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The Use of Artificial Neural Networks to Detect Supernova Remnants in the Fermi Deep Field

Artificial neural networks, such as multi-layer perceptrons, are computer programs designed to mimic the pattern recognition performed by organic brains. They have many uses in particle physics and astronomy, where a small signal is swamped by a large (but identifiable background). In this poster we will present a novel implementation of a neural net to detect and classify sources with both the Fermi Space Telescope and the planned Cherenkov Telescope Array (CTA). As an example of one use of neural nets in gamma-ray astrophysics, we present evidence to support the use of such programs to detect fine structure in Supernova Remnants. Such structure in the gamma-ray image, as seen with the Fermi Space Telescope, is indicative of the acceleration of cosmic-ray protons. This study utilises toy models of supernova remnants as viewed by telescopes with different point spread functions, training multi-layer perceptrons on various parameters of the images, and then comparing the mean probabilities of signal generated when the networks were cross-tested. This work indicates that neural nets have a role to play in source characterisation against a diffuse gamma-ray background and could potentially further constrain the role Supernova Remnants play in cosmic-ray acceleration.

Summary

Artificial neural networks were used to identify Supernova Remnants in images from the Fermi Space Telescope.

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