

Figure 6: Effects of Hyper-parameters (HP). We have observed that there are sudden downfall of PSNR value during the execution. The experiments were performed for different values of (λ_1, λ_2) with the same set of HP (the experimental setup is the same). We have observed such events when learning rate or size convolutional kernel is high. However, a smaller value of learning rate would result in a slower convergence near optimum. The sensitivity of image restoration quality due to change in the learning-rate is studied in [4]). One way to control the sensitivity of the hyper-params is to minimize the total variation norm (TV norm) along with the MSE loss. TV norm is the sum of the absolute differences for neighboring pixel values of an image which measures how much noise is in the images. Minimizing the TV norm reduces the noise and provide more control over the image restoration procedure. The resulting image of the above experiment is shown in Fig. 4.

able mapping between the network parameter space and the natural image space [4].

The HP could be set for each image to get better results. However, we focused on determining HP which give satisfactory results for all the images in the dataset. The HP given in Listing 1 to Listing 6 were found using the *Tensorflow* implementation of our methods. One could also find different HP using a careful analysis.

References

- [1] Y. Li, M.-Y. Liu, X. Li, M.-H. Yang, and J. Kautz. A closed-form solution to photorealistic image stylization. In *Proceedings of the European Conference on Computer Vision (ECCV)*, pages 453–468, 2018.
- [2] R. Mechrez, I. Talmi, F. Shama, and L. Zelnik-Manor. Learning to maintain natural image statistics. *arXiv preprint arXiv:1803.04626*, 2018.
- [3] G. Petschnigg, R. Szeliski, M. Agrawala, M. Cohen, H. Hoppe, and K. Toyama. Digital photography with flash and no-flash image pairs. In *ACM transactions on graphics (TOG)*, volume 23, pages 664–672. ACM, 2004.
- [4] D. Ulyanov, A. Vedaldi, and V. Lempitsky. Deep image prior. In *The IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, June 2018.



Figure 7: Restoration from 90% missing pixels *part-1*.

