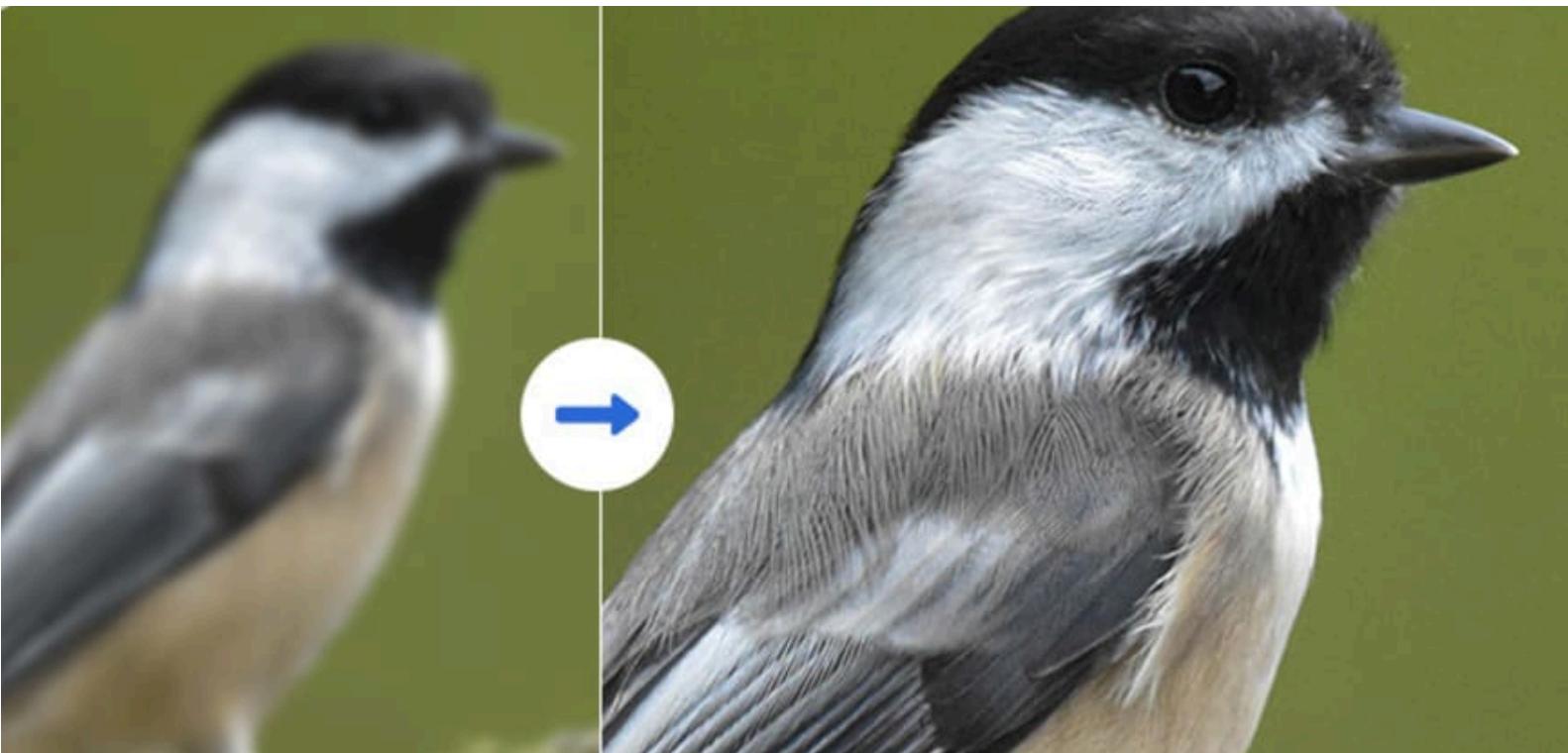
Motivación



El desenfoque de movimiento (motion blur) es un problema común en la adquisición de imágenes y videos, causado por el movimiento relativo entre la cámara y los objetos durante la exposición. Este fenómeno degrada la nitidez y los detalles de la imagen, afectando negativamente la calidad visual y el rendimiento de sistemas de visión por computador que dependen de dicha información, como la detección, el seguimiento o la reconstrucción.

Problema

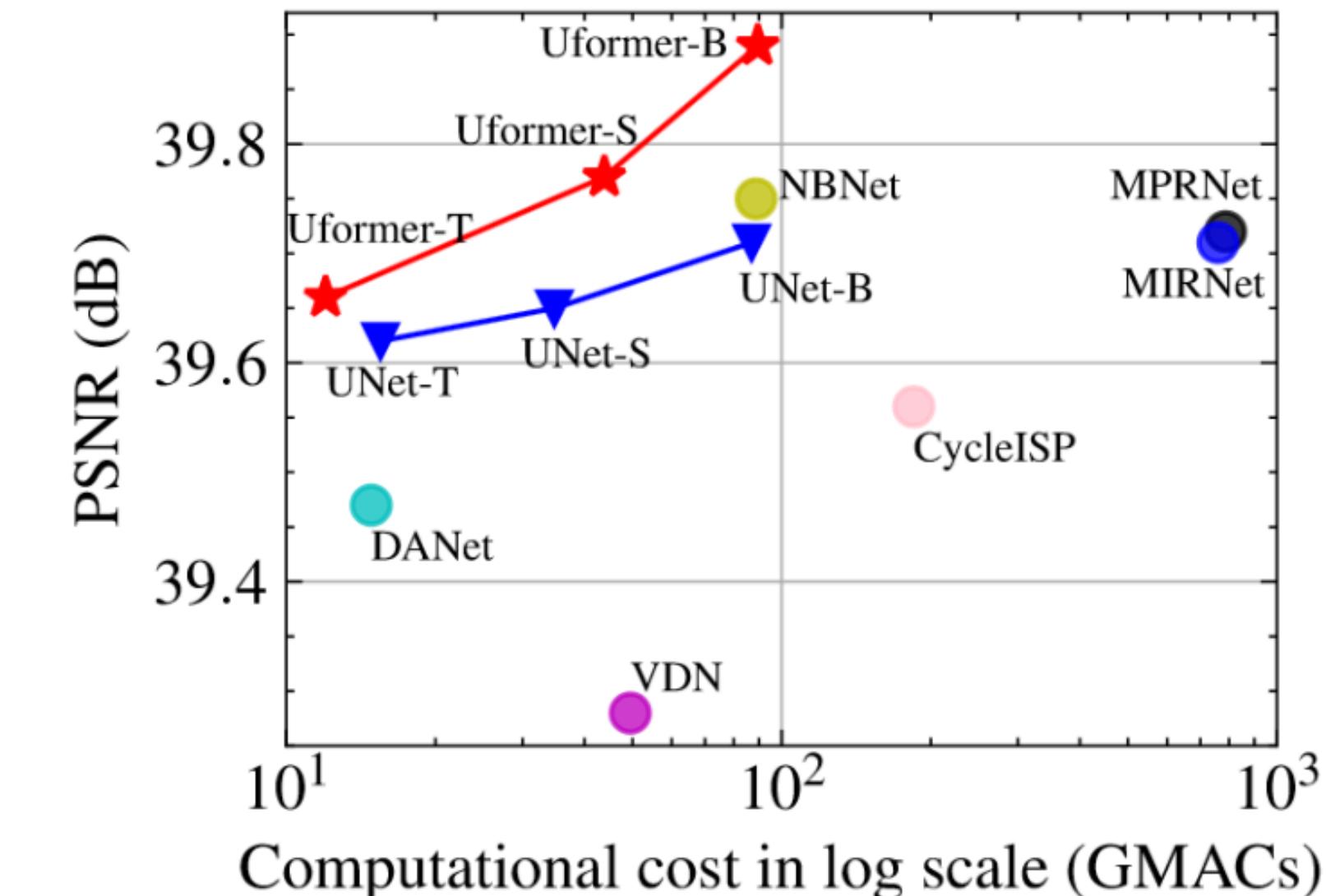
Para contrarrestar este tipo de desenfoque, se emplean técnicas de deblurring. Tradicionalmente, esto se ha abordado mediante modelos físicos y métodos de deconvolución



El proceso de deblurring consiste en recuperar una imagen nítida a partir de una versión borrosa, lo que implica resolver un problema inverso complejo y típicamente mal condicionado. En años recientes, los métodos basados en aprendizaje profundo (Deep Learning) han mostrado avances significativos frente a los enfoques tradicionales, gracias a su capacidad para aprender representaciones jerárquicas y modelar relaciones no lineales entre las regiones desenfocadas y su contraparte nítida.

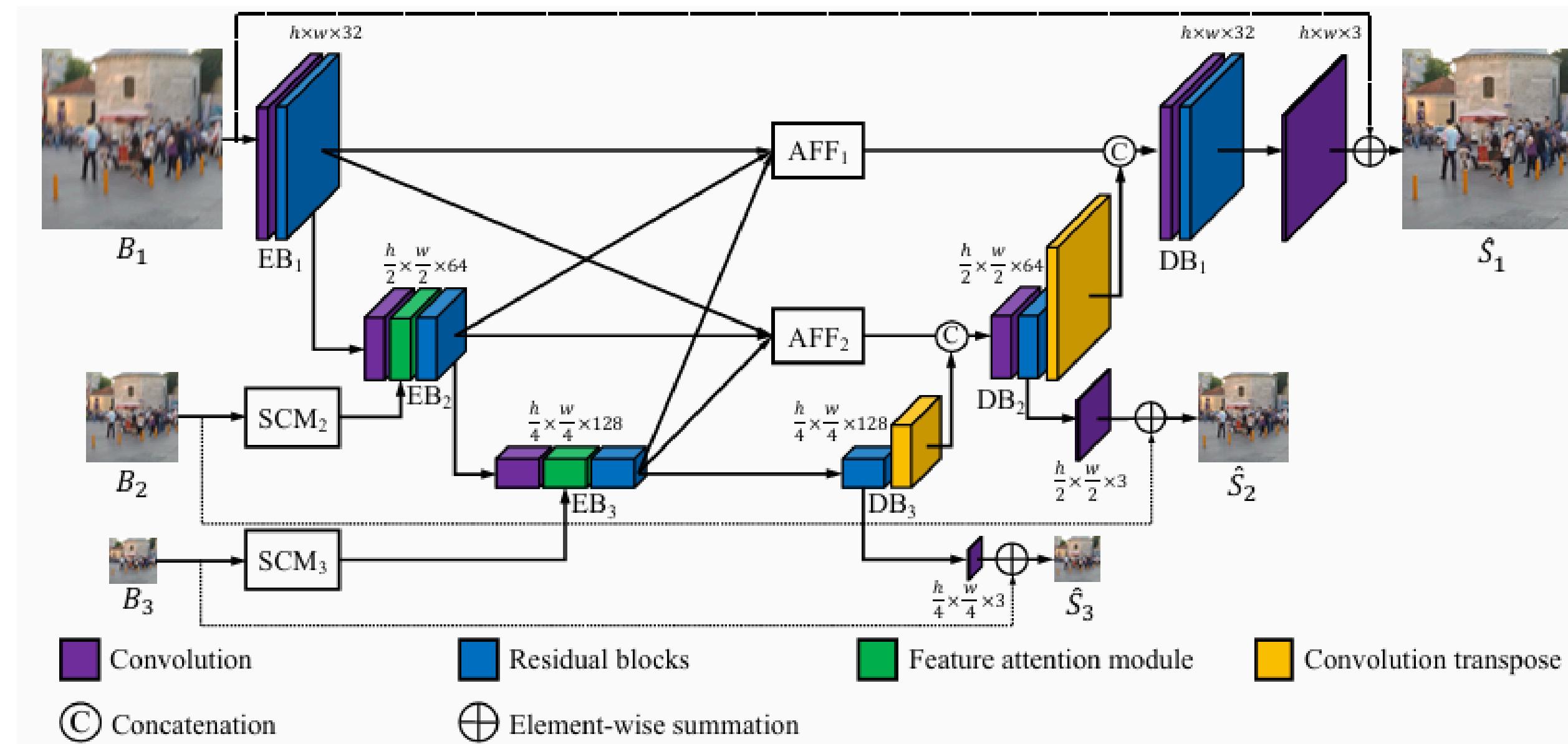
Objetivo

Explorar y comparar diversas estrategias de aprendizaje profundo, evaluando el rendimiento de modelos entrenados desde cero, redes preentrenadas mediante fine-tuning y arquitecturas físicamente basadas, con el fin de establecer una base sólida para la posterior implementación de métodos avanzados del estado del arte.



SoTA

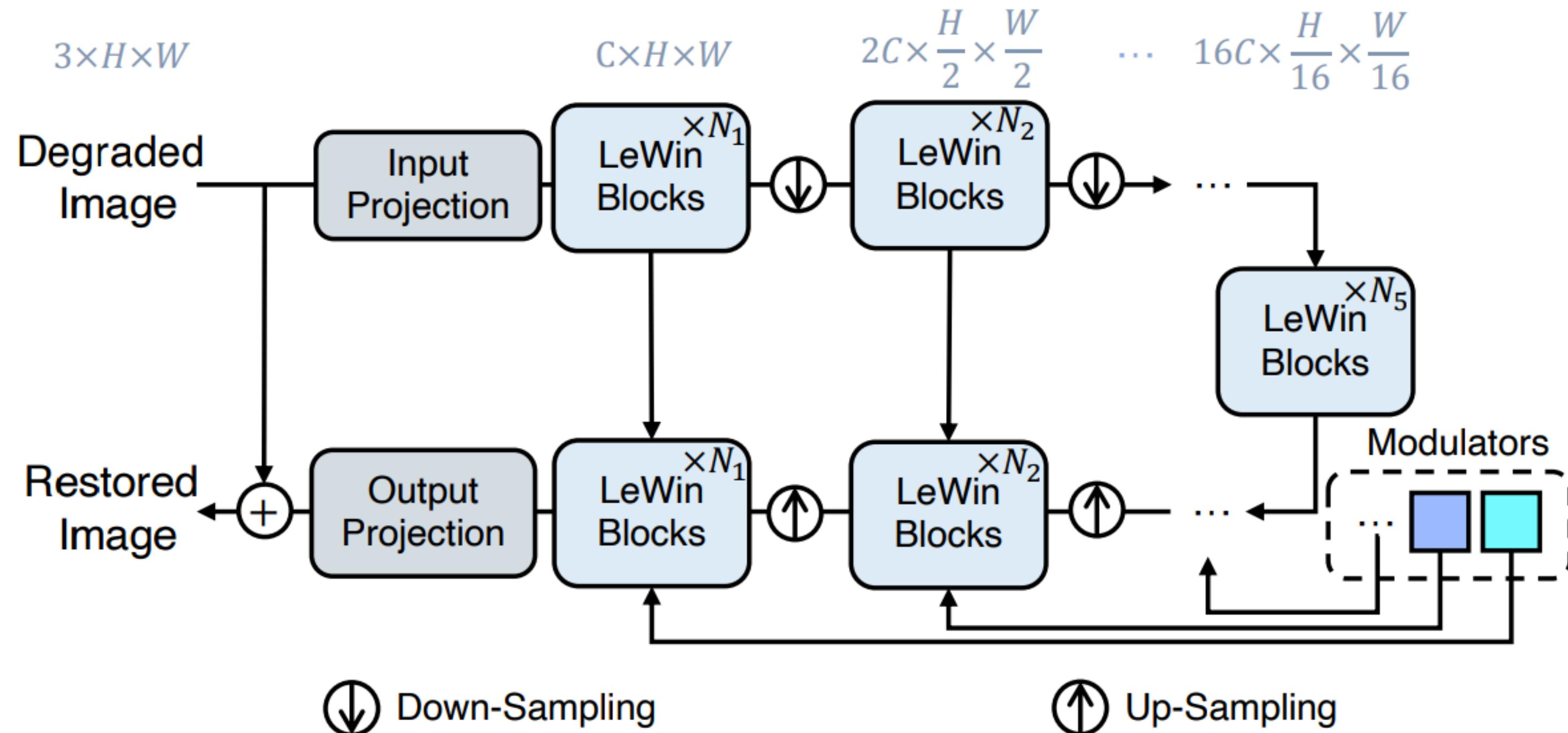
Rethinking Coarse-to-Fine Approach in Single Image Deblurring



