Bayesian Unbiasing of the Gaia Space Mission Time Series Database

Datenbank
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Deskriptoren
Datenanalyse; Zeitreihe; Markov-Kette

Freie Begriffe
hierarchisches Modell; Catalogues; complex space; ESA (European Space Agency); systematic bias

Abstract
21st century astrophysicists are confronted with the herculean task of distilling the maximum scientific return from extremely expensive and complex space- or ground-based instrumental projects. This paper concentrates in the mining of the time series catalog produced by the European Space Agency Gaia mission, launched in December 2013. We tackle in particular the problem of inferring the true distribution of the variability properties of Cepheid stars in the Milky Way satellite galaxy known as the Large Magellanic Cloud (LMC). Classical Cepheid stars are the first step in the so-called distance ladder: a series of techniques to measure cosmological distances and decipher the structure and evolution of our Universe. In this work we attempt to unbias the catalog by modelling the aliasing phenomenon that distorts the true distribution of periods. We have represented the problem by a 2-level generative Bayesian graphical model and used a Markov chain Monte Carlo (MCMC) algorithm for inference (classification and regression). Our results with synthetic data show that the system successfully removes systematic biases and is able to infer the true hyperparameters of the frequency and magnitude distributions.

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