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Photometric Redshift Estimation with Convolutional Neural Networks and Galaxy Images: A Case Study of Resolving Biases in Data-Driven Methods

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Deep Learning models have been increasingly exploited in astrophysical studies, yet such data-driven algorithms are prone to producing biased outputs detrimental for subsequent analyses. Using galaxy photometric redshift estimation as an example, we propose a set of consecutive steps for resolving two biases in the existing Deep Learning methods, namely redshift-dependent residuals and mode collapse. Experiments show that our methods possess a better capability in controlling biases compared to benchmark methods, and have promises for future cosmological surveys and may be applied to regression problems and other studies that make use of data-driven models.

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