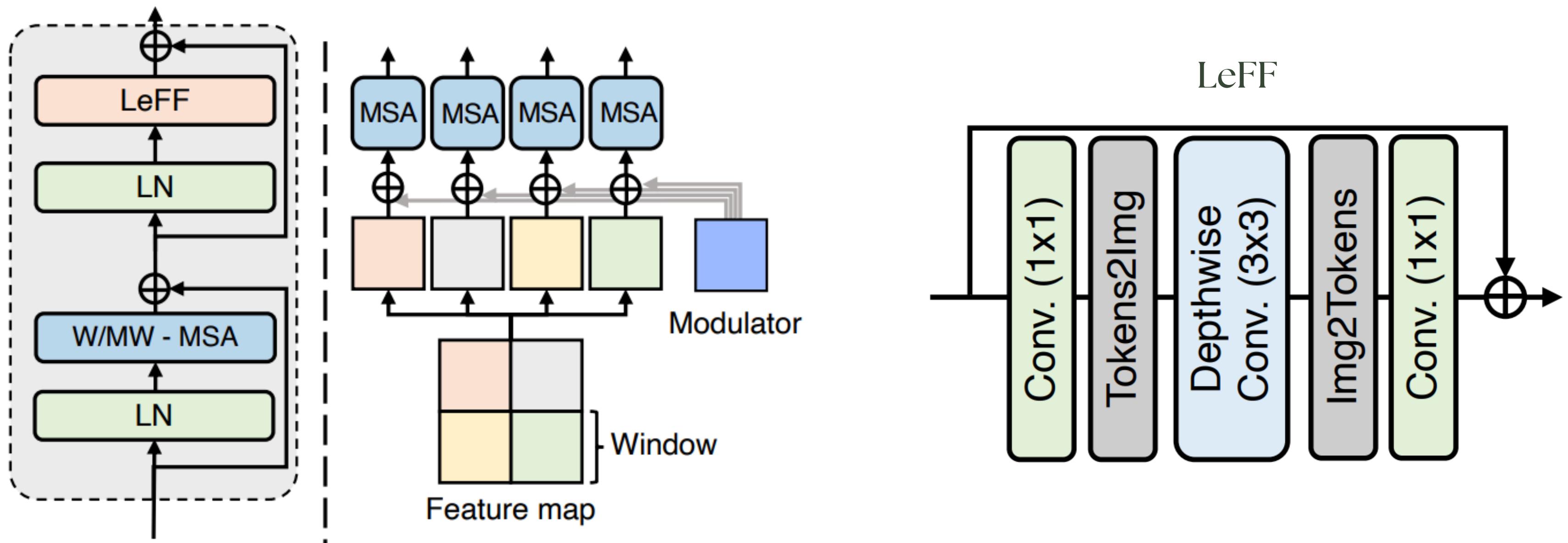
Rethinking Coarse-to-Fine Approach in Single Image Deblurring

Model	PSNR	SSIM	Runtime	Params.
DeepDeblur [20]	29.23	0.916	N/A	4.33
SRN [31]	30.26	0.934	0.342	1.87
PSS-NSC [5]	30.92	0.942	0.985	1.6
DMPHN [35]	31.20	0.945	1.061	0.424
SAPHN† [29]	31.85	0.948	N/A	0.34
SAPHN‡ [29]	32.02	0.953	N/A	0.77
MT-RNN [22]	31.15	0.945	0.063	0.07
RADN [23]	31.76	0.953	N/A	0.038
SVDN [33]	29.81	0.937	N/A	<u>0.01</u>
MPRNet [34]	<u>32.66</u>	<u>0.959</u>	0.162	0.18
MIMO-UNet	31.73	0.951	0.008	6.8
MIMO-UNet+	32.45	0.957	0.017	16.1
MIMO-UNet++	32.68	0.959	0.040	16.1

Uformer



Uformer

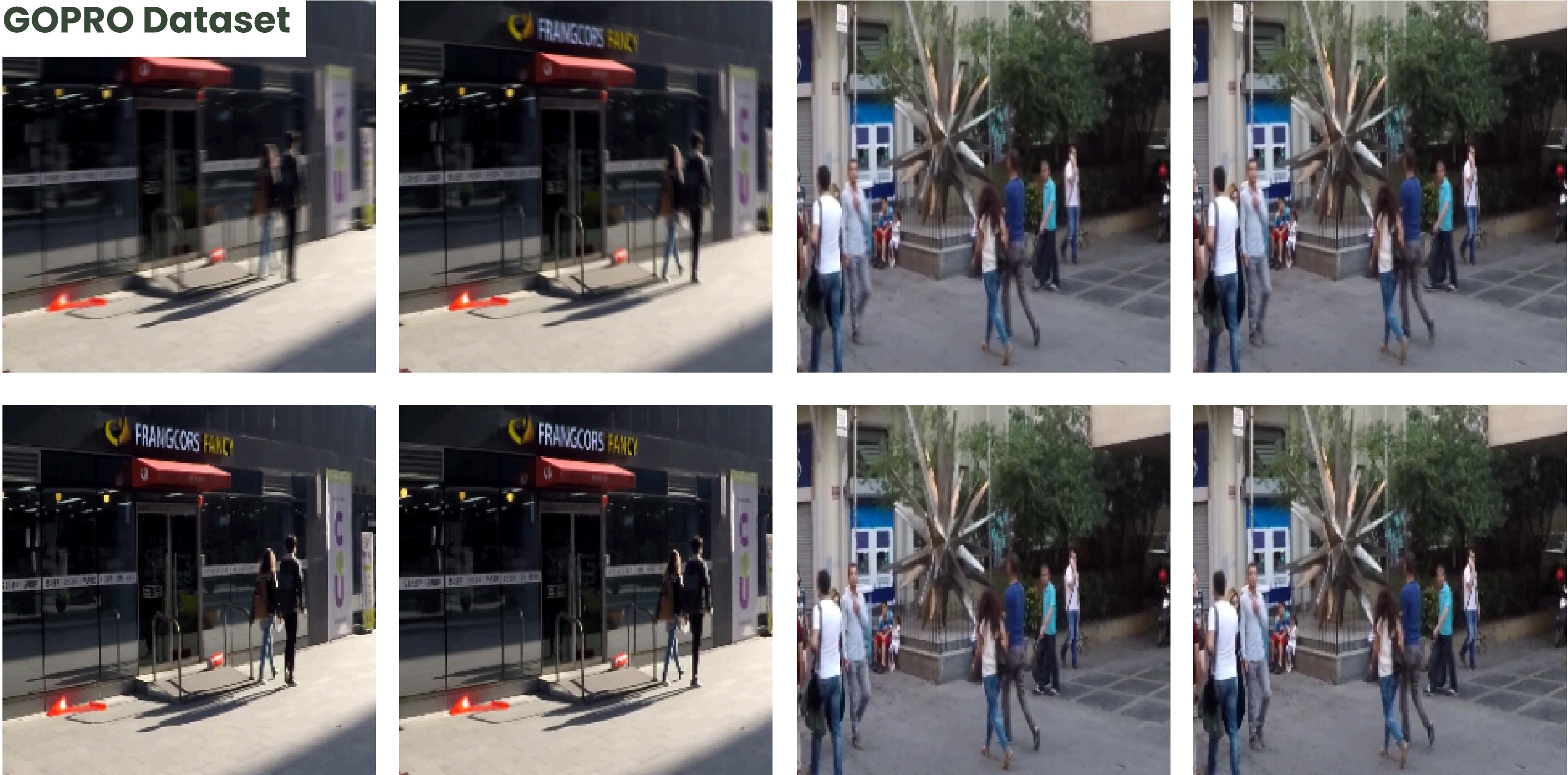


Uformer

	GMACs	# Param	PSNR ↑
UNet-T	15.49G	9.50M	39.62
UNet-S	34.76G	21.38M	39.65
UNet-B	86.97G	53.58M	39.71
ViT	8.83G	14.86M	38.51
Uformer-T	12.00G	5.23M	39.66
Uformer-S	43.86G	20.63M	39.77
Uformer-B	89.46G	50.88M	39.89

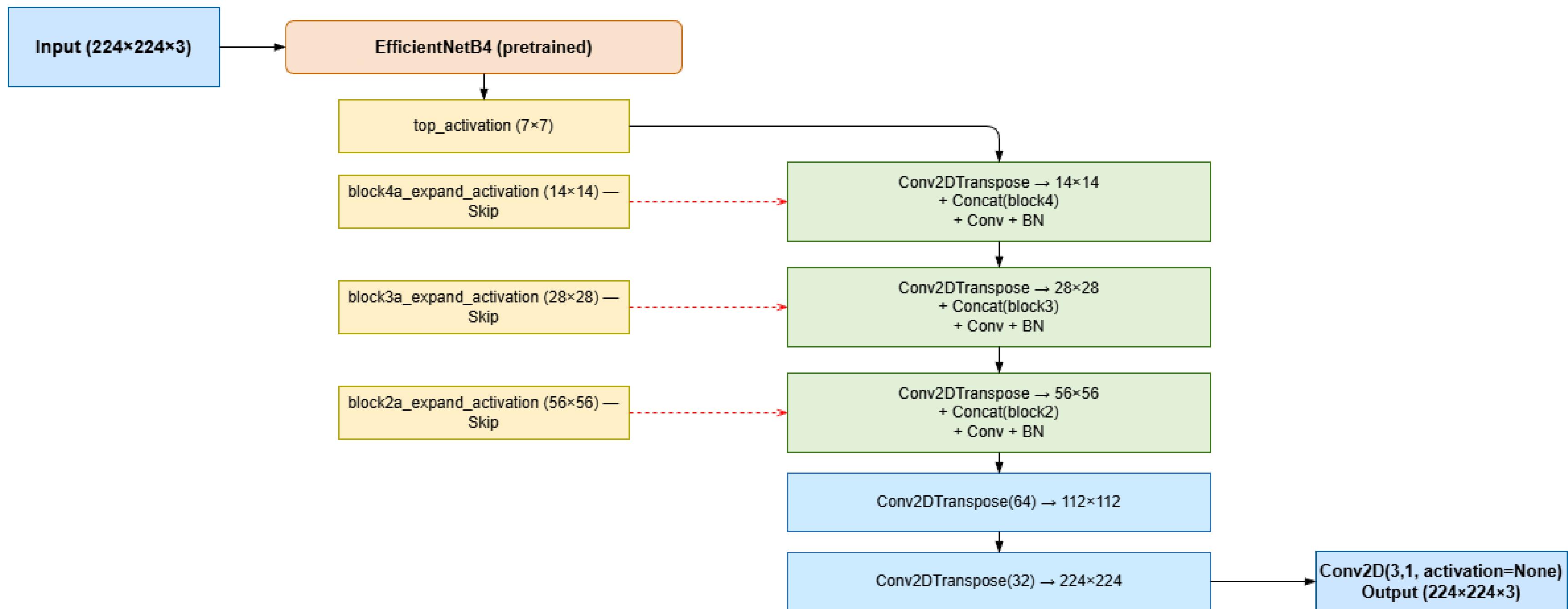
GOPRO DATASET

GOPRO Dataset

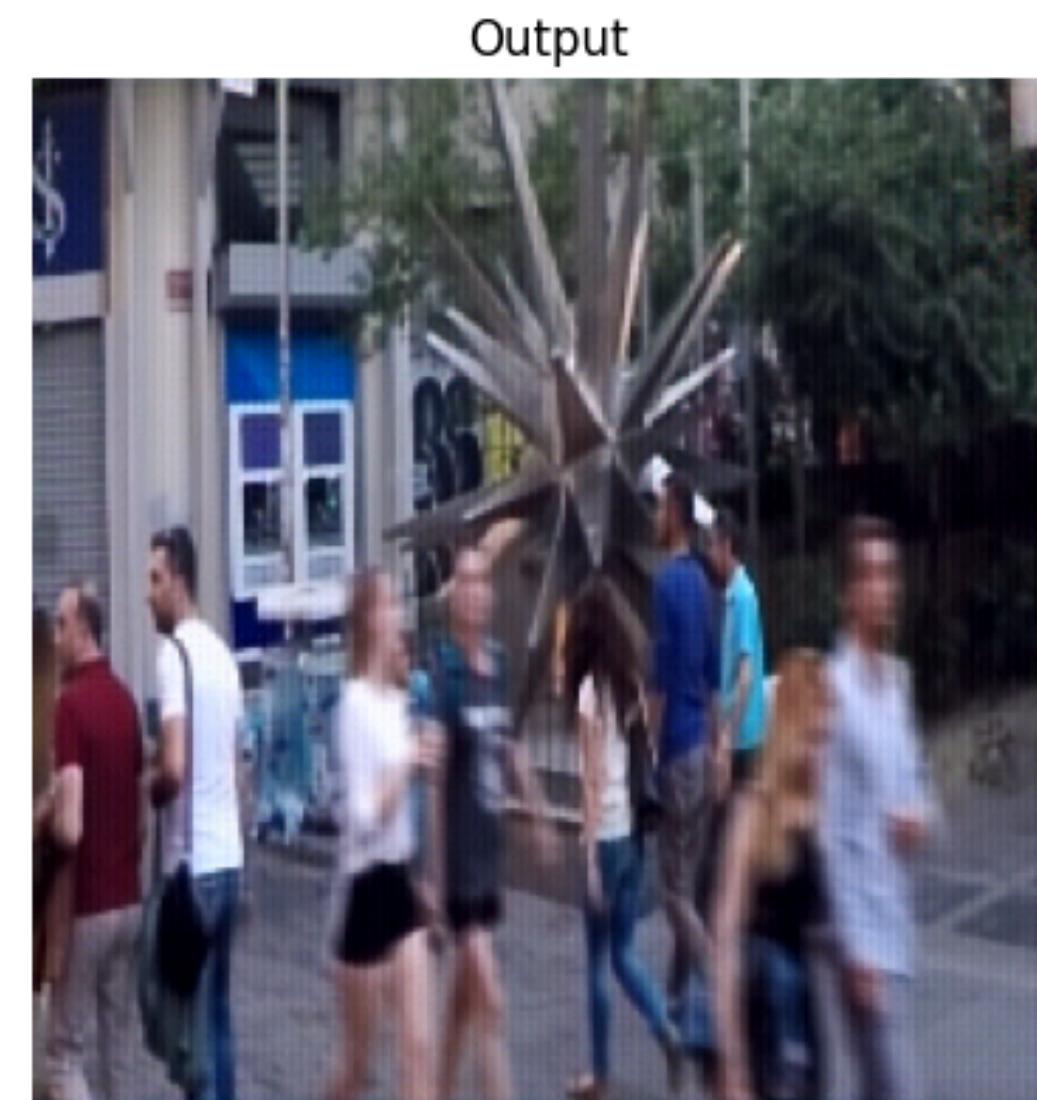
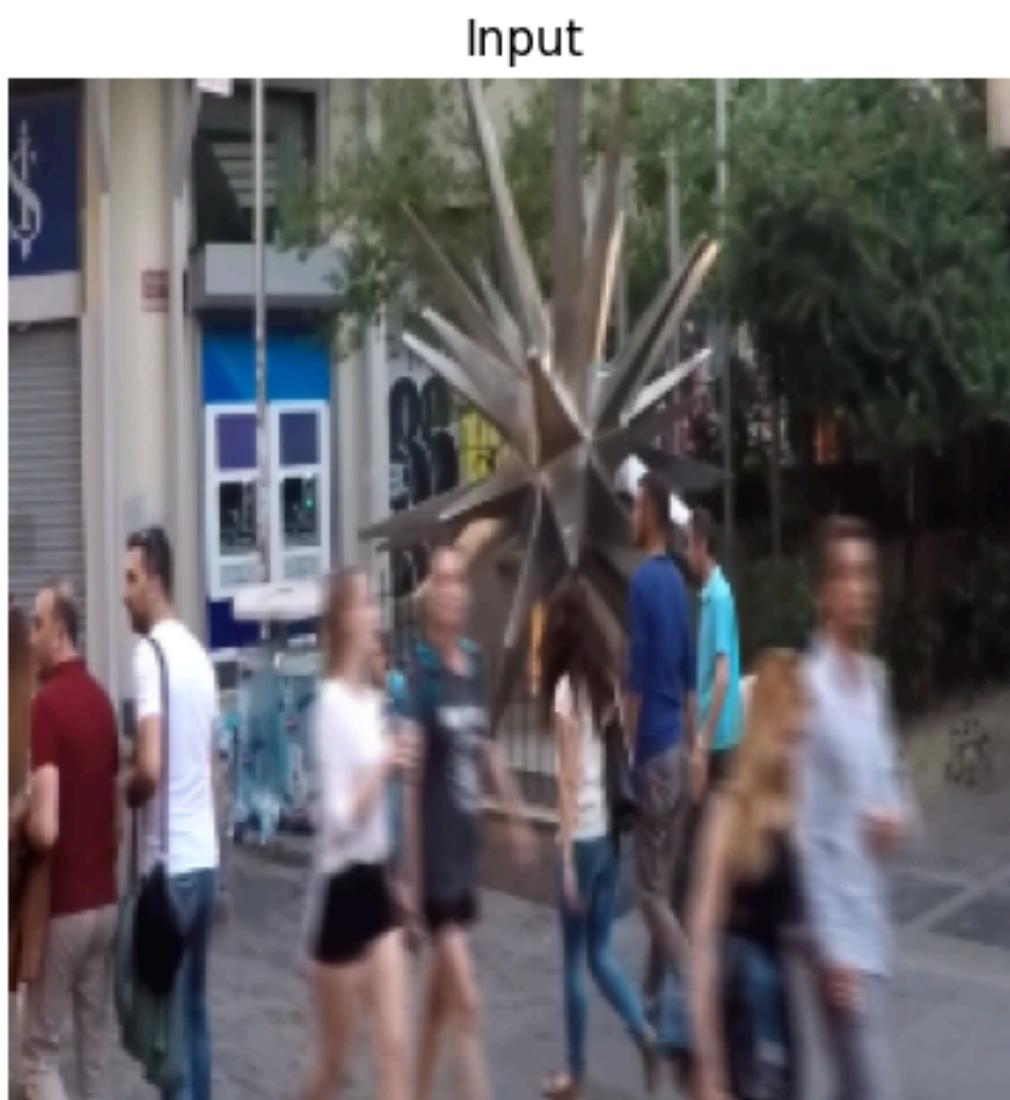


