IMAGE DEBLURRING USING GAN

DSAN 6500 PROJECT
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04/23/2025

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Dataset

Original Dataset:

- GROPRO_Large
- Size: 9.54 GB
- Total Images: 2103 (train), 1111 (test)
- Images are provided in pair format: One blurred and one corresponding sharp frame
- Original Resolution: 1280 x 720
- Common benchmark dataset for learning-based motion deblurring tasks

Preprocessing:

- Resized to 256x256
- Normalized pixel values to the range [-1,1]

Architecture

Generator Network

Initial Convolution → Down-sampling → Residual Blocks → Up-sampling → Output Layer

Initial Convolution

- 7x7 Conv.
- Reflection Padding
- Instance Normalization
- ReLU activation

Down-sampling

- 2 3x3 Conv.
- Stride 2

Residual Blocks

- 9 Residual Blocks
- 2 3x3 conv.
- Instance Norm
- ReLU
- 3x3 Conv.
- Instance Norm

Up-sampling

- Nearest Neighbor Interpolation
- 3x3 Conv.

Output Layer

- 7x7 Conv.
- Tanh activation
- Residual connection

Architecture

Discriminator Network

- The discriminator follows a PatchGAN design, evaluating image realism at the patch level rather than classifying the whole image.

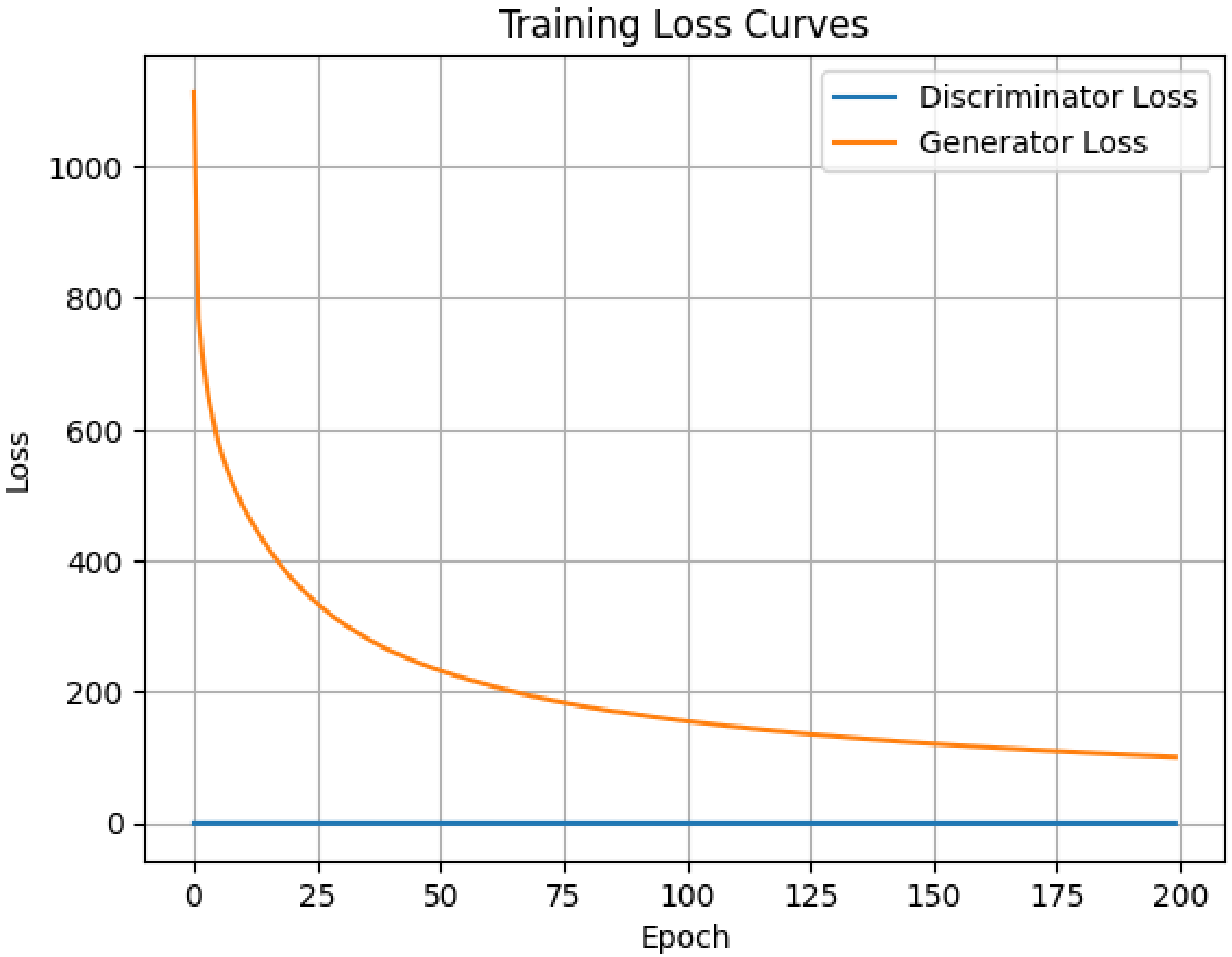
- It takes either a real sharp image or a deblurred image from the generator and passes it through a series of 5 convolutional layers with increasing filter sizes.

