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SkyCURTAINs: Model agnostic search for Stellar Streams with Gaia data

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We introduce SkyCURTAINs, an adaptation of the CURTAINs method—a weakly supervised technique originally developed for anomaly detection in high-energy physics data—applied to data from the second Gaia Data Release (GDR2). SkyCURTAINs is employed to search for stellar streams, which appear as line-like overdensities against the background of the Milky Way. To validate the feasibility of this approach, we evaluate its performance on the recovery of the GD-1 stream, a well studied stellar stream for which truth labels are available. SkyCURTAINs achieves a purity of 75.4%, a 10% improvement over existing methods, while maintaining a signal efficiency of 37.9%. These results highlight the effectiveness of generic, data-driven, and model-agnostic approaches in addressing anomaly detection across distinct domains. Notably, due to the generic nature of the method, CURTAINs can detect various types of anomalies, including streams, globular clusters, and dwarf galaxies. The SkyCURTAINs method is only specialised by the final step in the algorithm, which applies a Hough transform to specifically search for line-like structures, which leaves open the possibility of future searches for these other types of anomalies. The success of this study naturally suggests a follow up full sky scan that could potentially discover previously unknown stellar streams.

Track

Astrophysics

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