GOPRO Dataset

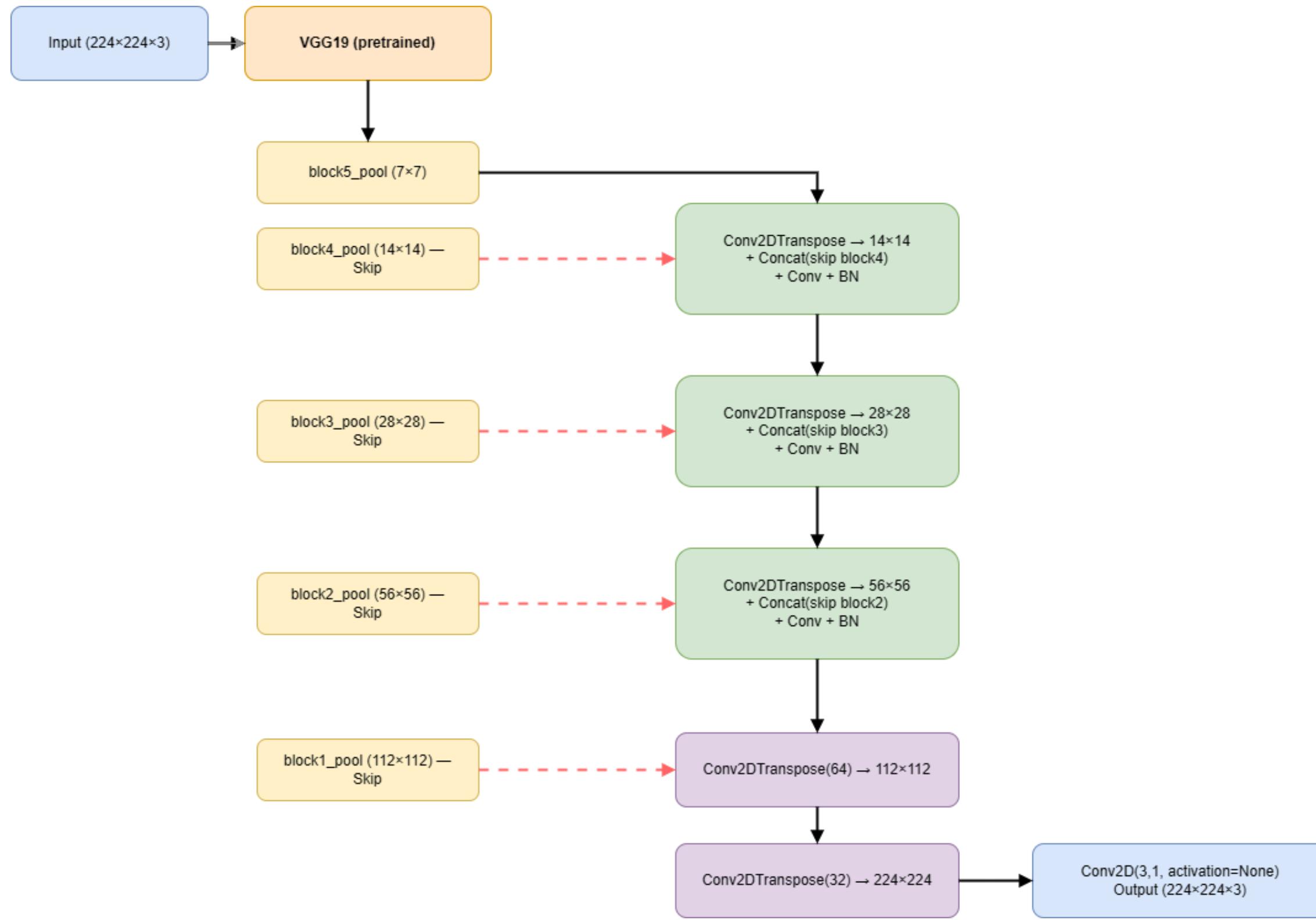
Fine Tunning EfficientNetB4



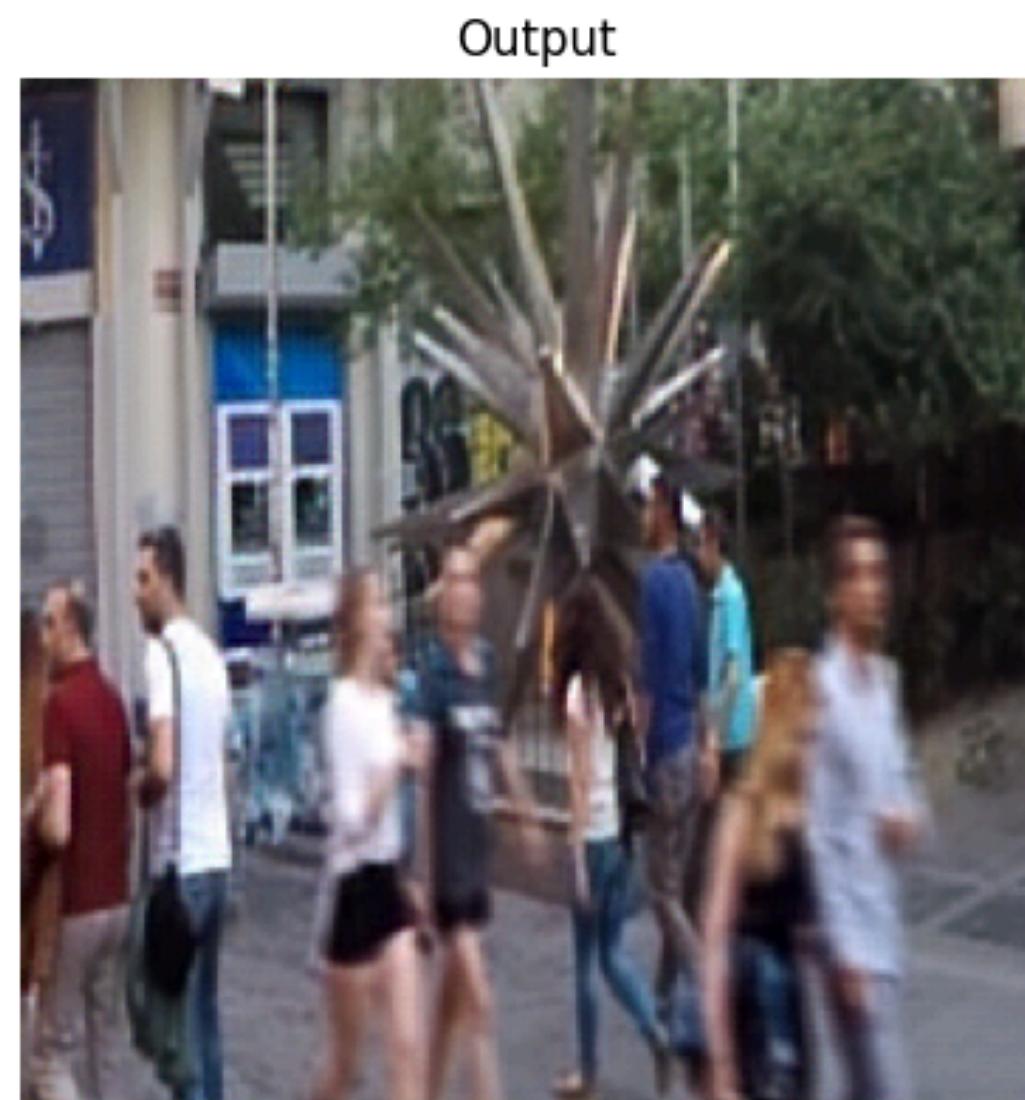
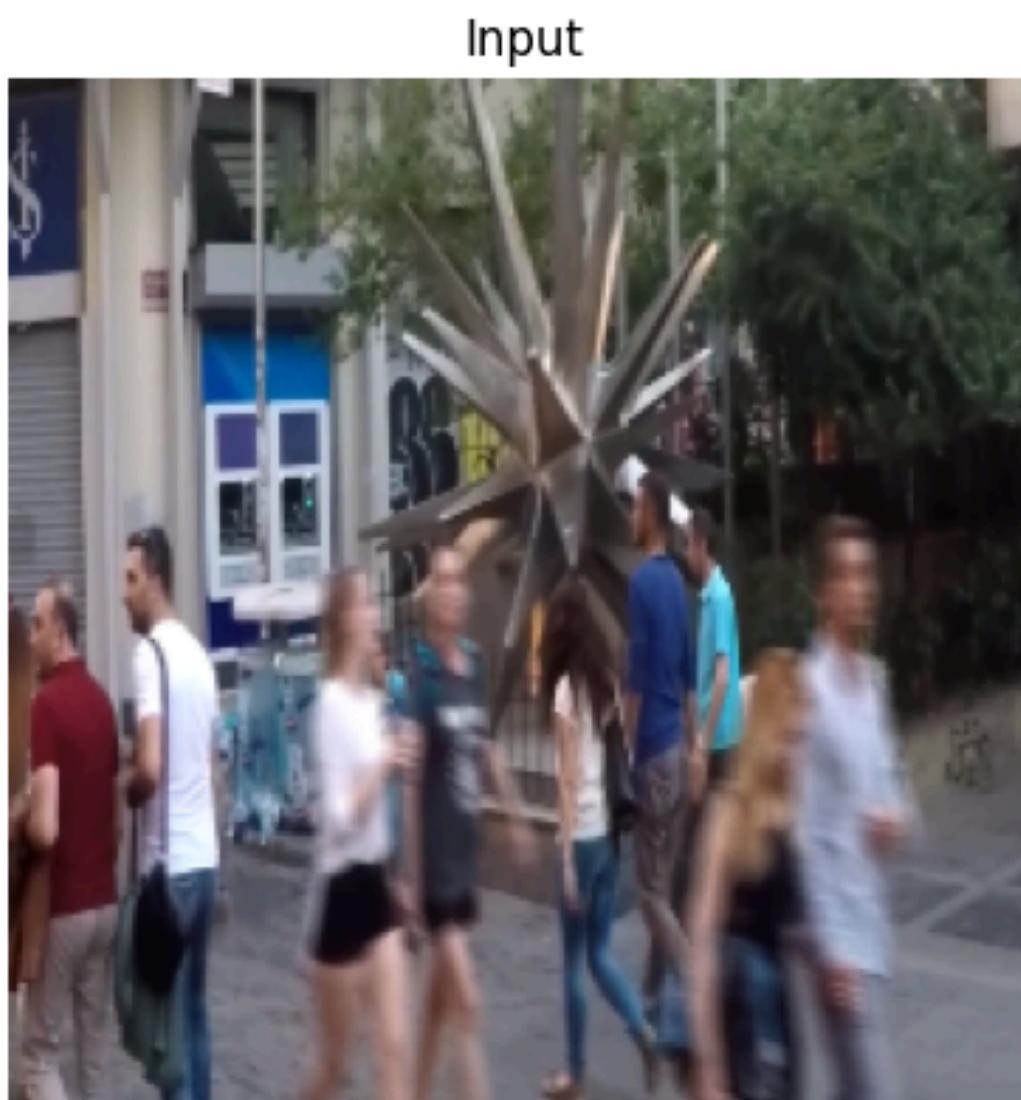
Fine Tunning EfficientNetB4



Fine Tunning VGG19



Fine Tunning VGG19



Métricas

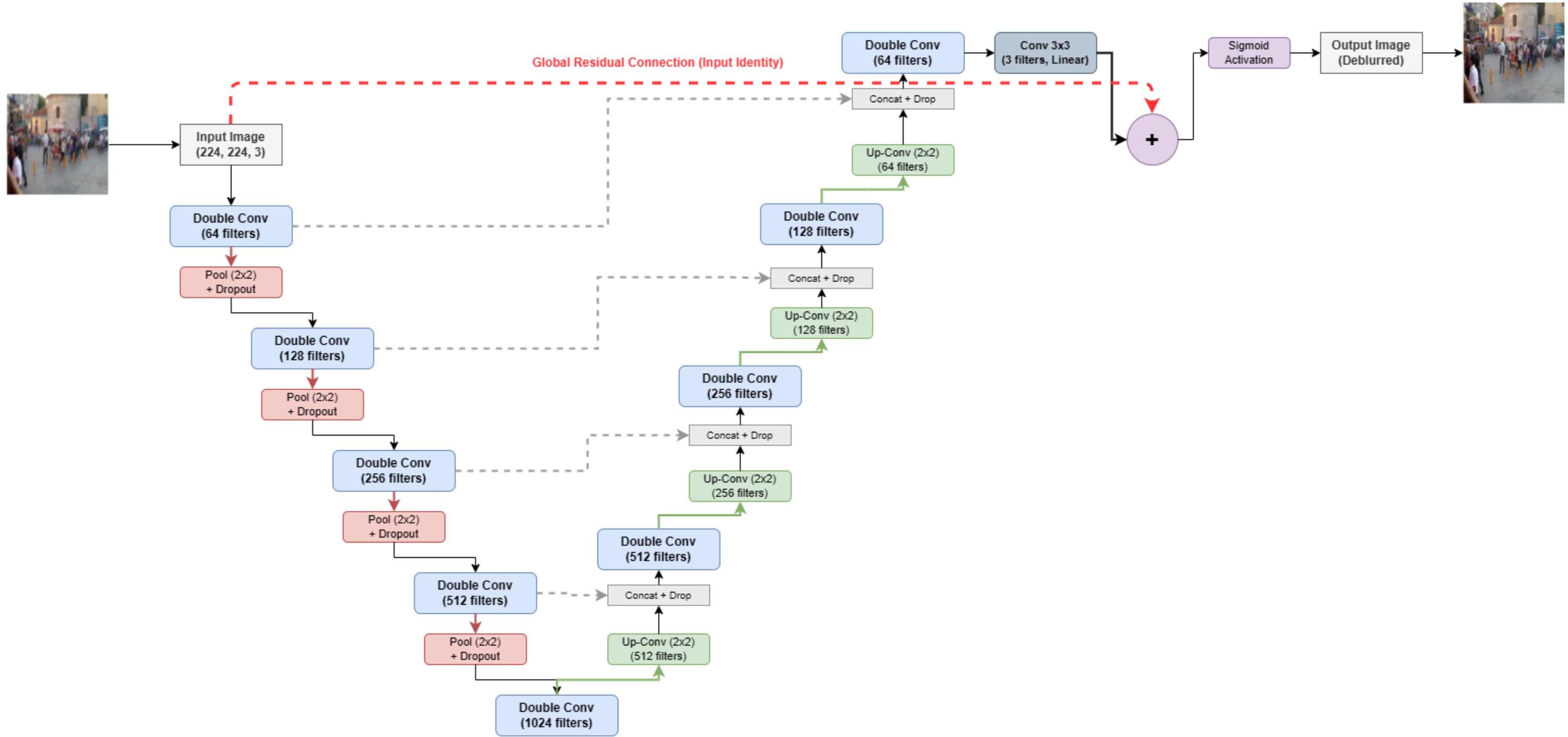
	PSNR	SSIM
DNN	14.83 dB	0,2655
Fine Tuning EfficientNetB4	17.42 dB	0,7575
Fine Tuning VGG19	18.42 dB	0,7641

