Deep Learning Methods for Galaxy Morphology Classification

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Accurate classification of galaxy morphologies from astronomical survey images is fundamental to understanding galaxy formation and evolution. Traditional manual classification methods, such as the crowdsourced Galaxy Zoo project, are time-consuming and struggle to keep pace with the rapidly increasing volume of imaging data. This study evaluates and compares the performance of Convolutional Neural Networks (CNNs), which have been widely applied to this task, and Convolutional Vision Transformers (CvTs), a newer architecture that has not yet been explored for the binary classification of elliptical and spiral galaxy images. Utilizing a dataset of galaxy images from the Galaxy Zoo project, the CNN model achieved a mean test accuracy of 98.12%, while the CvT achieved 97.88% across three runs. Although the results showed no statistically significant difference between the two models, the CNN exhibited faster convergence. These findings demonstrate the effectiveness of both deep learning architectures in efficiently and accurately distinguishing between galaxy types, offering a scalable solution for large-scale astronomical surveys and providing a foundation for future research into more complex morphological categories and other astronomical objects.

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