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RFI REJECTION IN MULTI-BEAM RECEIVERS USING A CNN: A PATH TO IDENTIFYING ETI SIGNALS

Abstract

As society's reliance on technology grows, so does the prevalence of radio frequency interference (RFI), complicating the search for extraterrestrial intelligence (ETI) signals. In this study, we propose a machine learning approach to distinguish false positive narrowband ETI signals detected by multi-beam receiver telescopes and interferometric arrays. Leveraging over 1000 hours of Galactic Plane data from the Parkes Telescope's 21cm Multibeam receiver, obtained as part of the Breakthrough Listen program, we employ a convolutional neural network (CNN) as our final filter to identify potentially artificial narrowband transmitters from ETIs. Using the *setigen* tool (Brzycki et al. 2022), we generate signals for our training set and inject them into background noise from real data. Training ResNet50 (He et al. 2015) through transfer learning, we achieved a remarkable model validation accuracy of 98.46%. Unlike traditional RFI filtering methods, our approach analyzes each spectrogram containing a candidate signal independently, assigning a predicted signal probability. We then verify if all beams with high signal probabilities meet our coincidence rejection criteria. This significantly reduces the number of candidates requiring visual inspection to a mere 0.2%. This paper outlines our data collection process, signal generation, training data, CNN algorithm, and proposes its applicability to upcoming interferometer projects, offering an alternate, efficient solution to the daunting task of scrutinizing millions of potential ETI signals.