

Study of Periodicity in Blazar Light Curves with a Machine Learning Approach

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Long-term periodicity in Blazar light curves could be linked to the innermost zone of the complex structure of AGN, such as possible presence of binary system of supermassive black holes.

We analysed 16 years light curves of 1525 gamma-ray sources coming from the Fermi-LAT Light Curve Repository (LCR). First, we set up a periodicity analysis pipeline using Lomb-Scargle Periodogram (LSP) and Weighted Wavelet Z-transform (WWZ), employing Emmanoulopoulos simulations for significance estimation. We found significance periodicities in almost 1% of the sources, consistent with recent works, and identified a golden sample of 6 sources.

Furthermore, we used a machine learning approach to explore similarities not necessarily related to periodicity, and to control, from a different perspective, Quasi Periodic Oscillations against red noise. Hence we used an unsupervised algorithm: t-Stochastic Neural Embedded (t-SNE), it calculates the probability of considering neighbor set of data, defining Euclidean distances without proper meanings. The goal of this work is to highlight similar sources or identify a sample of interesting variable sources.

The t-SNE map for simulations showed signals well separated from white and red noises. Therefore, applying the tuned method to the sources, we obtained a similar morphology, where the golden sources are arranged close to each other.

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