Contribution ID: **31** Type: **Parallel talk**

SKATR: A Self-Supervised Summary Transformer for the Square Kilometer Array

The Square Kilometer Array (SKA) will bring about a new era of radio astronomy by allowing 3D imaging of the Universe during Cosmic Dawn and Reionization. Machine learning promises to be a powerful tool to analyze the highly structured and complex signal, however accurate training datasets are expensive to simulate and supervised learning may not generalize. We introduce SKATR, a self-supervised vision transformer whose learned encoding can be cheaply adapted for downstream tasks on 21cm maps. Focusing on regression and posterior inference of simulation parameters, we demonstrate that SKATR representations are near lossless. We also study how SKATR generalizes to differently-simulated datasets and compare to fully-supervised baselines.

AI keywords

Self-Supervision; Simulation-Based Inference; Transformers

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Track Classification: Foundation Models