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The halo-galaxy connection from a machine learning perspective

The relationship between galaxies and halos is central to describing galaxy formation and a fundamental step toward extracting precise cosmological information from galaxy maps. However, this connection involves several complex processes that are interconnected. Machine learning methods are flexible tools that can learn complex correlations between a large number of features but are traditionally designed as deterministic estimators.
In this work, we use the IllustrisTNG300-1 simulation and investigate how machine learning methods capable of predicting distributions can accurately reproduce features of different galaxy populations based on their host halo properties. In particular, we study how the models can quantify the uncertainty related to the intrinsic scatter in the halo-galaxy connection.

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