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Using bowties to catch radio emitting transients

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Short timescale radio-transient events provide a signature of extreme astrophysical phenomena. They are often associated with radio emitting neutron stars and Fast Radio Bursts and have been theorised to be emitted by merging black holes and neutron stars. However, discovering these single pulses is computationally challenging and often does not use all available information when selecting candidates. Modern telescopes generate vast numbers of candidates due to the search parameter space spanning large numbers of beams, dispersion measures and pulse widths. Traditionally, the searches are done on dedispersed time series using thresholding techniques based on the statistical properties of the data. More recently, post processing of the potential sources has generated diagnostic plots that have been passed to machine learning algorithms for improved identification of candidates to be viewed by eye. We have investigated a method which bypasses the thresholding step and proceeds straight to generating images of the dispersion measure-time domain. A Mask RCNN model is then used to perform an instance segmentation task on these images to localise potential new transient sources. The deep learning model returns a classification score, a bounding box, and a binary mask of the candidate. The network was trained to identify sources based on the characteristic bowtie shape of the signal-to-noise degradation expected for a real dispersed pulse. I will present the methodology and the results of the training and application to some real datasets.

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