FAST RADIO BURSTS

Digging deeper

Astrophys. J. (in the press); preprint at
https://arxiv.org/abs/1809.03043

The fast radio burst source first detected in Arecibo Observatory data from 2 November 2012 has become known to the community as 'the repeater' due to the fact that repeat bursts were detected 2.5 years after the initial one, and tens of others have been seen since then. Yunfan Zhang et al. have used a machine learning technique to identify 72 further radio bursts from the repeater in Green Bank Telescope (GBT) data obtained in 2017. A previous search of the same data using conventional methods turned up only 21 bursts (V. Gajjar et al., *Astrophys. J.* **863**, 2; 2018).

Zhang et al. trained a convolutional neural network (TensorFlow) on the raw spectrogram data from the C-band (4–8 GHz) receiver at the GBT using a supervised learning technique. Such an approach not only processes data 70 times faster than real time using a single GPU, but also reduces the number of (RFI-based) false positives, which can plague traditional algorithmic methods. The network was trained on ~200,000 simulated pulses (positives) and a similar number of negative samples (noise plus RFI). After 100 epochs, the accuracy converges to 93% on the test data with minimal over-fitting.

Burst properties are consistent with those determined previously, and moreover the bursts exhibit complex spectro-temporal structures across the 4 GHz bandwidth: several characteristic frequencies with high flux densities persist over the first hour of observations. Interestingly, using times of arrival for all 93 bursts, the pulse period for perfectly periodic emission could be constrained to ≤10 ms with 99% confidence, including no (or a non-detectable) period.

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