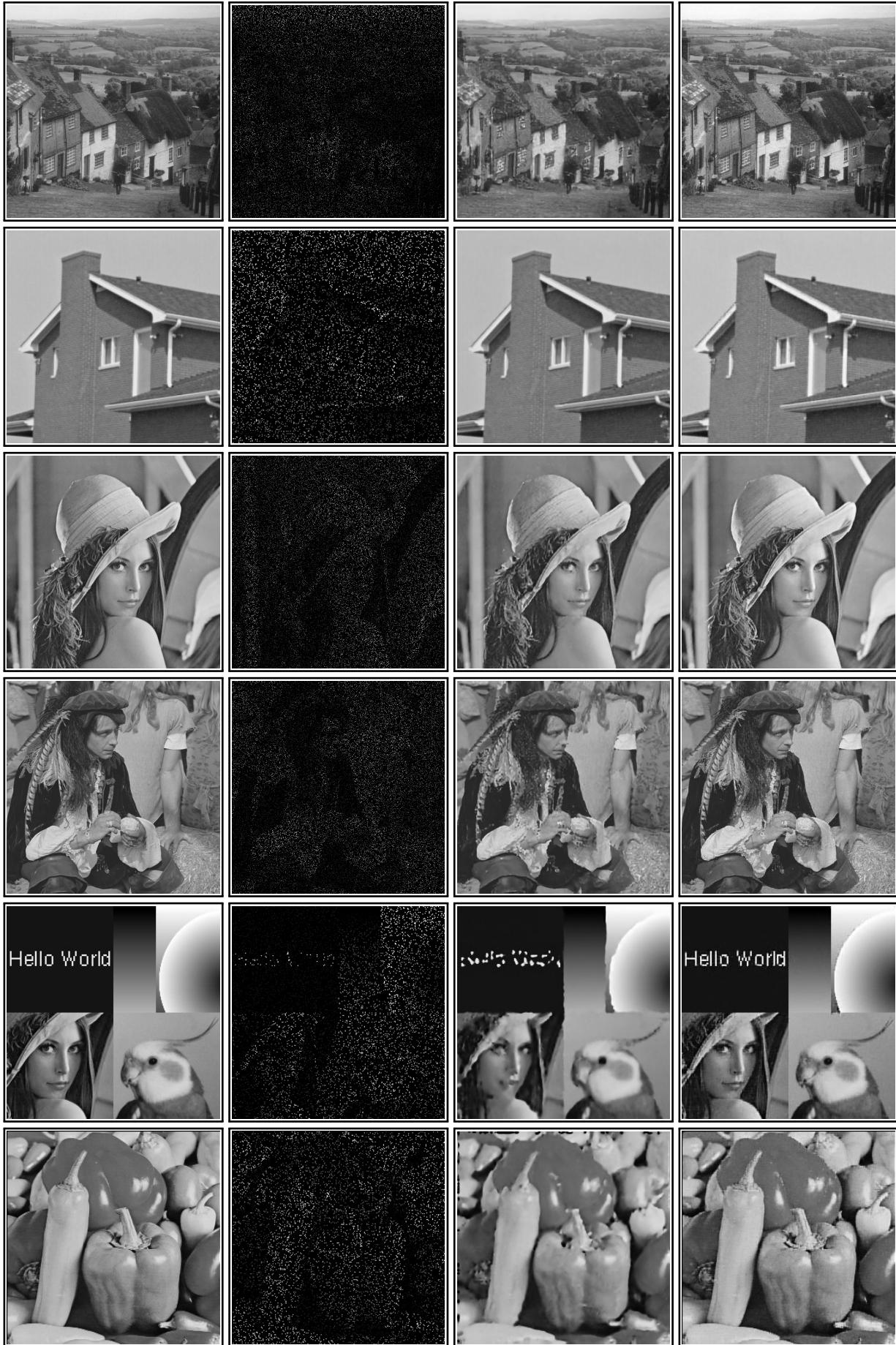
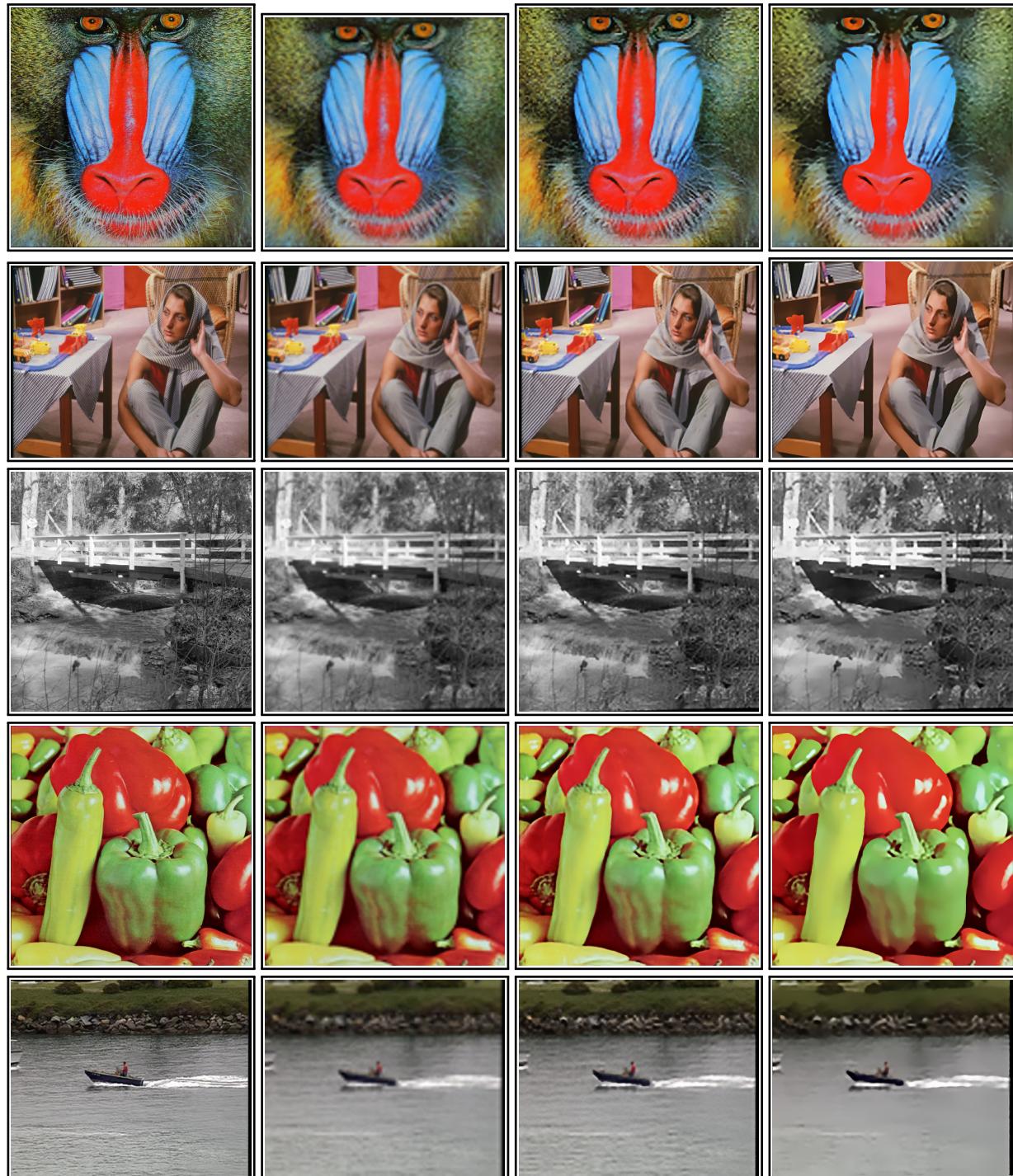


