ID de Contribution: **15**   Type: **Non spécifié**

YOLO-CL cluster detection in the Rubin/LSST DC2 simulations

mardi 11 juin 2024 15:25 (20 minutes)

Galaxy clusters serve as powerful probes for cosmological models. Upcoming large-scale optical and infrared surveys will reach unprecedented depths across extensive areas, necessitating highly complete and pure cluster catalogs with well-defined selection functions. We have developed a novel cluster detection algorithm called YOLO-CL. This algorithm is a modified version of the state-of-the-art object detection deep convolutional network YOLO, specifically optimized for galaxy cluster detection (Grishin, Mei, Ilic 2023). It has been adapted to the datasets from the forthcoming LSST by training on a combined sample of observed SDSS clusters and simulated galaxy cluster images from the DESC Data Challenge 2 (DESC DC2).

The YOLO-CL cluster catalog achieves 100% and 94% completeness for halo masses $M_{200c} > 10^{14.6}M_{\odot}$ at $0.2 < z < 0.8$, and $M_{200c} > 10^{14}M_{\odot}$ with redshifts z
$lesssim 1$, respectively, with only a 6% false positive rate. Additionally, we found that the YOLO-CL selection function is nearly flat with respect to halo mass within the range 0.2
$lesssim z$
$lesssim 0.9$. Our paper detailing the performance of YOLO-CL on DESC DC2 simulated images (Grishin, Mei, Ilic, Aguena, Boutigny et al.) has been submitted for internal review within the DESC collaboration.

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Classification de Session: Science talks