UPDATES



Residual U-net

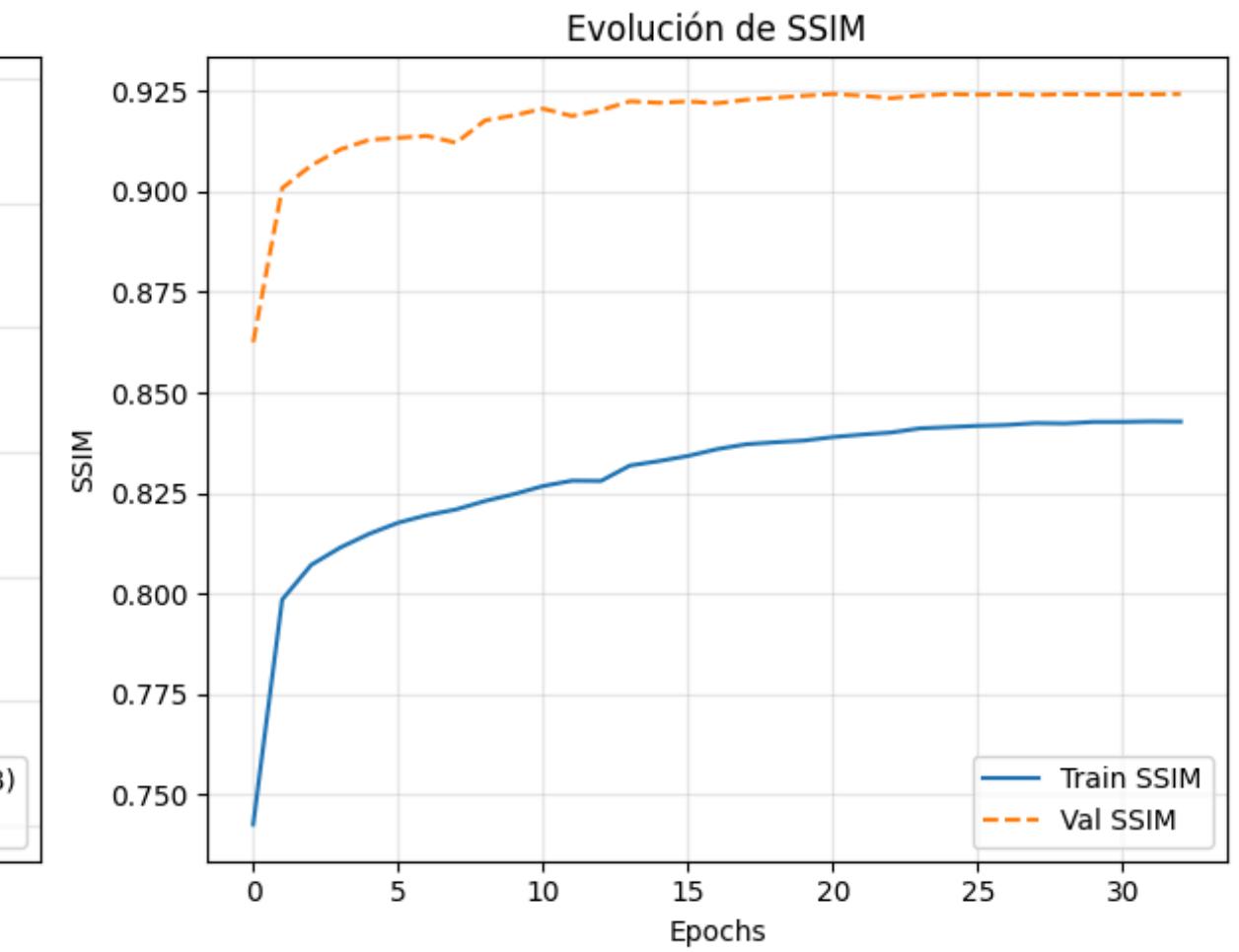
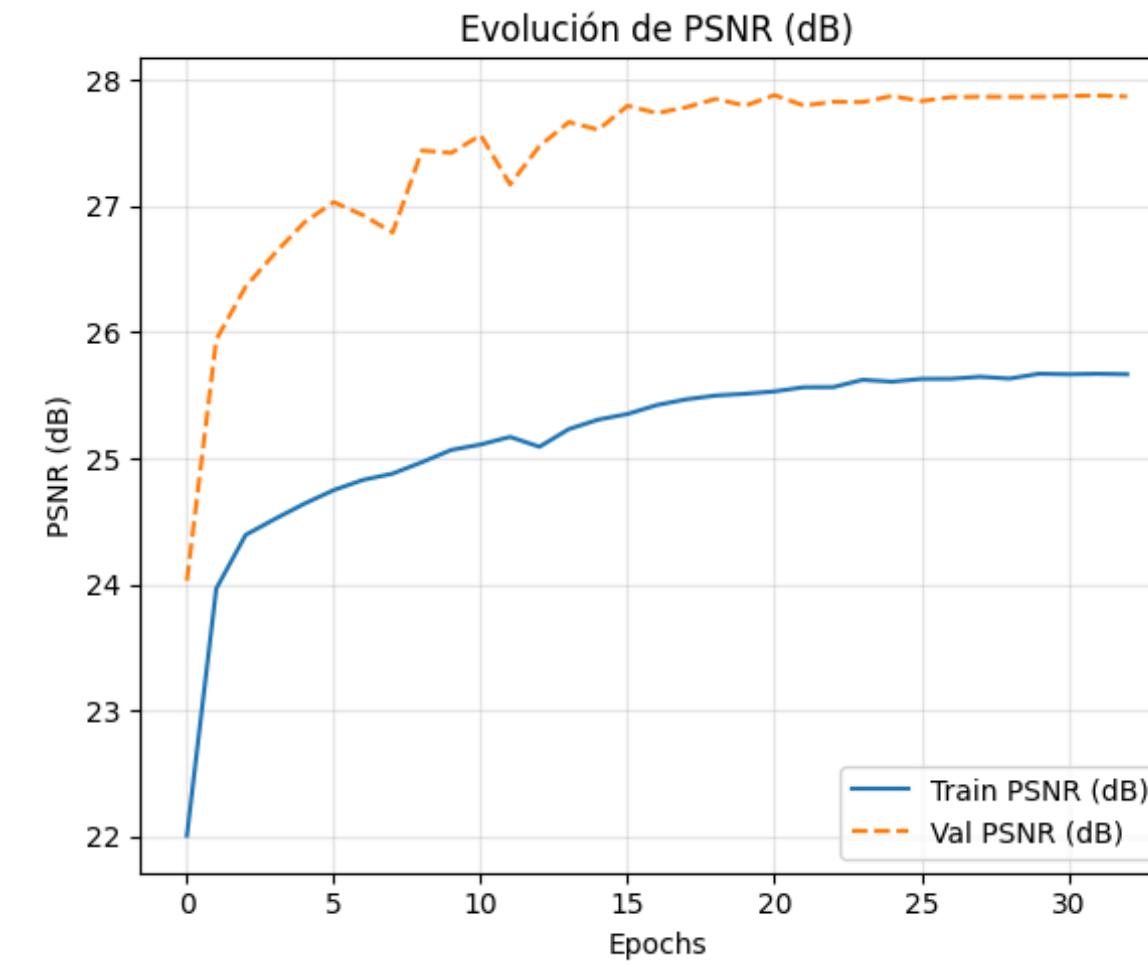
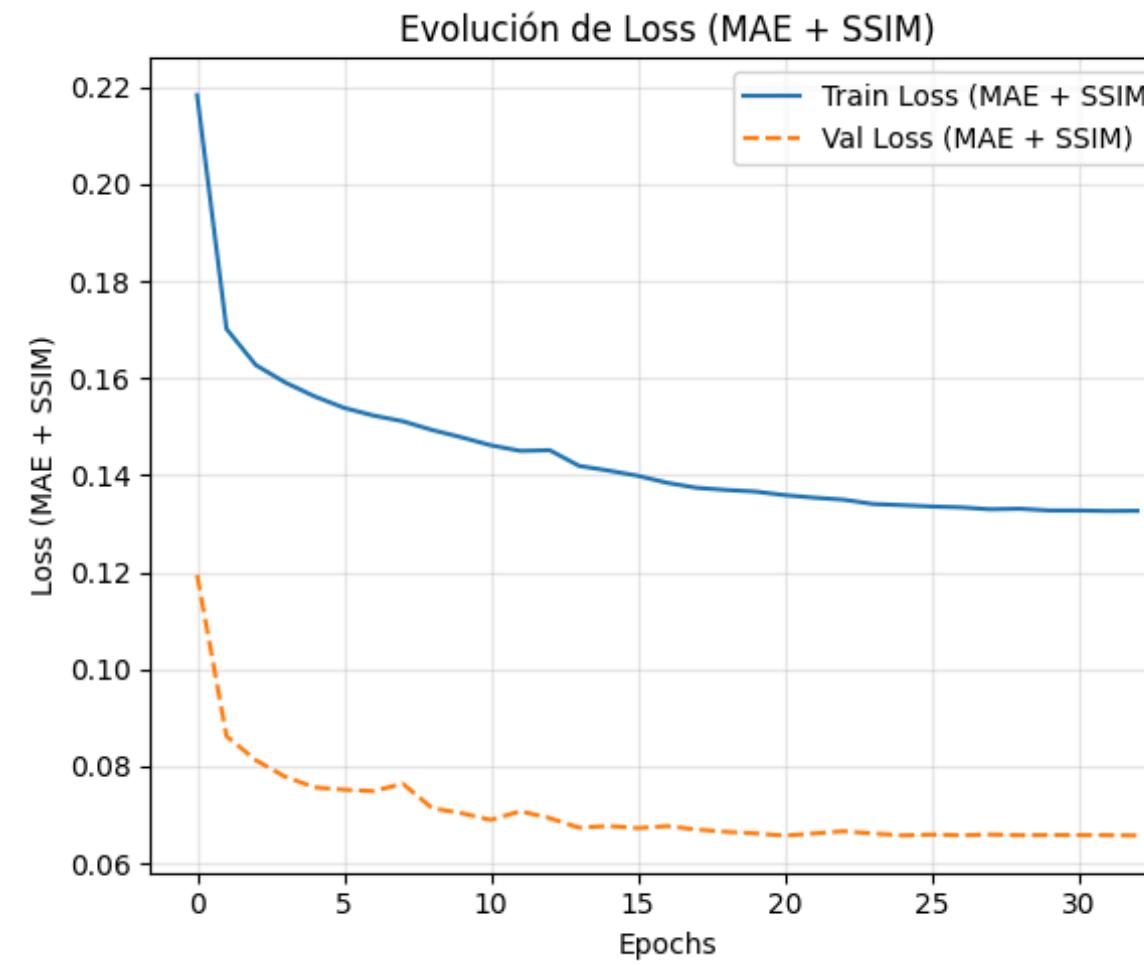
19





