Machine Learning Applied to 21 cm Cosmology Analysis

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Abstract

Upcoming 21 cm observations from radio interferometers such as HERA and the SKA will yield a tremendous amount of information about Cosmic Dawn and the Epoch of Reionization. The information from the power spectrum and intensity maps of these eras can be used to inform astrophysical parameters pertaining to the first luminous sources in the Universe, as well as some cosmological parameters such as tau. However, the optimal methods for extracting this information is still an active area of research. We present here several new methods for analyzing 21 cm data from experiments using machine learning (ML) algorithms. These ML approaches represent a complementary approach to more traditional power spectrum analyses, and have the potential to extract information beyond two-point statistics. We show that state-of-the-art ML techniques for image analysis can yield competitive results with MCMC-style parameter estimation, with a significant reduction on the size of the training data needed for accurate prediction. We also show how ML techniques can be used in HERA data analysis to remove radio frequency interference (RFI), allowing for more robust scientific interpretation.

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