Determining the radius of an open cluster from stellar proper motions.

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Abstract

We propose a new method for calculating the radius of an open cluster in an objective way from an astrometric catalogue containing, at least, positions and proper motions. It uses the minimum spanning tree in the proper motion space to discriminate cluster stars from field stars and it quantifies the strength of the cluster-field separation. This is done for a range of different sampling radii from where the cluster radius is obtained as the size at which the best cluster-field separation is achieved. The novelty of this strategy is that the cluster radius is obtained independently of how its stars are spatially distributed. We test the reliability and robustness of the method with both simulated and real data from a well-studied open cluster (NGC 188), and apply it to UCAC4 data for five other open clusters with different catalogued radius values. NGC 188, NGC 1647, NGC 6603, and Ruprecht 155 yielded unambiguous radius values. However, ASCC 19 and Collinder 471 showed more than one possible solution, but it is not possible to know whether this is due to the involved uncertainties or due to the presence of complex patterns in their proper motion distributions. (See poster).