Residual U-net

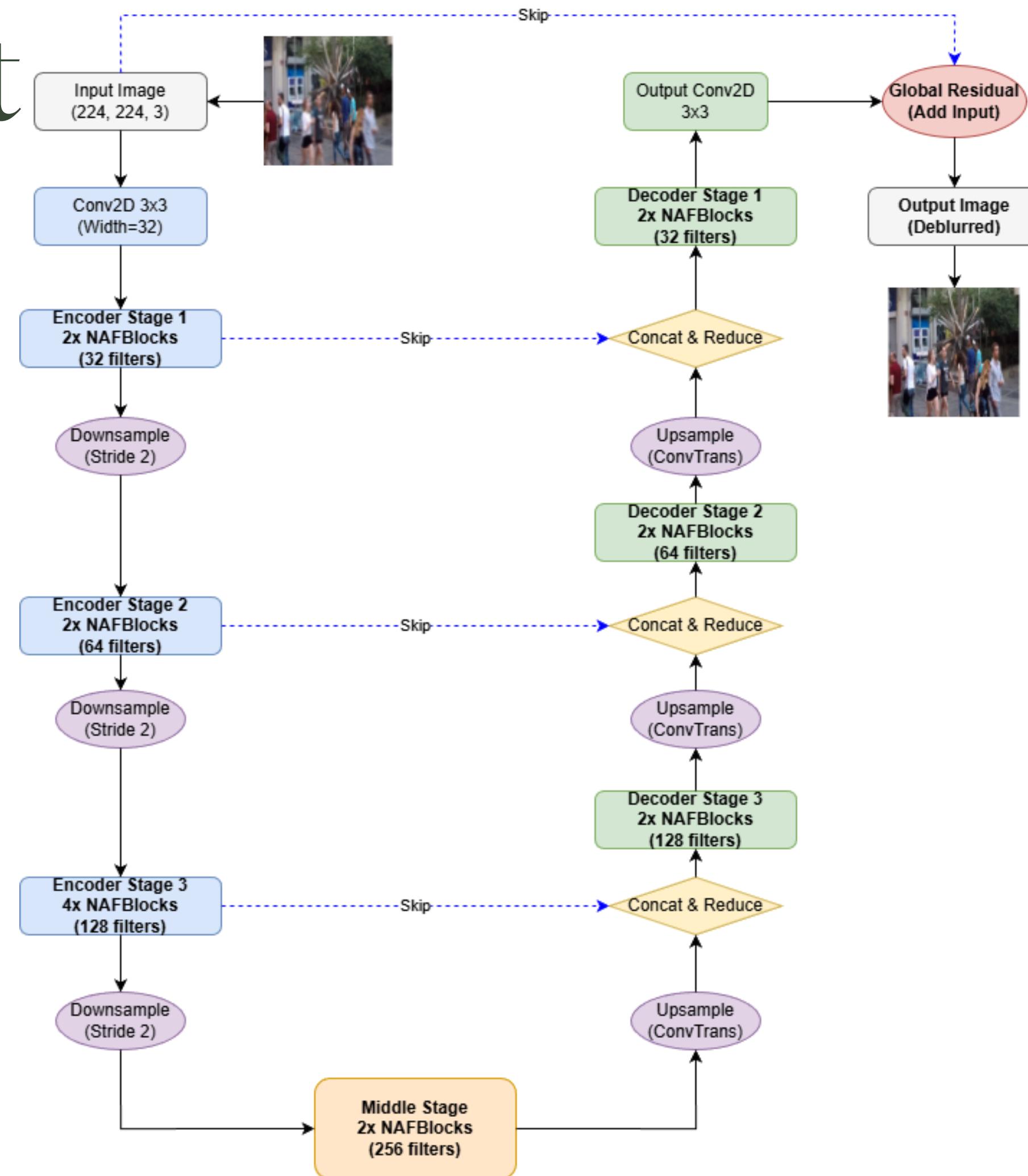
20





NAFNet

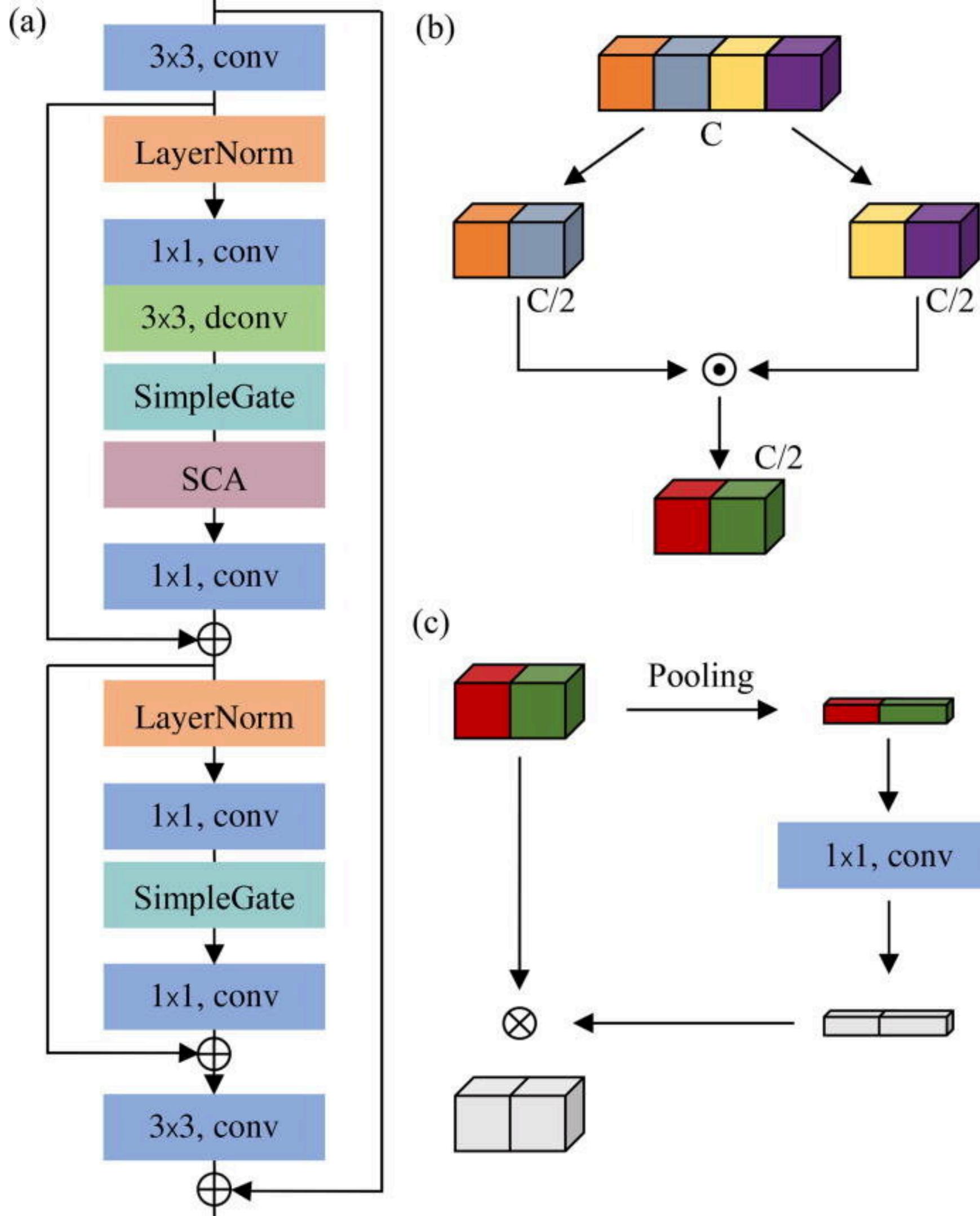
21

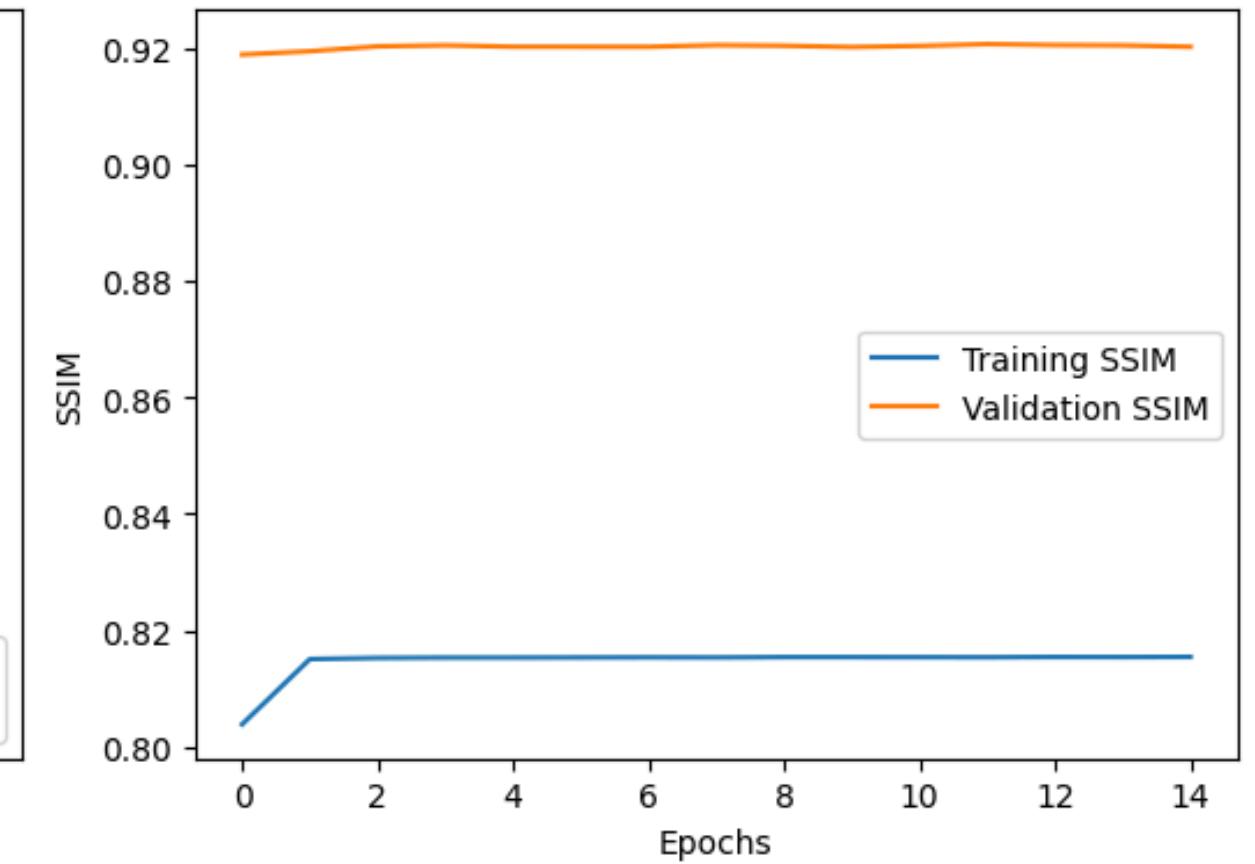
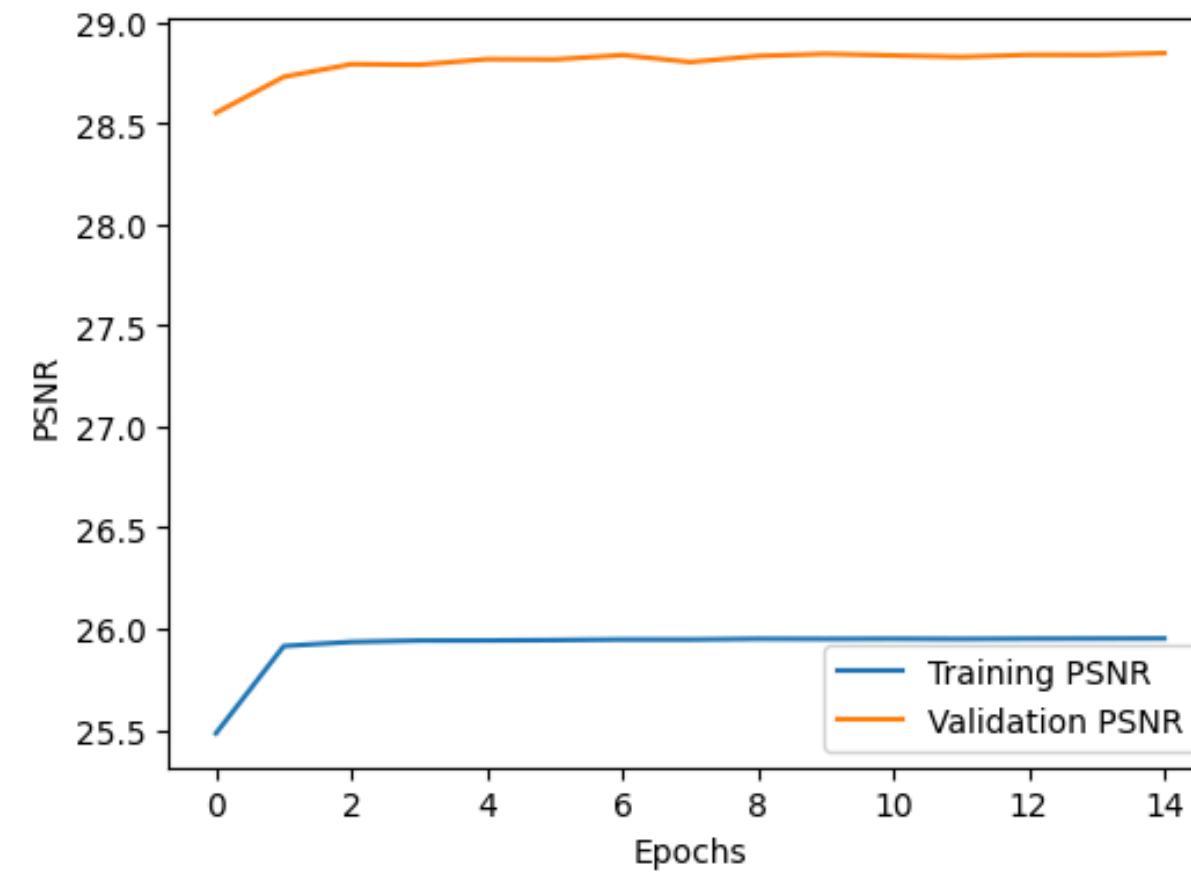
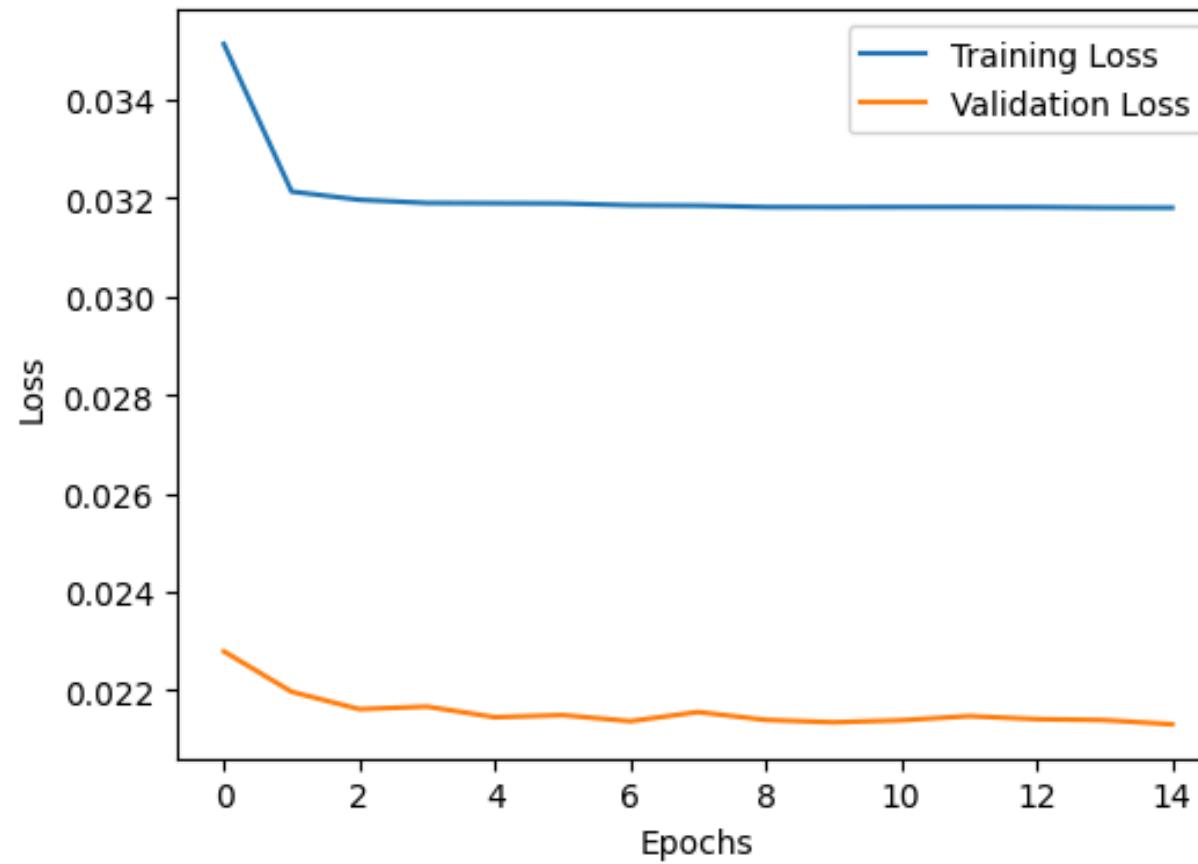