Figure 8: Restoration from 90% missing pixels part-2.



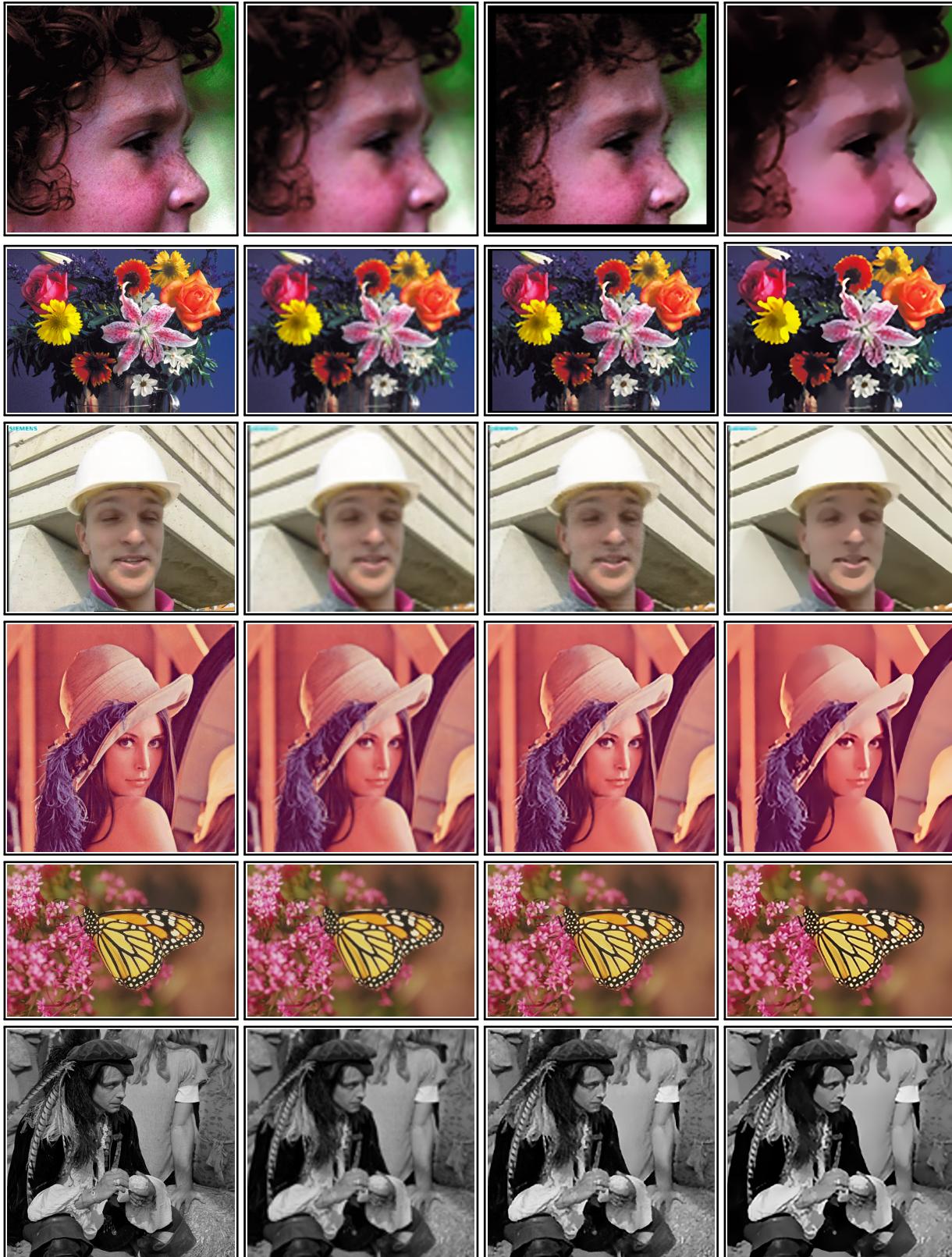
(a) HR image

(b) Bicubic

(c) DIP

(d) MEDSF

Figure 9: $4\times$ Super-resolution on Set14 dataset *part-1*.



