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Cycle-GANs: generating artificial images for supervised galaxy classification deep learning algorithms

Supervised deep learning (DL) algorithms have been demonstrated to be extremely successful and efficient for classifying large number of galaxy images (e.g., Domínguez Sánchez et al. 2018, 2019). However, these supervised algorithms need of large labelled training sets coming from the same data domain as the sample they aim to be applied to. Brand new surveys would require of a visual inspection of a large number of galaxies to construct catalogues which can serve as training, but this step is very time consuming.

This limitation can be overcome by generating artificial data by means of a Cycle GAN, which is an image “translator”. A generative adversarial network (GAN, Goodfellow et al. 2014) is a class of machine learning framework which learns to generate new data with the same statistics as the training set by combining two neural networks which contest with each other in a game (in the form of a zero-sum game, where one agent's gain is another agent's loss). A cycle GAN combines two generators and two discriminators to convert an image from data domain A into its corresponding version from data domain B. In particular, in this project we will convert SDSS images, with available morphological labels, into their DES counterparts. Then we will test the ability of DL models trained with the mock DES galaxies and the SDSS labels to properly classify original DES images. If successful, this approach will be a fundamental shortcut for classifying galaxy images in future Big Data surveys such as Euclid or LSST.