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Detecting Fast Radio Bursts Using Convolutional Neural Networks

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Extended Abstract

Fast Radio Burst (FRB) are high intensity bursts of radio energy lasting only a few milliseconds with large dispersion measures, suggesting extragalactic origin [1]. FRBs have gained intense interest in the astronomical community because their physical origin is not well understood, and because they may be useful as a probe of the intergalactic medium. With its large field of view, the Allen Telescope Array (ATA) is an instrument that is well-designed to observe FRBs over a wide frequency range (simultaneously from 1-10 GHz). Like many other cm-wave observatories (Parkes, ASKAP, MeerKAT, GMRT) the ATA is developing high speed detection systems to identify FRBs that fortuitously appear in our field of view during commensal observations.

FRB detection is somewhat challenging since a computationally intensive de-dispersion search must be performed at GB/s data rates in a time-frequency analysis. Here we explore an alternative detection method that may offer greater reliability and/or less computational effort for the discovery of FRBs. We use deep neural networks to distinguish between Fast Radio Bursts and other astronomical or interfering signals. To generate training data for deep neural networks, we simulate FRB-like signals based on the characteristics and shape of previously observed FRBs [2]. Convolutional neural networks (CNN) have previously shown good results in classifying radio signals in SETI institute's code challenge, ML4SETI 2017. We train CNNs on spectrograms generated from simulated FRB signals, and will evaluate CNN performance in terms of accuracy and computational requirements as compared with a more conventional de-dispersion search [3,4].

References

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