

# Point source location and classification at GeV energies using image segmentation and classification neural networks

*Saturday, 17 April 2021 15:00 (15 minutes)*

At GeV energies, the sky is dominated by the interstellar emission from the Galaxy. With limited statistics and spatial resolution, accurate separation of point sources is therefore challenging. In this presentation I will describe the first application of deep learning based algorithms to detect and classify point sources from raw gamma-ray data. To detect point sources we utilise U-shaped convolutional networks for image segmentation and k-means for source clustering and localisation. We also explore the Centroid-Net algorithm, which is designed to find and count objects. The training data is based on 9.5 years of Fermi-LAT exposure and we use source properties of active galactic nuclei (AGNs) and pulsars (PSRs) from the fourth Fermi-LAT source catalog (4FGL) in addition to several models of background interstellar emission. We demonstrate that the source localization algorithms are robust to modifications to the background emission models by using a series of different models. This gives them an important advantage with respect to the more traditional, likelihood based, catalogue derivation techniques. In terms of the source classification, we show that the network is capable of distinguishing between the three general source classes we trained it on (AGNs, PSRs and FAKE) with global accuracy of ~70%, as long as balanced data sets are used in classification training. I will also describe the data challenge that we introduce with this work, inviting the community to participate with the clear scope to address the question: How can we best locate and classify gamma-ray point sources?

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