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Deep learning tools for detecting and segmenting galactic structures and contaminants in low surface brightness images

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The diffuse tidal stellar features that surround galaxies bring a testimony on past galaxy collisions. Because of their low surface brightness and the presence of multiple image contaminants, they are particularly difficult to isolate with classical IA techniques. We present new deep learning techniques to finely characterise the morphology of galaxies from large datasets of deep optical imaging. They are designed to address the specific challenges of these astrophysics data (dynamic range, contrast, noise and contaminants). In particular, we adapt the architecture of a neural network to improve its sensitivity to both short and large scale oriented textures, in order to locate dust clouds contaminants that are overlaid with the imaged galaxies. We also introduce an adaptive scaling layer that allows the neural network learning to focus on relevant parts of the dynamic range in order to reveal the low brightness structures. Our method is trained on a dataset of finely segmented galactic structures, which is built using a home-made annotation tool and a semi-automatic dataset augmentation strategy.

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