Title:	Identification and Analysis of Tidal Tails in Open Star Clusters
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Abstract:	This research presents an unsupervised approach to the identification and characterization of tidal tails in open star clusters. We work on the extensive astrometric and photometric data from the Gaia-DR3 catalog to train machine learning algorithms, specifically unsu- pervised clustering and density-based spatial clustering of applications with noise (DB- SCAN) with Markov chain Monte Carlo (MCMC) optimization. This approach allows us to objectively identify member stars within a cluster based on their kinematic (proper motion and radial velocity), photometric (color), and astrometric (position) proper- ties. Following member star identification, we investigate the resulting stellar substructures for characteristics indicative of tidal tails. These telltale signs include stars with a similar range of radial velocities to the member stars (within 10 km/s), evidence of a shared history (simi- lar age and metallicity), and location beyond the cluster's tidal radius – the distance where the Galaxy's gravitational force dominates. Once potential tidal tails are identified, we perform a detailed analysis encompassing their morphology (shape) and dynamical behavior (proper motion). This analysis aims to elu- cidate the evolutionary history of the cluster by evaluating the impact of these features on the cluster's past and future dynamics. Finally, the research delves into the rotational aspects of the confirmed tidal tail in M67. This methodological framework represents a significant advancement in our understanding of the interplay between stellar clusters and their Galactic environment.
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