Can Computers Help Us See the World More Clearly?

How Artificial Intelligence Reduces Image Noise to Improve Visual Quality

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RGB representation

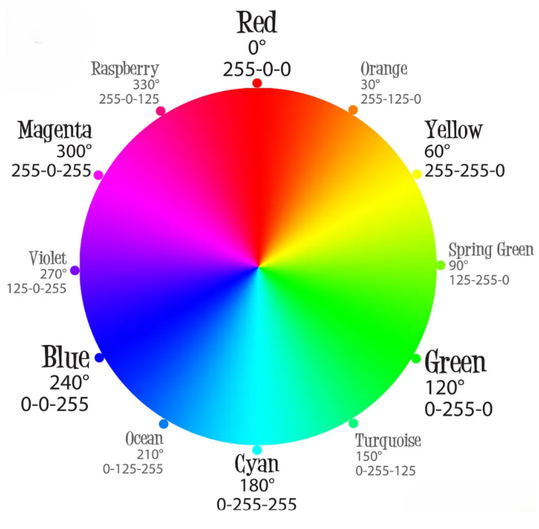

Figure 1: Pixels can be written by 3 numbers in RGB format. Image from [1].

Datasets

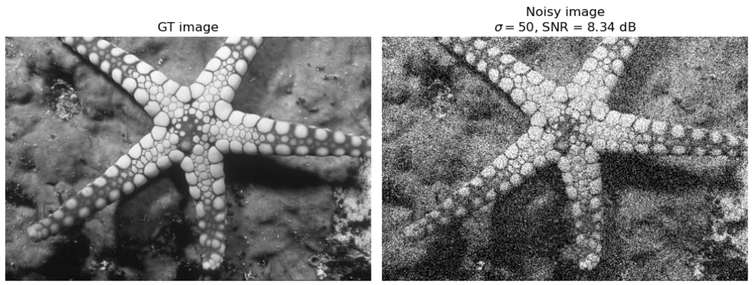

Figure 2: Pairs of Ground Truth (GT) image and noisy image

We split images from the BSD500 dataset into three sections for different purposes:

- **Train dataset**
- **Validation dataset**
- **Test dataset**

Structure of our model

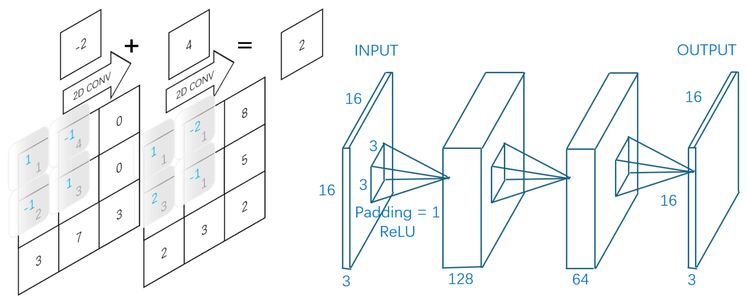

Figure 3: Our model's building block with convolutional layers.

Training process

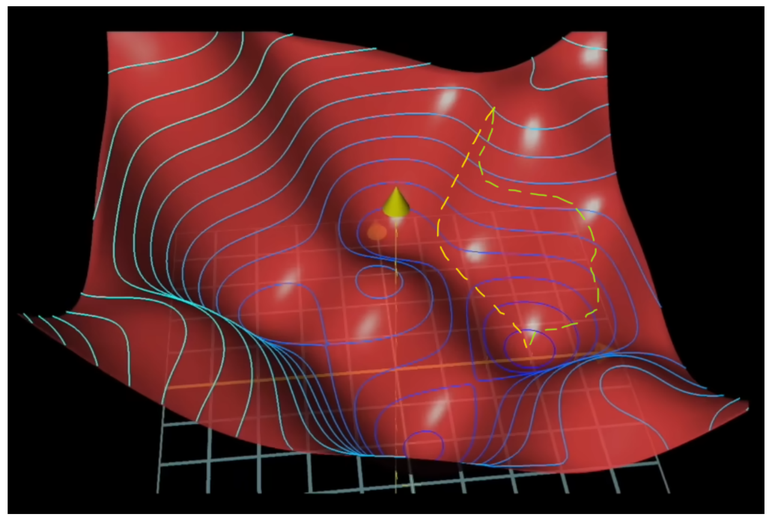

Figure 4: Adjust parameters to reduce errors. Image from [2].

Scan me for more information!

Key results

Results in Figure 5 are obtained by our linear layer-based LISTA model repeating experiment designed in [3].

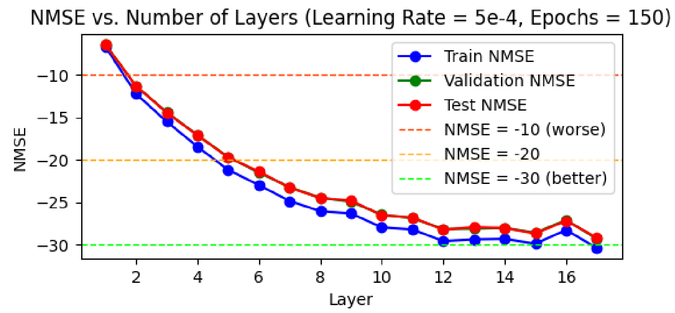

Figure 5: Level of -20 dB indicates moderate performance; more negative values reflect better reconstruction.

Figure 6 shows visualizations of the model's performance on a randomly selected image from the test dataset.

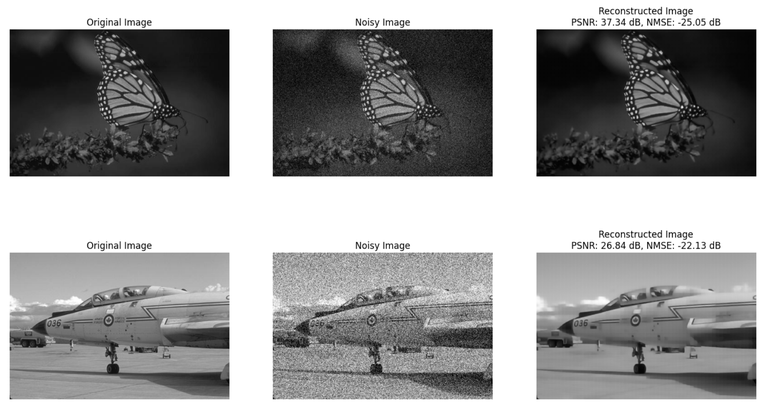

Figure 6: Performance with noise levels $\sigma = 20$ and $\sigma = 50$

References

[1] https://medium.com/@brugmanj

[2] https://www.youtube.com/@3blue1brown

[3] X. Chen, J. Liu, Z. Wang, and W. Yin, *Hyperparameter Tuning is All You Need for LISTA*, Advances in Neural Information Processing Systems, vol. 34, pp. 11678–11689, 2021.

[4] K. Gregor and Y. LeCun, *Learning Fast Approximations of Sparse Coding*, in Proceedings of the 27th International Conference on Machine Learning, 2010.