LISTA-NET: LEARNABLE ITERATIVE SOFT-THRESHOLDING ALGORITHM

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ABSTRACT

This work is based on the paper ISTA-Net [4], which focuses on reconstructing natural images by combining traditional optimization-based methods and recent network-based ones. Specifically, [4] developed a novel structured deep network, dubbed ISTA-Net, inspired by Iterative Shrinkage-Thresholding Algorithm(ISTA) for optimizing a general ℓ_1 norm CS reconstruction model. Moreover, considering that the residuals of natural images are more compressible, an enhanced version of ISTA-Net in the residual domain, dubbed ISTA-Net$^+$, is derived and compared with the state-of-the-art methods. This report discusses the current work and produces interesting results by considering additional learnable parameters $\mathbf{\Phi}$ in the ISTA-Net model.

Index Terms— Compressive sensing,Deep Learning.

1. RESULTS

We used 88912 images of size 33×33 for training and standard Set11, BSD68 dataset (which contains 11 and 68 gray images respectively) for testing. The measurement matrix $\mathbf{\Phi}$ is constructed by generating a random Gaussian matrix and then orthogonalizing its rows.

2. CONCLUSION AND FUTURE WORK

We thoroughly understood the ISTA-Net paper and produced some of the results from their code. Motivated by the fact that the ISTA-Net model with unshared parameters performs well, we introduced $\mathbf{\Phi}$ as a learnable parameter in the model and compared the performance with the results shown in the paper. We observed that ISTA-Net with learnable $\mathbf{\Phi}$ is performing better than the ISTA-Net$^+$. We have demonstrated the proposed method results on Set11 and BSD68 datasets. One can see the performance of ISTA-Net with learnable $\mathbf{\Phi}$ on other optimization methods, such as FISTA.

3. RESOURCES

1. https://github.com/jianzhangcs/ISTA-Net-PyTorch

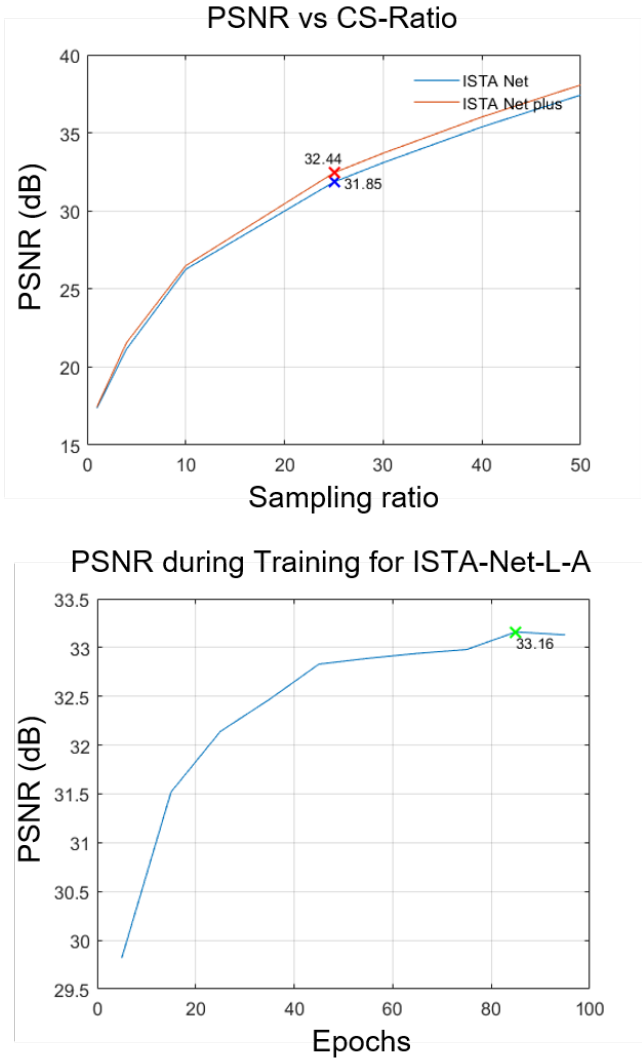

Fig. 1. Comparing PSNR curves of ISTA-NET and ISTA-NET$^+$ with ISTA-Net learnable $\mathbf{\Phi}$ on Set11 dataset

4. REFERENCES

1. Zhang, Jian, and Bernard Ghanem. "ISTA-Net: Interpretable optimization-inspired deep network for image compressive sensing." Proceedings of the IEEE conference on computer vision and pattern recognition. 2018.

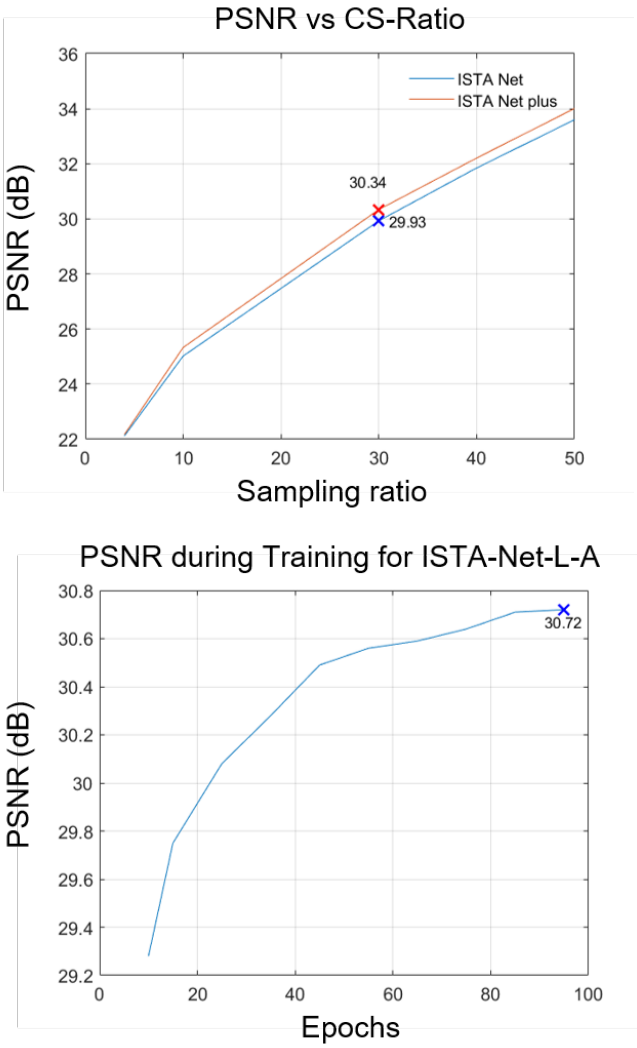

Fig. 2. Comparing PSNR curves of ISTA-NET and ISTA-NET^{+} with ISTA-Net learnable $\mathbf{\Phi}$ on BSD68 dataset