A MINIMAX ENTROPY METHOD FOR BLIND SEPARATION OF DEPENDENT COMPONENTS IN ASTROPHYSICAL IMAGES

Cesar F. Caiafa[1], Ercan E. Kuruoğlu[2] and Araceli N. Proto[1,3]

(1) Lab. de Sistemas Complejos. Fac. de Ingeniería (UBA), Buenos Aires, Argentina

(2) Istituto di Scienza e Tecnologie dell'Informazione - CNR, Pisa, Italy

(3) Comisión de Inv. Científicas de la Prov. de Buenos Aires, Buenos Aires, Argentina

(e-mail: ccaiafa@fi.uba.ar, ercan.kuruoglu@isti.cnr.it and aproto@fi.uba.ar)

Abstract

We develop a new technique for the blind separation of potentially non independent components in astrophysical images. Given a set of linearly mixed images, corresponding to different measurement channels, we estimate the original electromagnetic radiation sources in a blind fashion. Specifically, we investigate the separation of cosmic microwave background (CMB), thermal dust and galactic synchrotron emissions without imposing any assumption on the mixing matrix. In our approach, we use the Gaussian and non-Gaussian features of astrophysical sources and we assume that CMB-dust and CMB-synchrotron are uncorrelated pairs while dust and synchrotron are correlated which is in agreement with theory. These assumptions allow us to develop an algorithm which associates the Minimum Entropy solutions with the non-Gaussian sources (thermal dust and galactic synchrotron emissions) and the Maximum Entropy solution as the only Gaussian source which is the CMB. This new method is more appropriate than ICA algorithms because independence between sources is not imposed which is a more realistic situation. We investigate several measures associated with entropy and we compare them. Finally, we present an example of separation using the Euclidean distance between the Gaussian probability density function (pdf) and a Parzen based estimation of the pdf associated with the data. For the validation of our approach we present experimental results using a database that simulates de one expected from the instruments that will operate onboard ESA's *Planck* Surveyor Satellite to measure the CMB anisotropies all over the celestial sphere.

Key Words: Entropy measures, Blind Source Separation (BSS), astrophysical images.