NAFNet

22

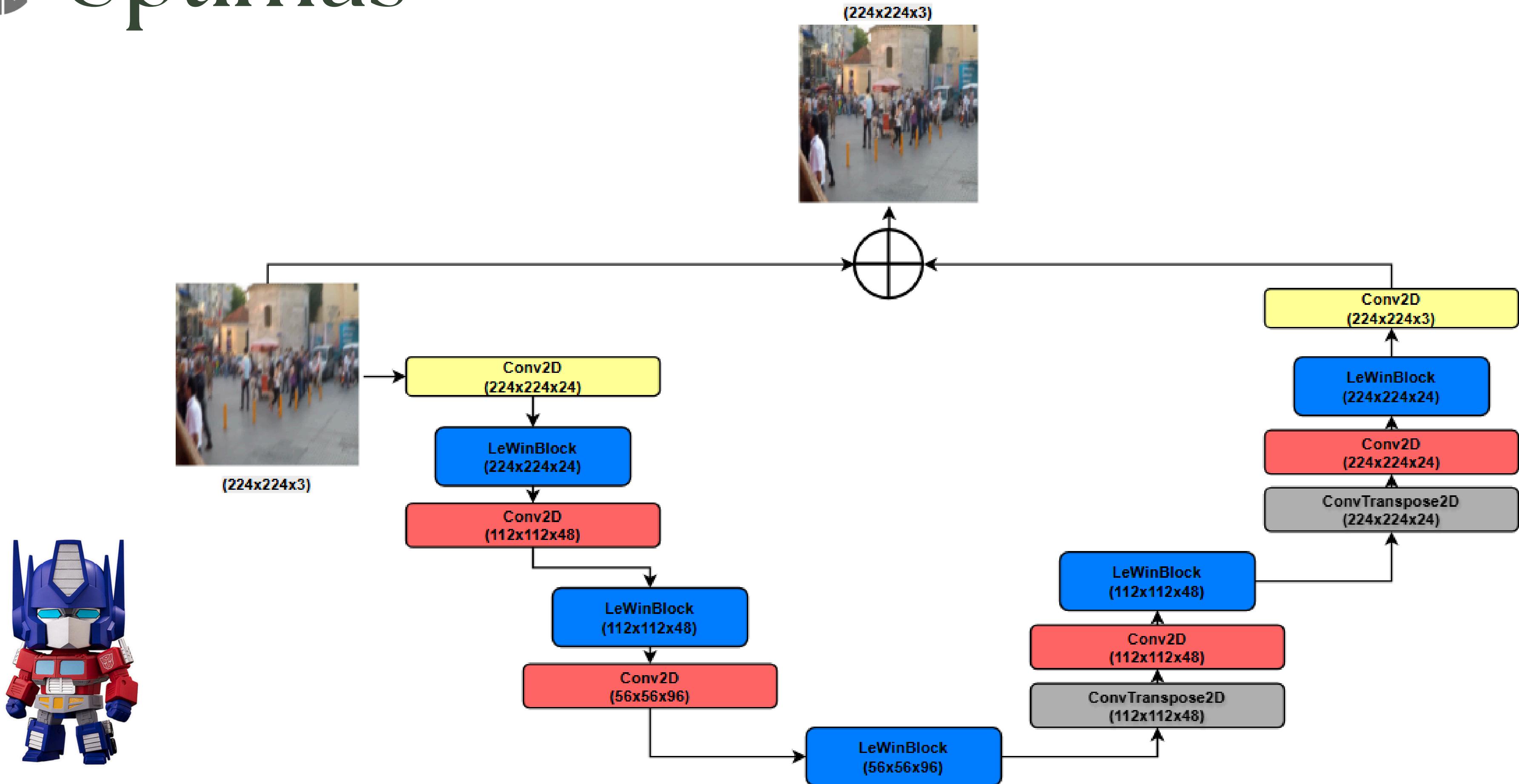






Uptimus

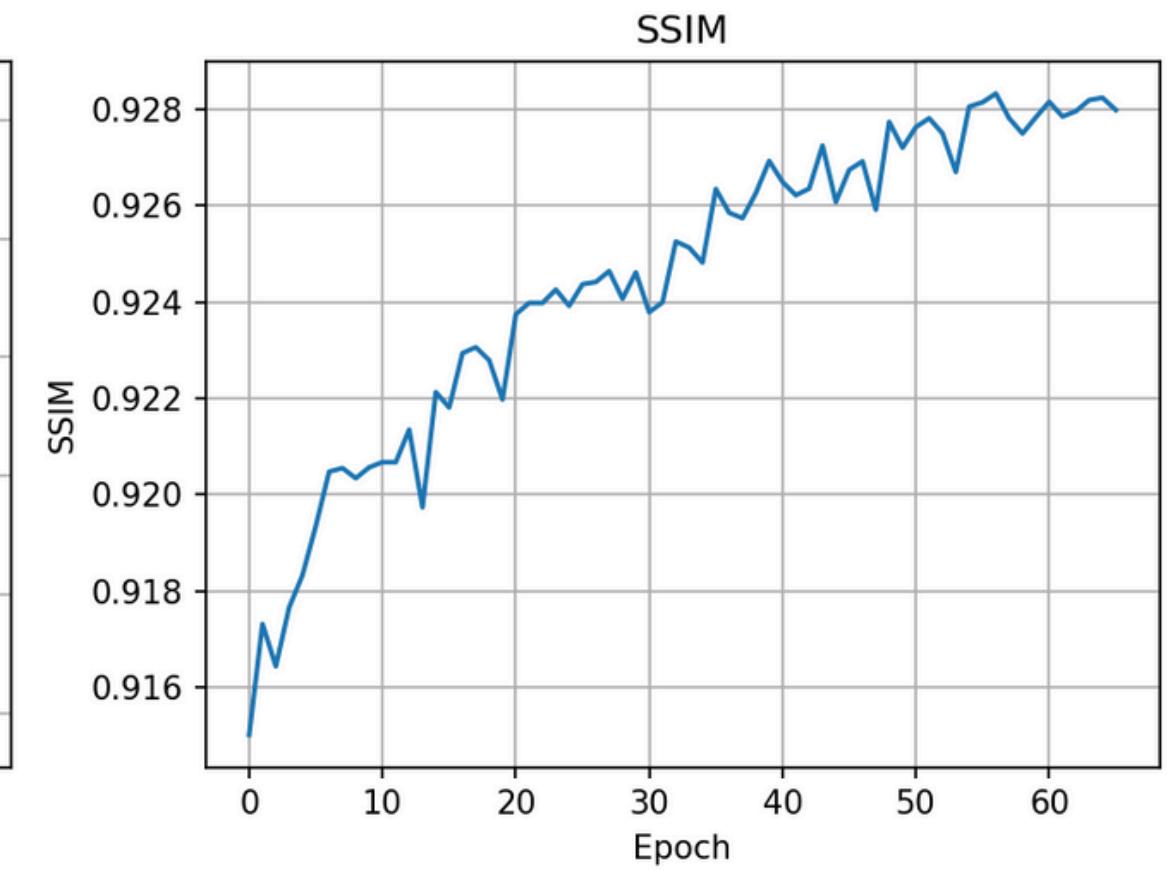
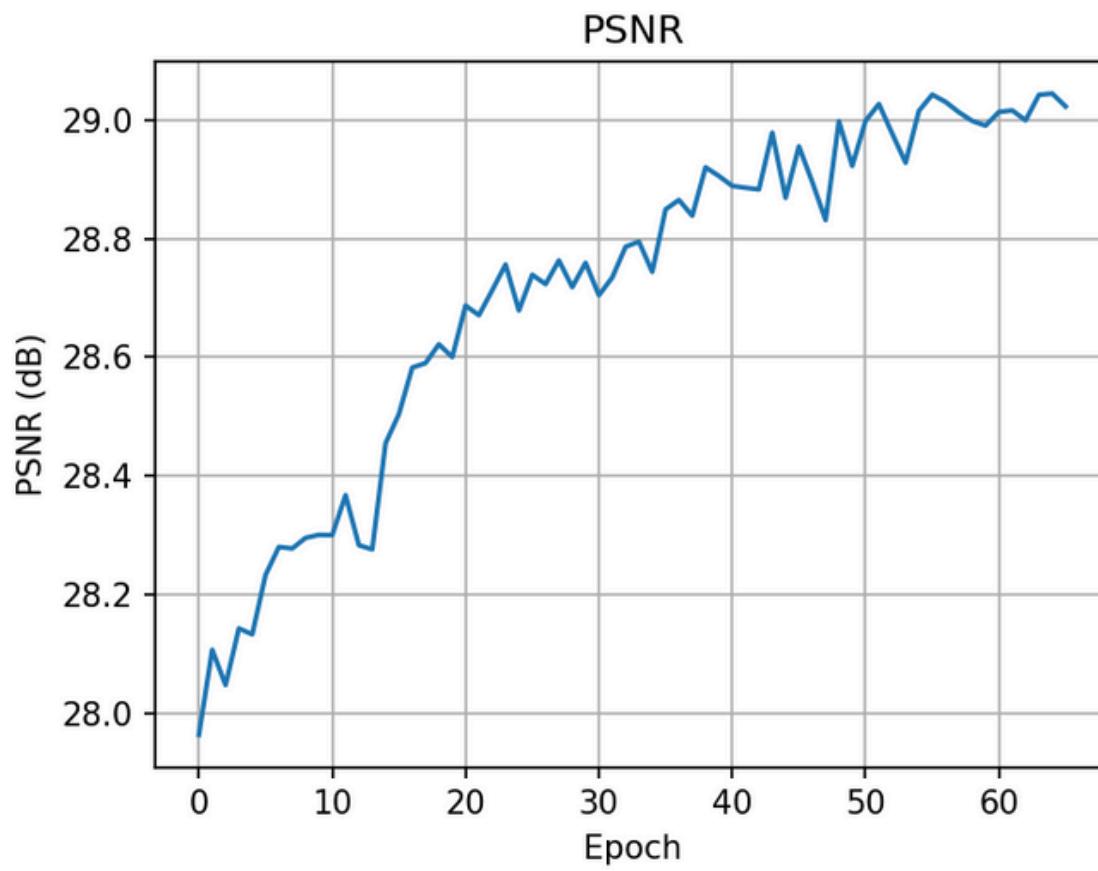
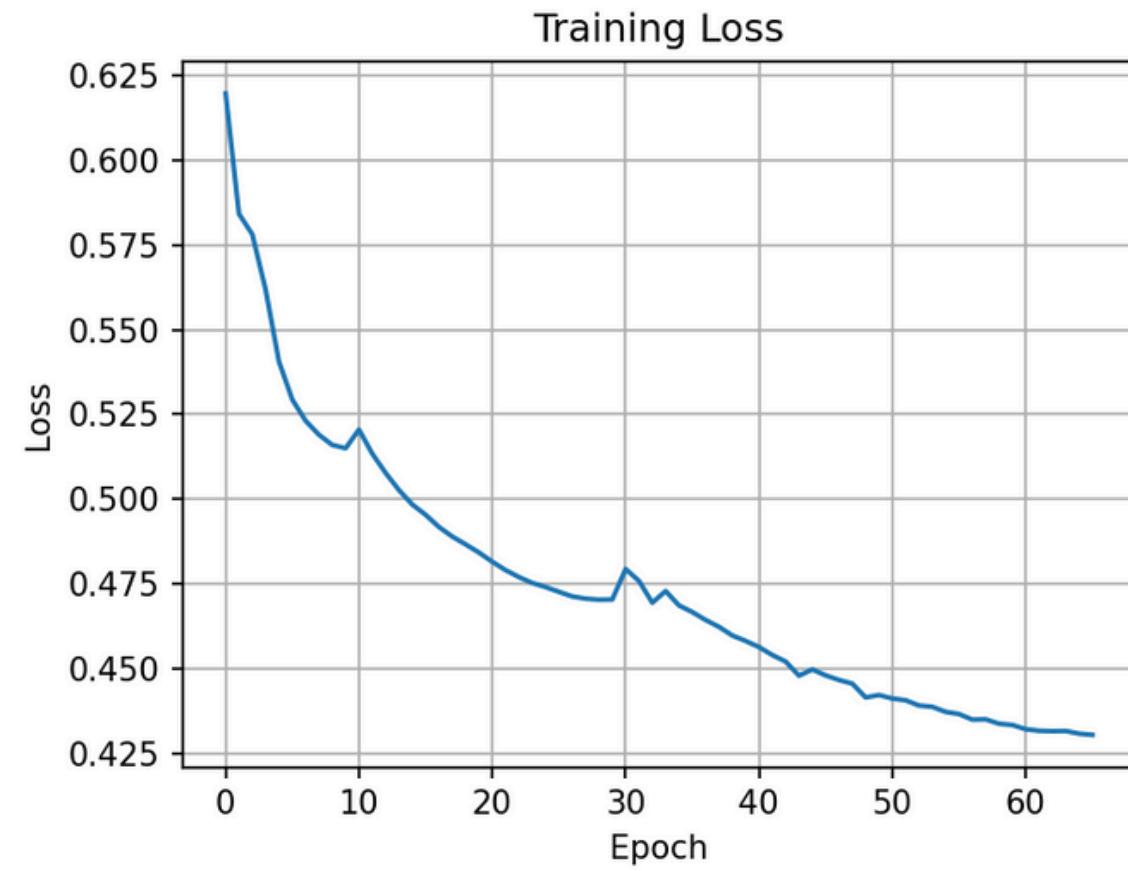
24

