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Towards new approaches to cluster detection for cosmology

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Galaxy clusters and dark matter halos constitute a building block of many cosmological analyses. However, amongst simulations and observations, there is a wide variety of definitions of what a cluster is from a physical standpoint that do not necessarily match with each other. On top of that, on the algorithmic side, detection strategies can vary greatly from traditional friend-of-friend approaches to image-based detection using convolutional neural networks. However, the potential of the latter is often hampered by the black-box aspect of it. In this talk, I will present the starting investigations on a new approach to combine the best of both worlds, using physics to guide machine learning algorithms. I will discuss in particular how the task of cluster detection may be reframed as a game on graphs that can be played with algorithms similar to AlphaGo. I will then present a road-map for such project to succeed, the challenges, and what it could bring to both numerical and observational cosmology.

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