(a) HR image

(b) Bicubic

(c) DIP

(d) MEDSF

Figure 10: 4 \times Super-resolution on Set14 dataset *part-2*.



Figure 11: $4 \times$ Super-resolution the Set14 dataset *part-3*.



Figure 12: **Denoising (I).** A comparison between CBM3D, DIP [4], and our MEDSF for noise strength of $\sigma = 100$.

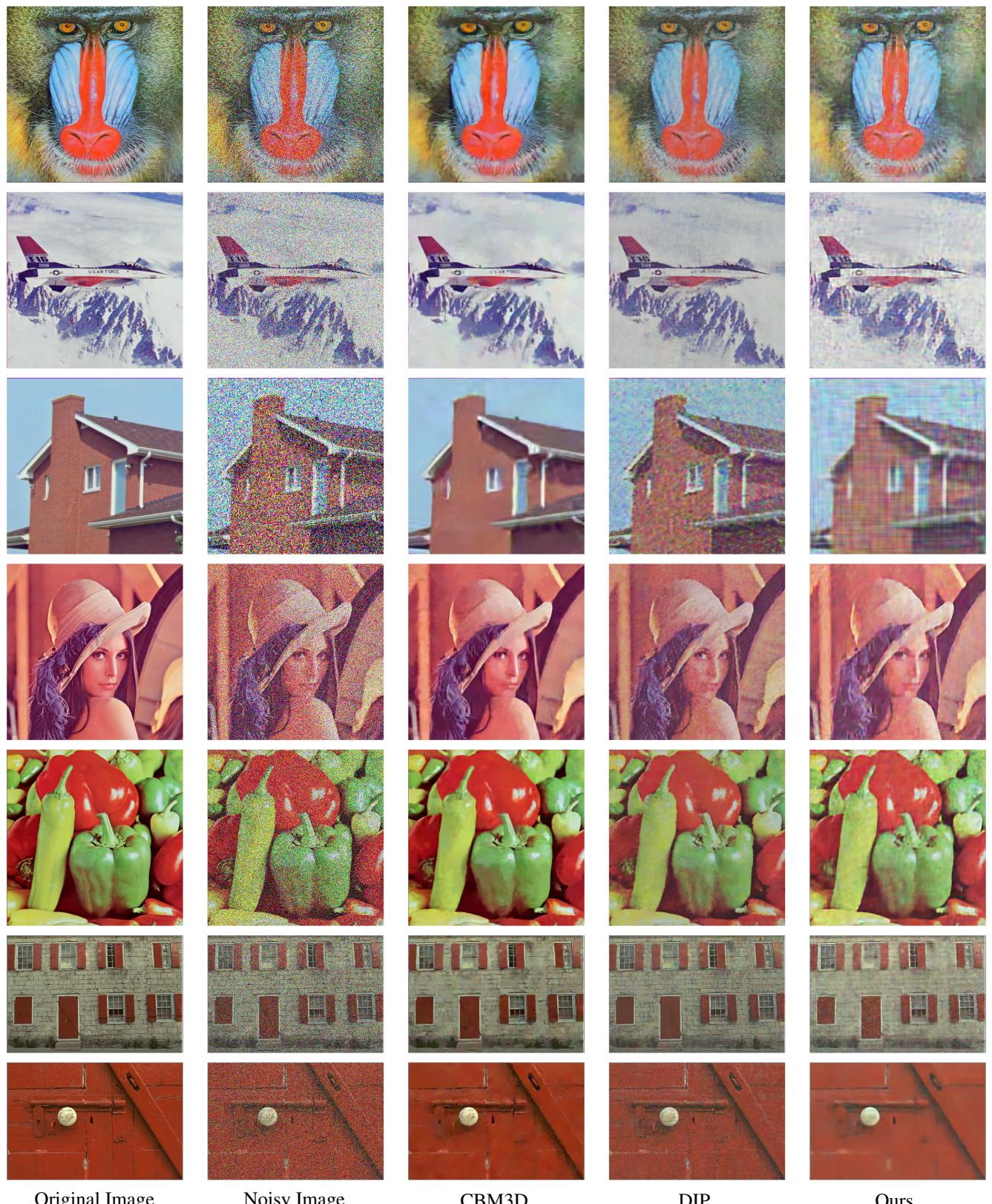


Figure 13: **Denoising (II).** A comparison between CBM3D, DIP [4], and our MEDSF with noise strength of $\sigma = 100$.