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ML Approach to Infer Galaxy Cluster Masses from eROSITA X-ray Images

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We have developed a neural network-based pipeline for estimating galaxy cluster masses directly from X-ray photon data, using known redshift information. Our approach involves training convolutional neural networks on eROSITA simulations, with a focus on the Final Equatorial Depth Survey (eFEDS) dataset. Unlike previous methods, our approach incorporates additional cluster information, including redshift, and uses simulations that include background and point sources. This enables mass estimation for a wide range of clusters ($10^{13} M_\odot < M < 10^{15} M_\odot$) directly from observational eROSITA data. We've applied this method to eFEDS clusters and achieved consistent results with weak lensing-calibrated masses, without using weak lensing data itself. Compared to simulated data, our method shows reduced scatter in relation to luminosity and count-rate-based scaling relations.

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