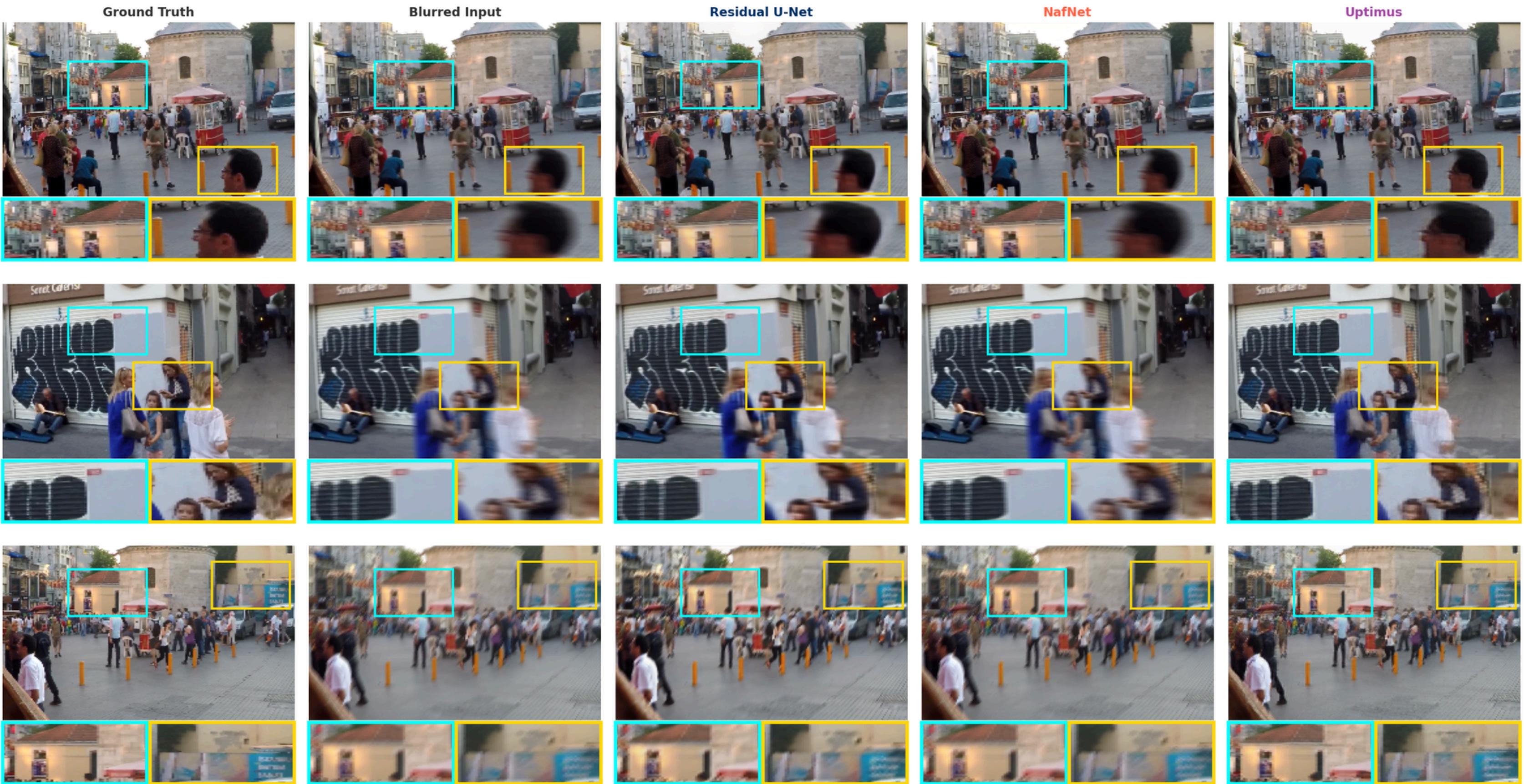


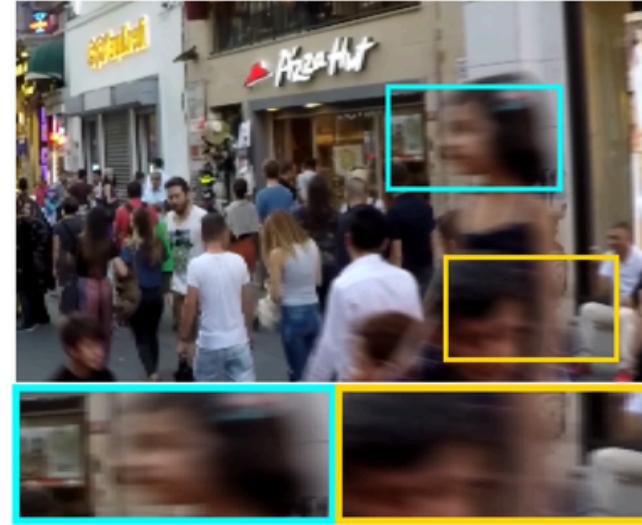
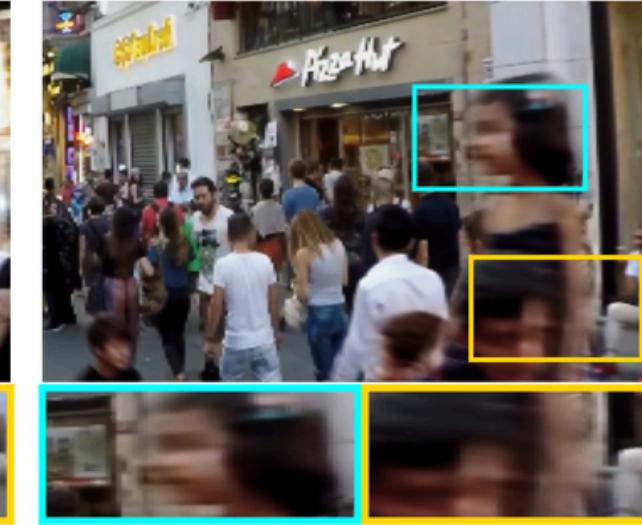
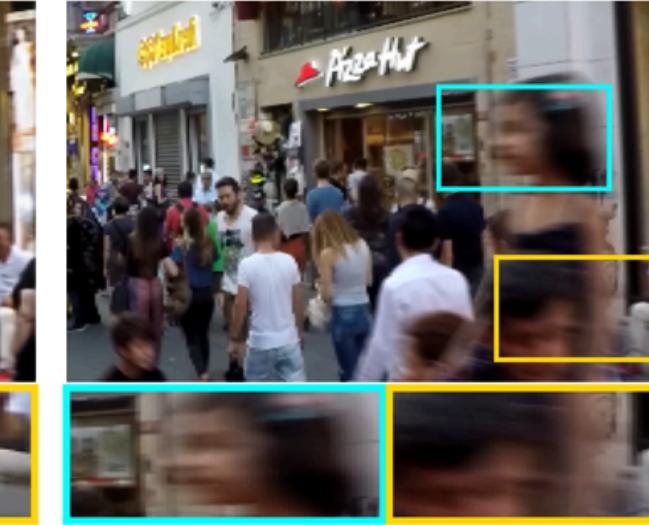
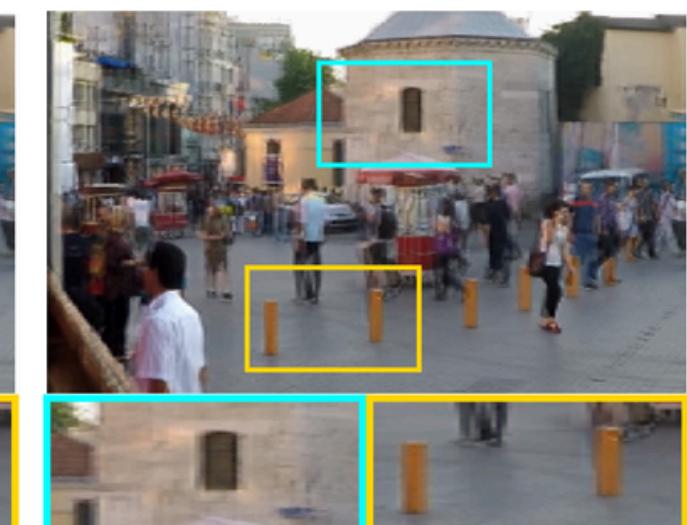
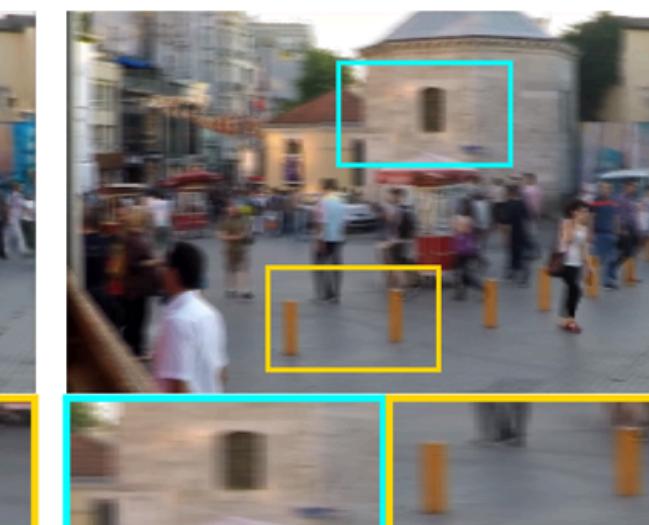
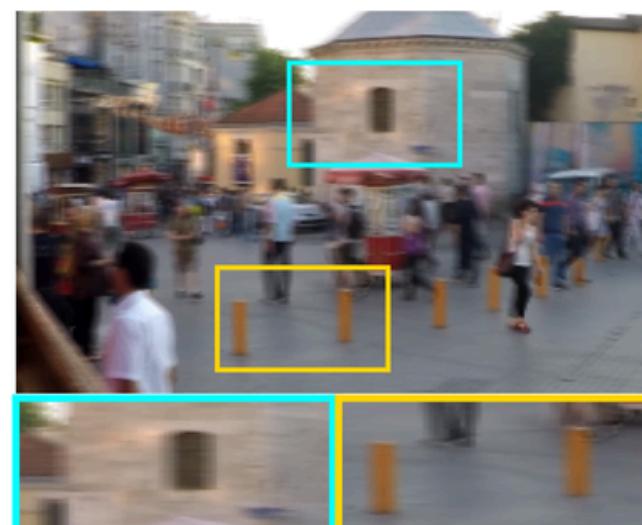
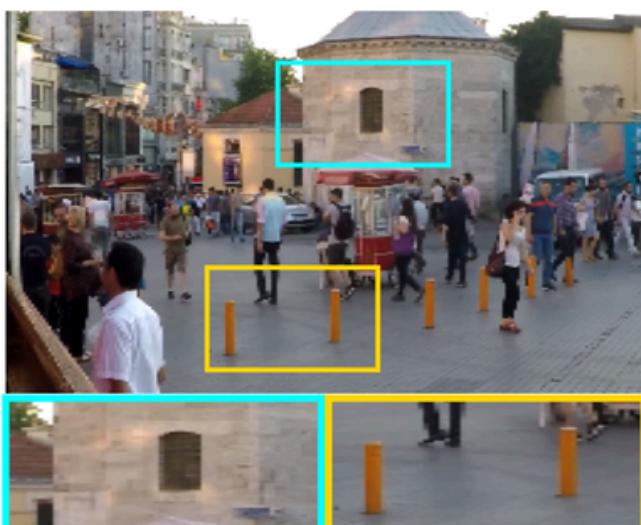
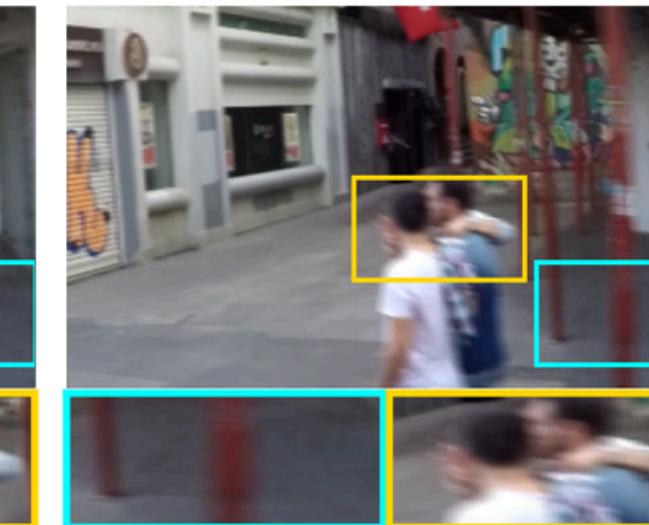
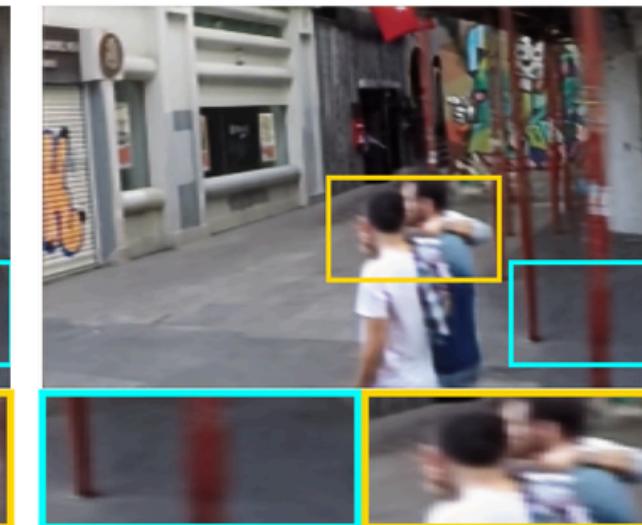
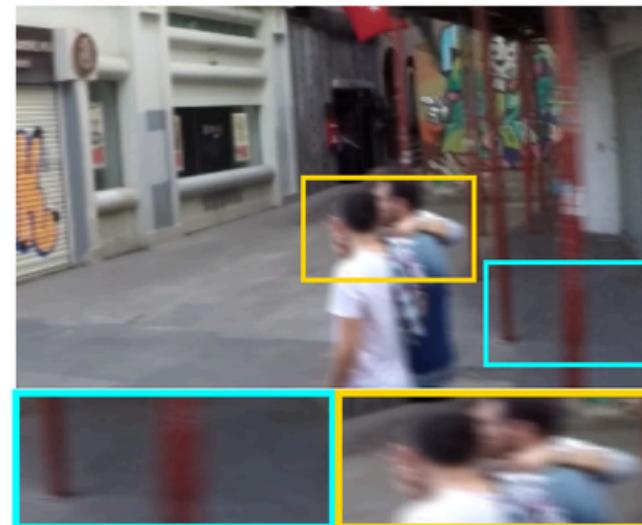
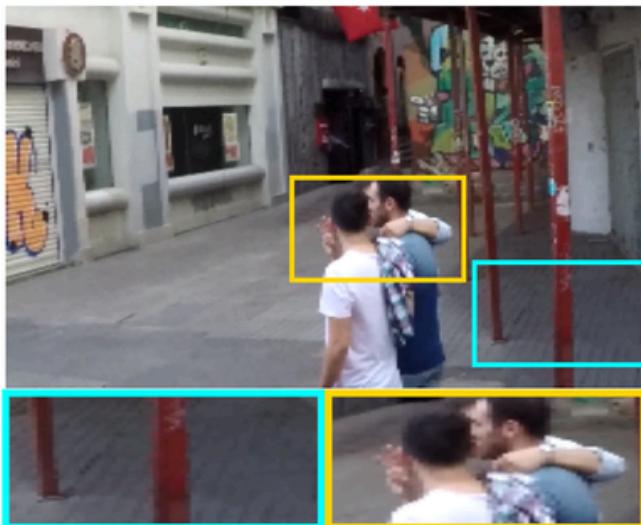
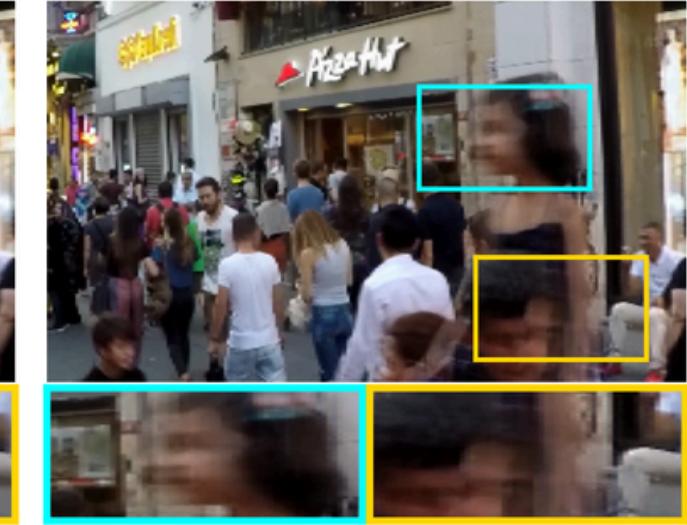


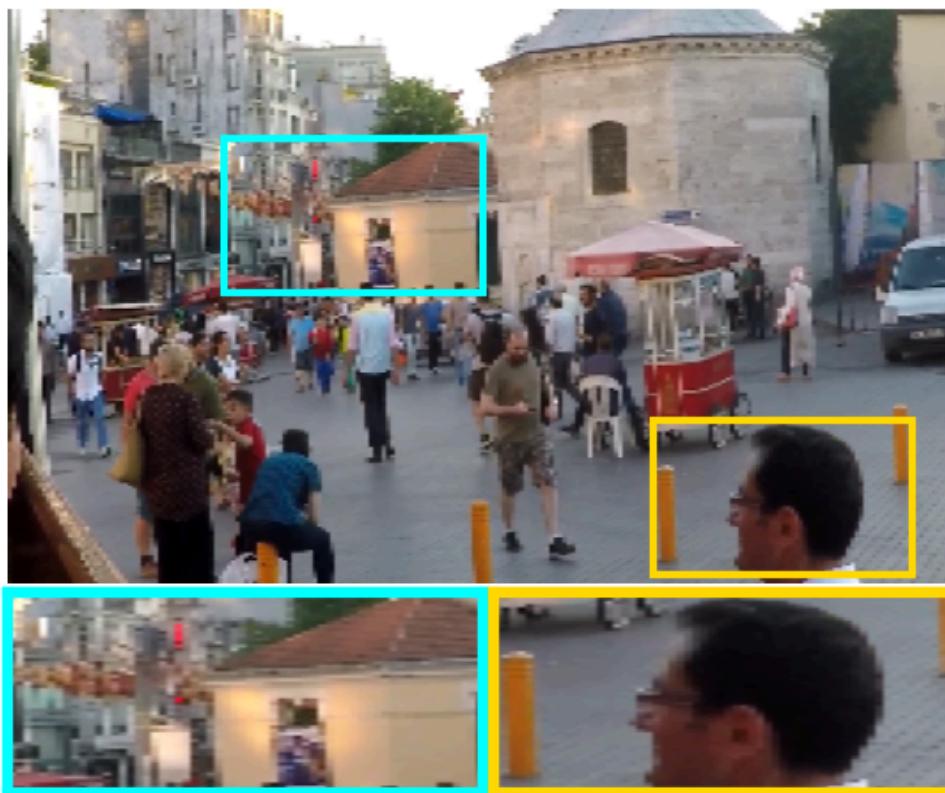
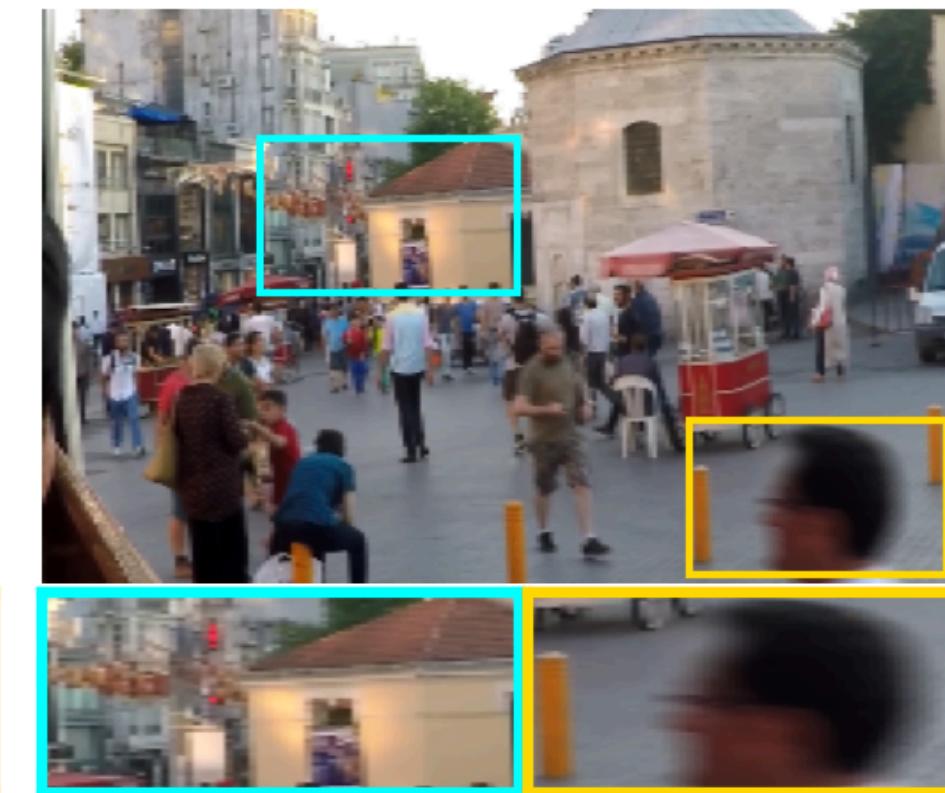
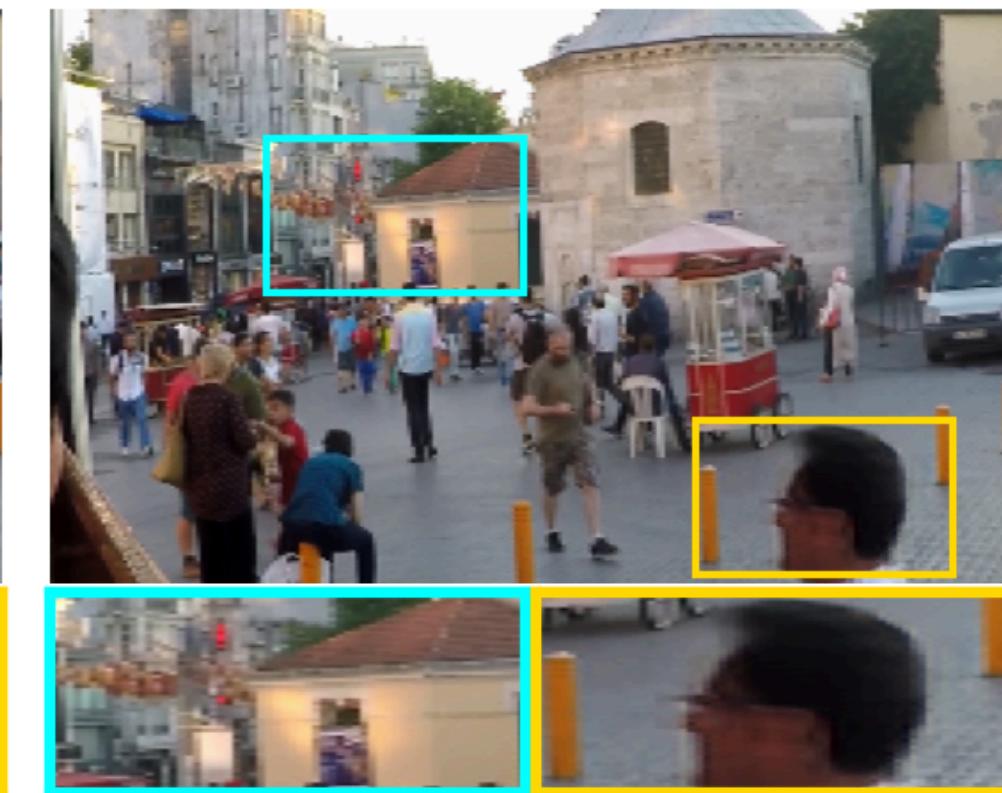
Uptimus

