

# Exploring the Low Surface Brightness Galaxies in Abell 194 with Transfer Learning.

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Low surface brightness galaxies (LSBGs), characterized as galaxies fainter than the night sky, hold significant importance in comprehending galaxy evolution. The upcoming large-scale surveys such as the Rubin Observatory Legacy Survey of Space and Time (LSST) and Euclid are expected to uncover a large number of LSBGs which would require accurate automated methods for their detection. We study the scope of transfer learning for the identification of LSBGs in the Abell 194 cluster with the deep data we obtained from our Hyper Suprime-Cam (HSC) observations of this cluster. We use two ensemble of transformer models that have been trained on the dark energy survey data release 1 (DES DR 1) which is two order of magnitude shallower than the data from HSC. The transformer ensemble model achieved a classification accuracy of 95% on the data from DES DR1 and achieved a recall rate of 93% on the HSC dataset. Using the transformer ensemble models we identify a sample of 171 LSBGs among which 87 are completely new from the cluster Abell 194. We further classify 28 LSBGs among them as ultra-diffuse galaxies (UDGs). We show that transfer learning from a shallow survey to a deeper survey using transformer models can be successful with appropriate data normalization. This methodology could prove valuable for identifying and analyzing astronomical data in upcoming surveys like LSST and Euclid.

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