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SPECTRAL SYNTHESIS WITH EMPIRICAL PRIORS

Laerte Sodré Jr.[1]

RESUMEN

Estamos desenvolvendo um estimador de parâmetros bayesiano que é bastante competitivo comparado com outros métodos, como evidenciado por vários experimentos realizados por nosso grupo (com redshifts fotométricos e síntese espectral de galáxias). Nossa abordagem baseia-se em um conjunto de treinamento (empírico, teórico ou mixto) com parâmetros conhecidos e provê a função de distribuição de probabilidades de um dado parâmetro, bem como outros sumários estatísticos da distribuição, para todas as galáxias de um levantamento. Estamos construindo uma grande biblioteca teórica de espectros para derivar parâmetros para as galáxias observadas pelos levantamentos J-PAS, J-PLUS e S-PLUS.

ABSTRACT

We have been developing a Bayesian parameter estimator which is very competitive compared with other machine learning methods, as evidenced by several experiments performed by our group (e.g., on photometric redshifts and galaxy spectral synthesis). Our approach relies on a training set, i.e., a (empirical, theoretical or mixed) data set with known parameters, and outputs the probability distribution function of a certain parameter, as well as other statistical summaries of this distribution, for all galaxies in the survey. We propose to build a large training set using theoretical libraries and use them to derive galaxy parameters from S-PLUS, J-PLUS and J-PAS observations.

Key Words: galaxies: evolution — galaxies: fundamental parameters — galaxies: stellar content

Sophisticated statistical methods are essential to extract the information in the data collected by contemporary surveys. The methods discussed here are being developed for the J-PAS, J-PLUS and S-PLUS surveys. J-PAS (Benítez et al. 2014) will provide a low-resolution spectra ($R \sim 40 - 50$) of each pixel in the sky through its innovative 59 filter system. J-PLUS and S-PLUS will provide multiband photometry with a 12 filter system.

Spectral synthesis (e.g., Cid Fernandes et al. 2005) is a powerful tool to estimate physical parameters of galaxies, such as mean stellar ages, metallicity and dust extinction. It is common to estimate galaxy parameters by fitting observed spectra with a set of a few templates. In this work we adopt a different approach: we generate a large library of simulated spectra, with known parameters, and use this library together with machine learning tools, to retrieve physical parameters for galaxies observed in surveys from their photometry. The library is produced by combining sets of simple stellar populations generated either with Bruzual & Charlot (2003) or with MILES (Vazdekis et al. 2010) models. The artificial spectral library is generated at z=0 and for the analysis of a certain observed galaxy, the library spectra are displaced to the appropriate galaxy redshift, random reddening is added to each model spectrum, and the appropriate photometric points are obtained for each model spectrum.

We use regression techniques for the spectral synthesis parameter estimation. Numerical experiments show that the best results are obtained with artificial neural networks, but simpler algorithms, such as Naive Bayes, also produce good results.

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REFERENCES

Benítez, N., et al. 2014, arXiv:1403.5237
Bruzual, G., & Charlot, S. 2003, MNRAS, 344, 1000
Cid Fernandes et al. 2005, MNRAS, 358, 363
Vazdekis, A. et al. 2010, MNRAS, 404, 1639

[1]Departamento de Astronomia, IAG, Universidade de São Paulo, R. do Matão 1226, 05508-090, São Paulo, Brazil (laerte.sodre@iag.usp.br).

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