DeepHalo Extension: Instance Segmentation of Dark Matter Halos

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Project Idea: To instance segment sub-halos in TNG simulation data

Baseline: Semantic segmentation of dark matter halos has already been done; we're trying to extend it to instance segmentation.

Dataset: https://www.tng-project.org/data/

Work Division: Papers to be read and coding to be done by both.
➔ Ipsita: Read and understand the data specification.
➔ Rishav: Explore NN approaches starting with Vision GNN.

Till Midsem:

➔ Read papers & understand data schema
➔ Exploratory data analysis (EDA)
➔ Learn about Graph Neural Networks

After Midsems

➜ Creating a list of baseline models for instance segmentation
➜ Implementing baseline models in code
➜ Tuning the selected best-performing models
➜ Solving the problems that we would encounter in the way

Relevant Papers

1. DeepHalo - Finding Dark Matter Halo Substructure Using Deep Learning
2. Simulating galaxy formation with the IllustrisTNG model
3. Vision GNN Paper
4. The IllustrisTNG simulations: public data release

Expected Results

➜ Instance segmentation of dark matter halos
➜ Obtaining the subhalo mass function from the segmented substructure