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Extracting galactic structure parameters from multivariate density estimation

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Multivariate statistical analysis, including cluster analysis (unsupervised classification), discriminant analysis (supervised classification) and principle component analysis (dimensionality reduction method), and nonparameter density estimation have been successfully used to search for meaningful associations (Crézé et al., 1991; Robin et al., 1992, Chen, 1992) in the 5-dimensional space of observables between observed points and the sets of simulated points generated from a synthetic approach of galaxy modelling (Robin and Crézé, 1986; Bienaymé et al. 1987). These methodologies can be applied as the new tools to obtain information about hidden structure otherwise unrecognizable, and place important constraints on the space distribution of various stellar populations in the Milky Way.

In this paper, we concentrate on illustrating how to use nonparameter density estimation to substitute for the true densities in both of the simulating sample and real sample in the five-dimensional space. In order to fit model predicted densities to reality, we derive a set of equations which include n lines (where n is the total number of observed points) and m (where m : the numbers of predefined groups) unknown parameters. A least-square estimation will allow us to determine the density law of different groups and components in the Galaxy. The output from our software, which can be used in many research fields, will also give out the systematic error between the model and the observation by a Bayes rule.

References

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