Section 12: Probability and Statistics | Poster number 275

Optimal segregation of a two-component sample based on maximum population entropy: An application to astronomy

S. Alcobé*, Dept. Matemàtica Aplicada i Telemàtica, Universitat Politècnica de Catalunya, Barcelona, Spain.
M.A. Catalá-Poch, Dept. Astronomia i Astrofísica, Universitat de Barcelona, Barcelona, Spain.
R. Cubarsi, Dept. Matemàtica Aplicada i Telemàtica, Universitat Politècnica de Catalunya, Barcelona, Spain.

ABSTRACT

Determination of stellar population parameters from statistics of global samples is extremely sensitive to the noise introduced by few non-typical stars. In order to obtain a nearly-pure two-population mixture a subsample is drawn from the nearby stars catalogue by applying a non-informative filtering. The method is used to study the trivariate velocity distribution of stars, which can be locally approximated by a superposition of two normal components. Thus, an auxiliar parameter P, depending or not on the velocity variables, such as the absolute velocity referred to the lower population mean, the absolute value of one peculiar velocity component alone, the distance to the galactic plane, etc. is introduced. This parameter must induce an ordered incorporation of stars to the population components, in the sense that the greater the P value, the greater the number of stars in each component. Then a subsample S(P) is drawn from the global one. Depending on this parameter the population entropy H(P) of the mixture is computed from the mixing proportions, and an optimal subsample S(P) is selected in order to maximize H(P). On the other hand, for each subsample S(P), the goodness of the superposition approximation is estimated by reconstructing the sample central moments up to fourth-order from the mixture parameters. A chi-square test, taking into account the sampling distribution moments, is evaluated to measure the fitting error. For different subsamples S(P) a total accordance between the minimum chi-square and the maximum population entropy H(P) is produced. Furthermore, this method can be used recursively in order to segregate a global sample in more than two populations.

Keywords: *mixture distributions, entropy of a partition, stellar classification*

Mathematics Subject Classification: *60, 62, 65, 85*

Contact Address: rcubarsi@mat.upc.es