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Deep Neural Networks for Restoration of Sky Images Affected by Static and Anisotropic Aberrations

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Abstract : Most image restoration methods in astronomy rely upon probabilistic tools that infer the best solution for a deconvolution problem. They achieve good performances when the point spread function (PSF) is spatially invariable in the image plane. However, this latter condition is not always satisfied with real optical systems. PSF angular variations cannot be evaluated directly from the observations, neither be corrected at a pixel resolution. We have developed a method for the restoration of images affected by static and anisotropic aberrations using deep neural networks that can be directly applied to sky images. The network is trained using simulated sky images corresponding to the T-80 telescope optical system, an 80 cm survey imager at Cerro Tololo (Chile), which are synthesized using a Zernike polynomial representation of the optical system. Once trained, the network can be used directly on sky images, outputting a corrected version of the image, which has a constant and known PSF across its field-of-view. The method was tested with the T-80 telescope, achieving better results than with PSF deconvolution techniques. We present the method and results on this telescope.

Keywords : aberrations, deep neural networks, image restoration, variable point spread function, wide field images
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