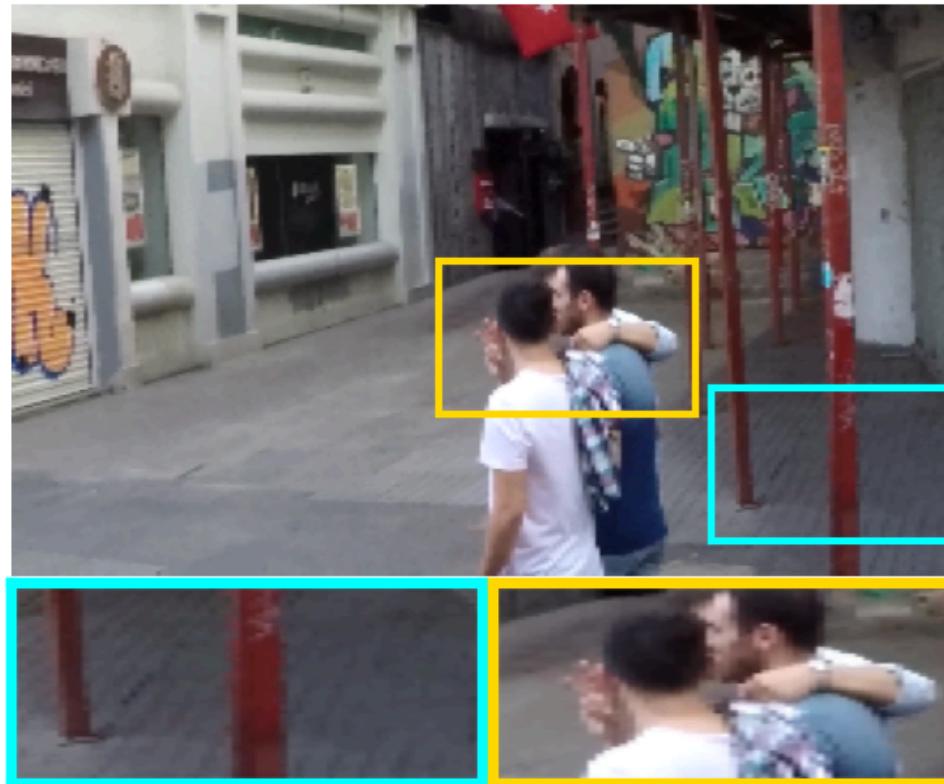
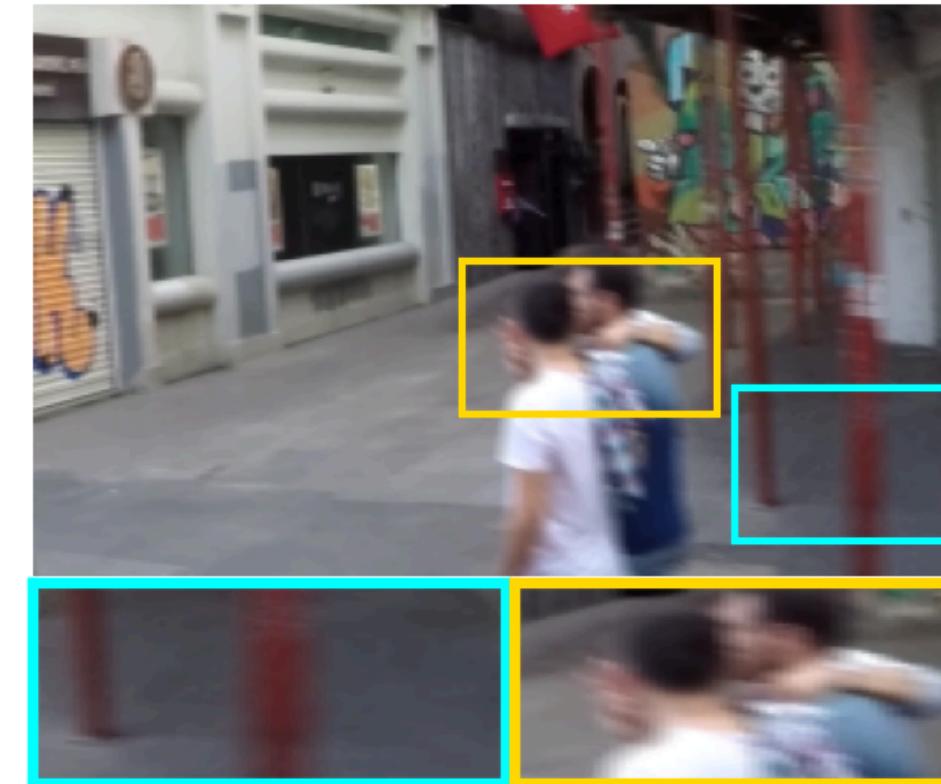
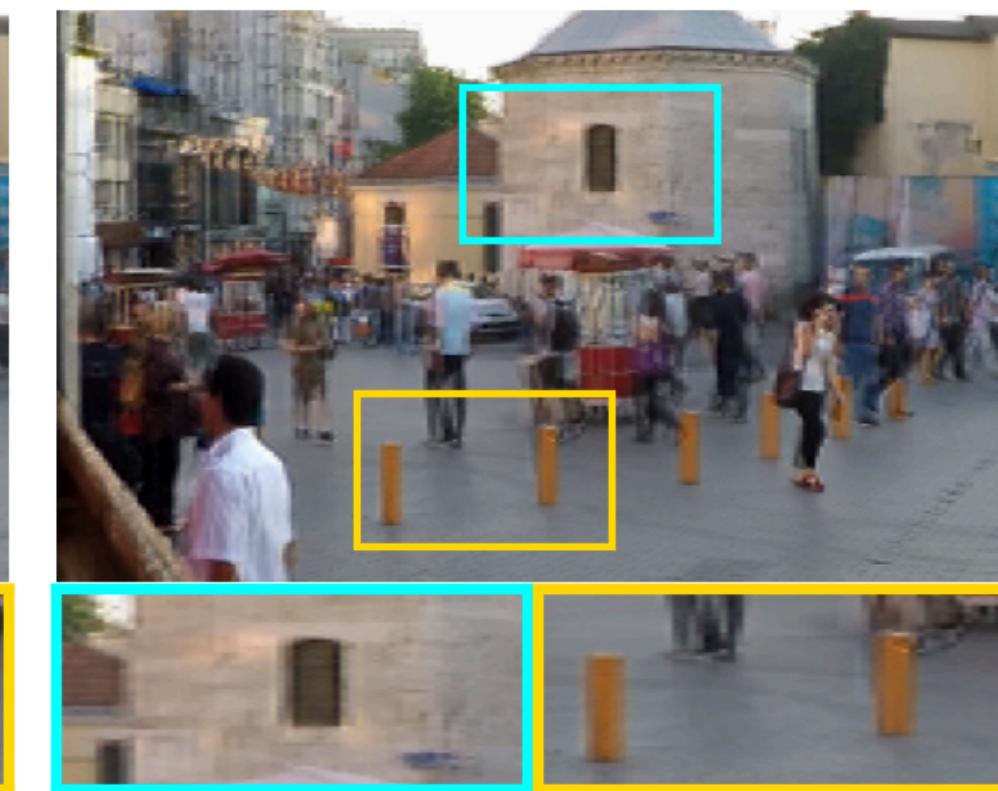
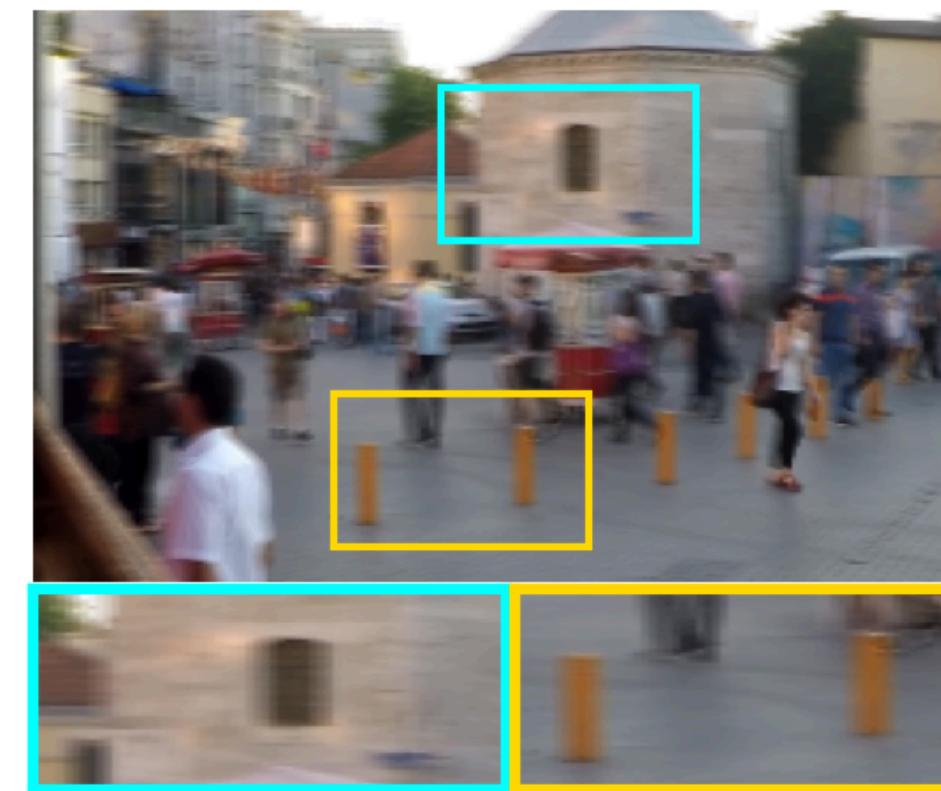
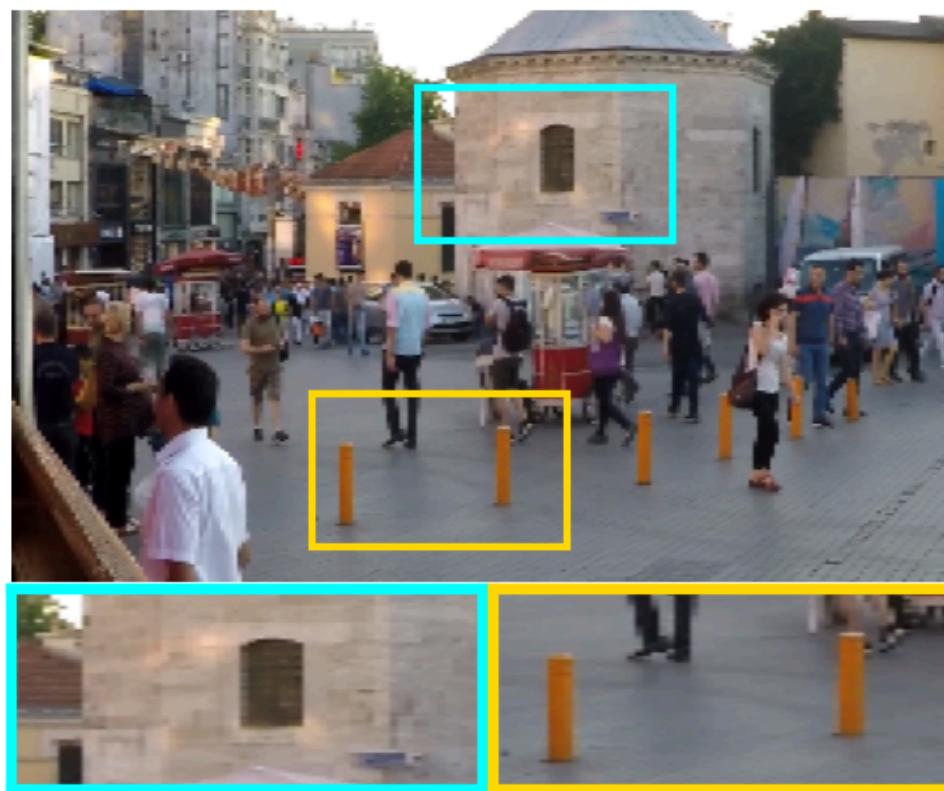
25





Ground Truth**Blurred Input****Residual U-Net****NafNet****Optimus**

Ground Truth**Blurred Input****Optimus**

Ground Truth**Blurred Input****Optimus**

Métricas

	PSNR	SSIM
Residual U-net	27.88 dB	0,9244
NAFNet	28.84 dB	0,9204
Optimus	29.04 dB	0,9282



Gracias