

New features in galaxy morphological analysis

Rubens A. Sautter^{a1}, Reinaldo R. Rosa ^a and Reinaldo R. de Carvalho^a

^aNational Institute for Space Research, São José dos Campos, SP, Brazil

Abstract

The precise galaxy classification is a challenge in morphology and data mining areas, due to the size of the datasets (for example, in this work we aim to classify more than 1Tb of galaxies images), and the variety of this data. One of the fundamental problems in the galaxies classification is the information extraction, which are expressed by a set of indexes. In this work is presented a study of the non-parametric indexes. We describe a refinement of the well-known non-parametric indexes, which are the Concentration (C_1 , C_2), Asymmetry (A_2 , A_3), and Smoothness (S_2 , S_3). We also describe improvements to the Entropy (H_n) and Spirality (σ_2 , σ_3) indexes that were recently introduced in morphometric systems [2]. To contribute with these systems, we also introduce a new index that follows the Gradient Pattern Analysis (GPA) formalism the so-called Algebraic Assymmetric Gradient Coefficient (G_{alg}). As result we observed an improvement in the entropy index, and in concentration indexes. We also observed good results for G_{alg} .

Keywords: Data Mining, Morphology, Image Processing.

References

- [1] H. Mo, F. van den Bosch, and S. White, Galaxy Formation and Evolution. Cambridge University Press, 1 ed., 6 2010.
- [2] F. Ferrari, R. R. de Carvalho, and M. Trevisan, Morfometryka a new way of establishing morphological classification of galaxies, The Astrophysical Journal, vol. 814, no. 1, p. 55, 2015.
- [3] R. R. Rosa, A. Sharma, and J. Valdivia, Characterization of asymmetric fragmentation patterns in spatially extended systems, International Journal of Modern Physics C, vol. 10, no. 01, pp. 147163, 1999.

¹E-mail Corresponding Author: rubens.sautter@gmail.com

- [4] C. J. Lintott et al., Galaxy zoo: morphologies derived from visual inspection of galaxies from the sloan digital sky survey, Monthly Notices of the Royal Astronomical Society, vol. 389, no. 3, pp. 11791189, 2008.
- [5] E. Bertin and S. Arnouts, SExtractor: Software for source extraction., AAPS, vol. 117, pp. 393404, June 1996.