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Calculating enclosed mass with machine learning and line-of-sight data

Accurately determining the mass distribution within galaxies is crucial for understanding their formation and evolution. Previous research has traditionally relied on analytical equations based on the Jeans equation to estimate the enclosed mass with minimum projection effect. In this study, we present a novel approach to predict the enclosed mass within a given radius using a machine learning model trained on line of sight data of high-resolution cosmological hydrodynamical simulations. Our dataset comprises a diverse sample of galaxies spanning a wide range of masses.

To train the model, we utilize projected positions and velocities of stars within the galaxies. Multiple training iterations are performed, each with the mass enclosed within a different radius as the target variable. By systematically varying the radius, we identify the optimal value at which the neural network exhibits the highest precision in predicting the enclosed mass.

Our results demonstrate the effectiveness of the machine learning-based approach in predicting galaxy mass within a specific radius. The trained model offers a valuable tool for studying galaxy properties, such as mass distribution and gravitational potential, providing insights into the formation and dynamics of galaxies. This work also highlights the utility of machine learning techniques for studying galaxies through line of sight data.

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