- Each convolution is followed by LeakyReLU activations and Batch Normalization (except the first).

- Instead of a single output, the model outputs a grid of probabilities, where each value corresponds to the "realness" of a specific image patch.

- A final fully connected layer maps this grid into a single probability, predicting whether the input is real or generated.

Training

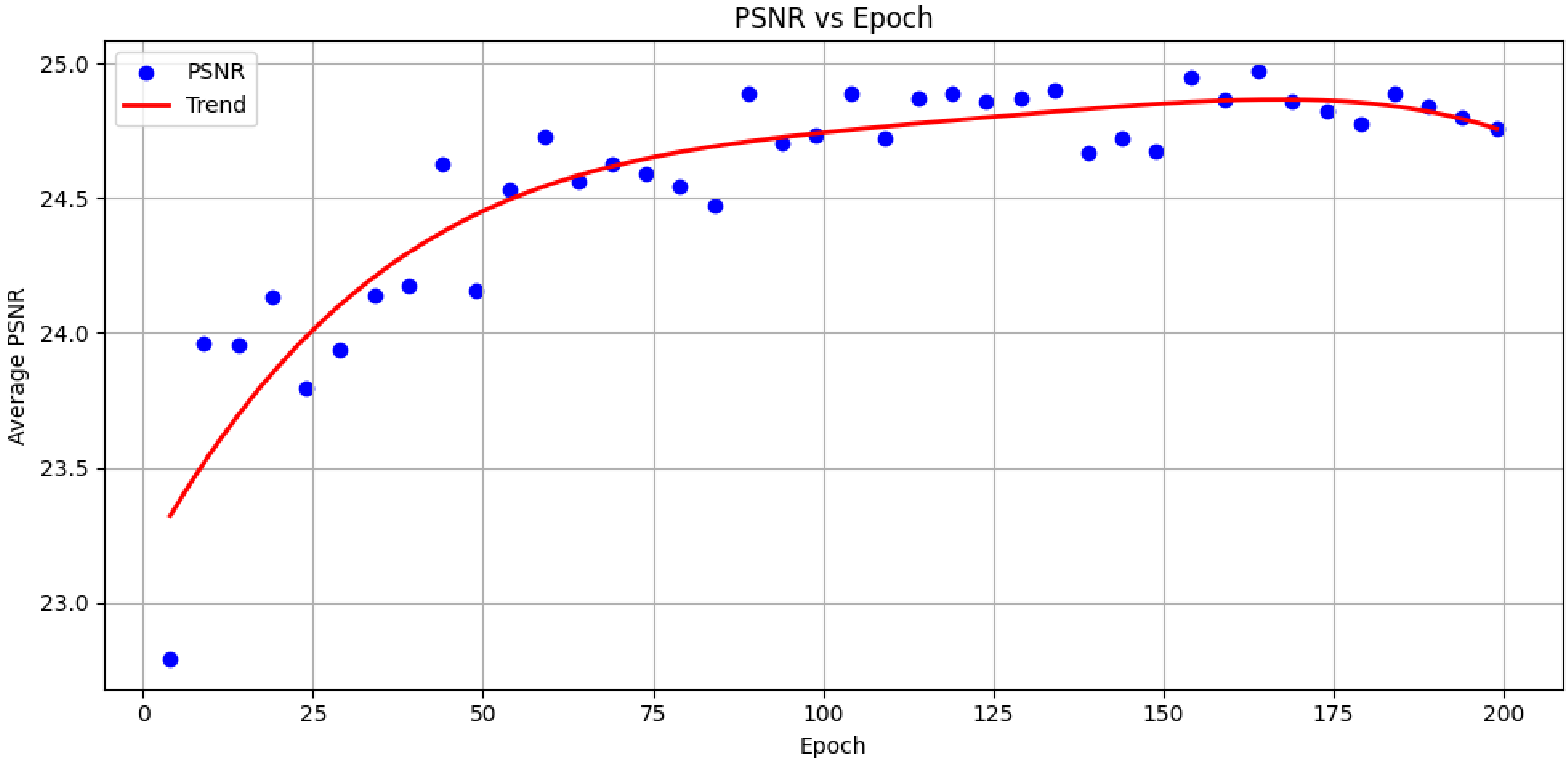


- Trained for 200 epochs

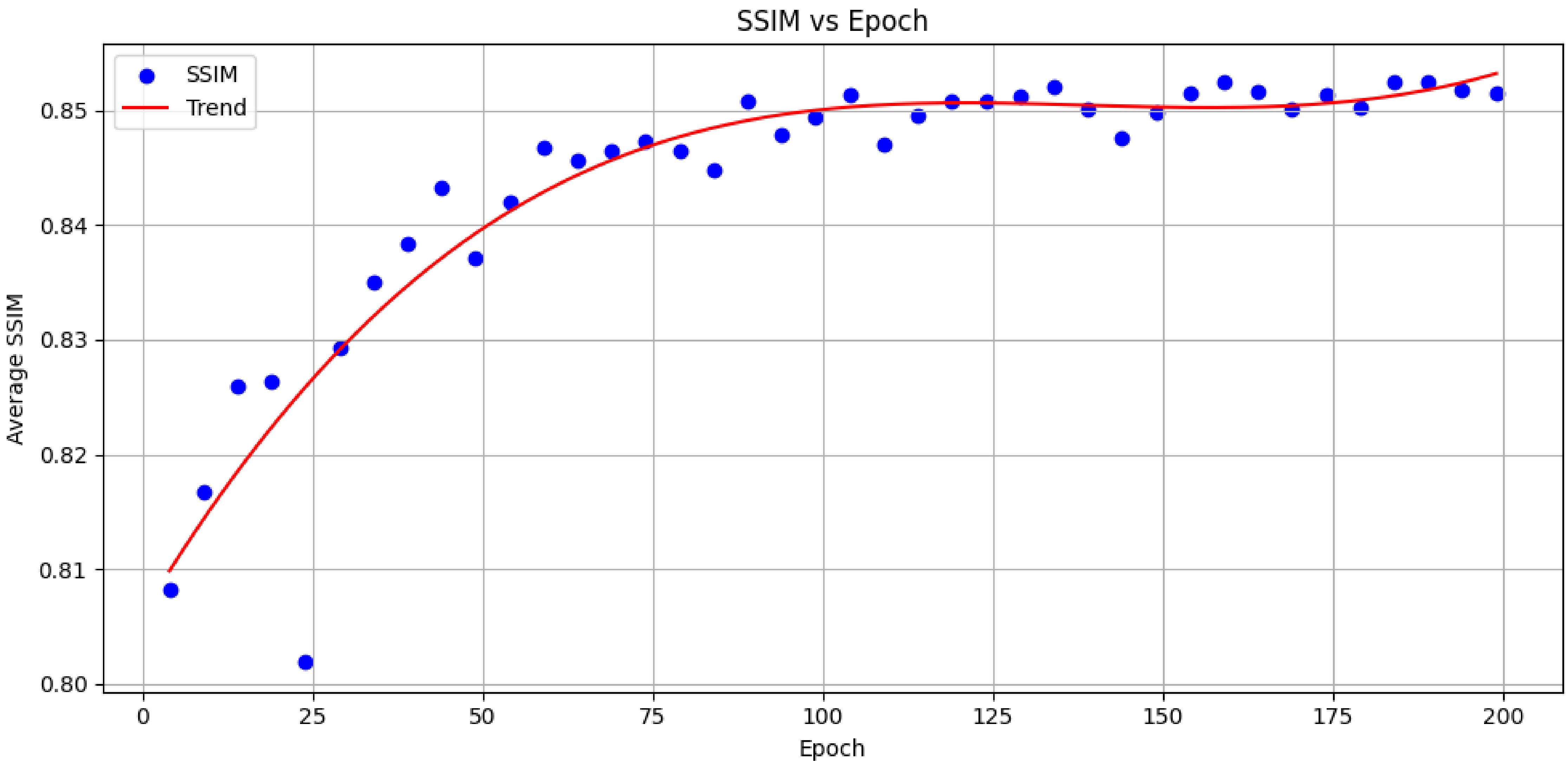
- Generator Loss: Weighted sum of
    - Perceptual loss (VGG16)
    - Wasserstein loss

