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Deep Learning for Artifact Removal in Galaxy Images.

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Abstract

In astronomical image acquisition, it is common to find artifacts and anomalies due to the particularities of the studied objects as well as the acquisition process. Two of these aberrations are, firstly, an object random light distribution that is usually modeled with a Poisson distribution, and, secondly, the loss of spatial resolution due to the optical and atmospheric point spread function (PSF).

Motivated by the recent advances in the field of Deep Learning in image reconstruction, we have built a solution based on convolutional neural network (CNN) for astronomic image aberrations removal. Our model is based on architectures with auto-encoders to extract fundamental image features, skip-connections to recover lost features during the compression stage, and two branches in parallel to perform the reconstruction task at different levels of resolution.

Our results over simulations of galaxy images show an improvement of up to 8dB in PSNR, and an increasement from ~ 0.45 to ~ 0.95 in SSIM for noise removal. However, weaker galaxy structures such as the halo, filaments and point-like structures associated with star formation regions are not well reconstructed yet. We are now researching to design and apply more complex deep learning models, such as U-Nets and GANs, to improve the quality in galaxy image recovery.

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My poster is available at https://zenodo.org/record/7048828#.Y3N3YHbP3cc