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Self-supervised learning applied to outlier detection: searching for jellyfish in the ocean of data from upcoming surveys

Human visual classification has been the traditional approach to identifying galaxies possessing extreme ram-pressure stripping, the so-called Jellyfish galaxies. However, this approach can lead to misclassifications due to human biases and is unsuitable for large-scale galaxy surveys. In this study, we employ self-supervised learning on a dataset of $\sim$200 images to extract semantically meaningful representations of galaxies. Despite the small dataset size, a similarity search using these representations demonstrates the robustness of the approach and slightly better performance than traditional supervised learning. Using self-supervised learning, we propose a straightforward framework for assigning JClass, a categorical stripping measure, using a k-nearest neighbor search in the self-supervised representation space. Our method can assist human visual classifiers and help improve the quality of JClass by significantly eliminating biases due to visual subjectiveness or supervised learning. Our framework is versatile and can be applied to various astronomical scenarios requiring the identification of rare objects within massive datasets.

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