- Discriminator Loss: Wasserstein Loss

Training

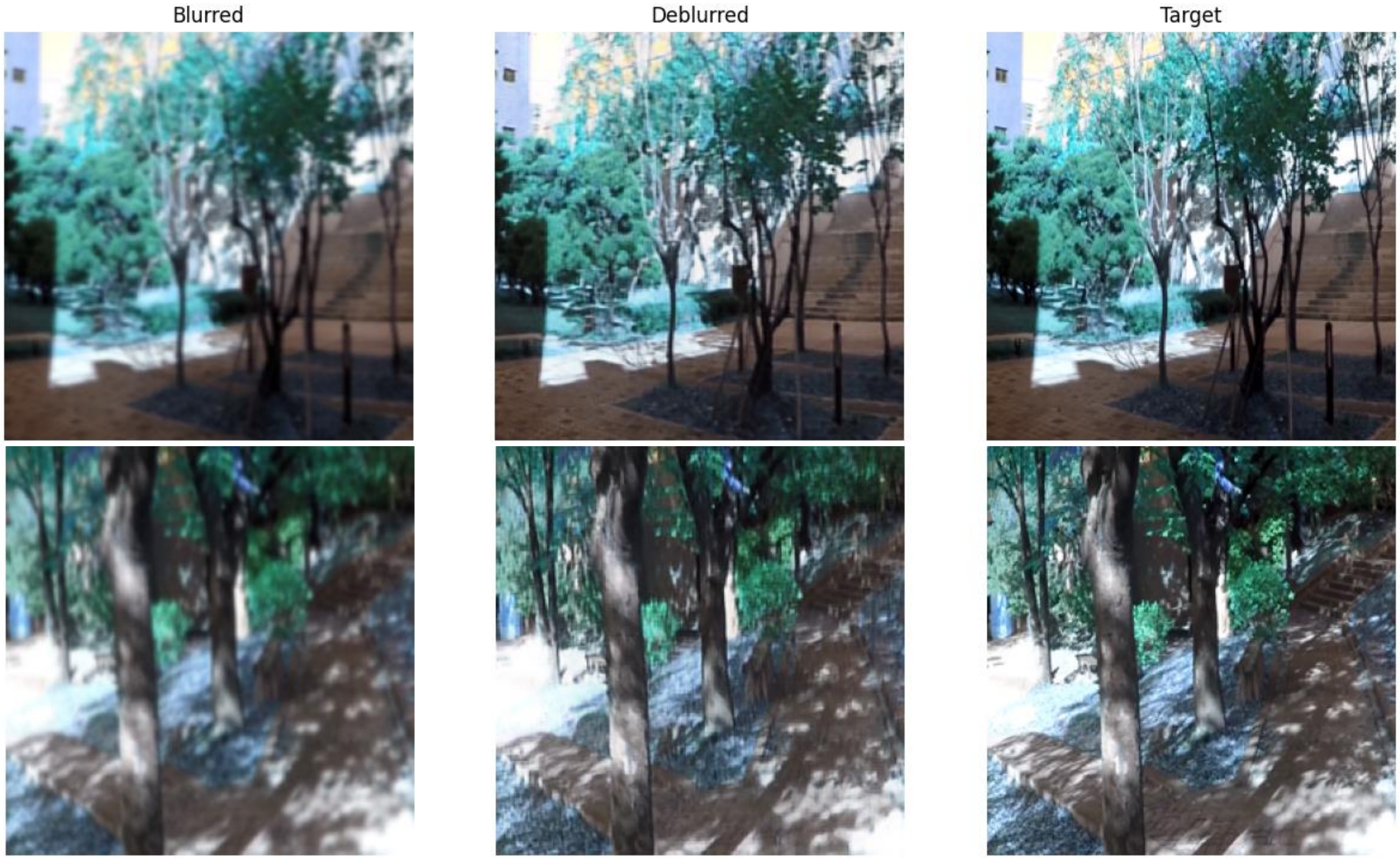

PSNR vs Epoch
PSNR
Trend
25.0
24.5
24.0
23.5
23.0
Average PSNR
0
25
50
75
100
125
150
175
200
Epoch

Training


SSIM vs Epoch
SSIM
Trend
Average SSIM
0.80
0.81
0.82
0.83
0.84
0.85
0
25
50
75
100
125
150
175
200
Epoch

Results

Results



Results

	Sun *et al.* (using CNN)	Nah *et al.* (Deep Multi-scale CNN)	Xu *et al.*	GAN
PSNR	24.6	28.3	25.1	26.42
SSIM	0.84	0.916	0.89	0.87

References

Nah, Seungjun, Tae Hyun Kim, and Kyoung Mu Lee. "Deep multi-scale convolutional neural network for dynamic scene deblurring." *Proceedings of the IEEE conference on computer vision and pattern recognition*. 2017.

Kupyn, Orest, et al. "Deblurgan: Blind motion deblurring using conditional adversarial networks." *Proceedings of the IEEE conference on computer vision and pattern recognition*. 2018.

Xu, Li, Shicheng Zheng, and Jiaya Jia. "Unnatural l0 sparse representation for natural image deblurring." *Proceedings of the IEEE conference on computer vision and pattern recognition*. 2013.

https://machinelearningmastery.com/how-to-implement-wasserstein-loss-for-generative-adversarial-networks/

https://www.kaggle.com/datasets/lqzmlaq/gopro-large