[포ST-09] Identifying potential mergers of globular clusters: a machine-learning approach

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While the current consensus view holds that galaxy mergers are commonplace, it is sometimes speculated that Globular Clusters (GCs) may also have undergone merging events, possibly resulting in massive objects with a strong metallicity spread such as Omega Centauri. Galaxies are mostly far, unresolved systems whose mergers are most likely wet, resulting in observational as well as modeling difficulties, but GCs are resolved into stars that can be used as discrete dynamical tracers, and their mergers might have been dry, therefore easily simulated with an N-body code. It is however difficult to determine the observational parameters best suited to reveal a history of merging based on the positions and kinematics of GC stars, if evidence of merging is at all observable. To overcome this difficulty, we investigate the applicability of supervised and unsupervised machine learning to the automatic reconstruction of the dynamical history of a stellar system. In particular we test whether statistical clustering methods can classify simulated systems into monolithic versus merger products. We run direct N-body simulations of two identical King-model clusters undergoing a head-on collision resulting in a merged system, and other simulations of isolated King models with the same total number of particles as the merged system. After several relaxation times elapse, we extract a sample of snapshots of the sky-projected positions of particles from each simulation at different dynamical times, and we run a variety of clustering and classification algorithms to classify the snapshots into two subsets in a relevant feature space.