Searching for Gamma Ray Sources in the Extra-Galactic Space: A Statistical Analysis of the Fermi LAT Data

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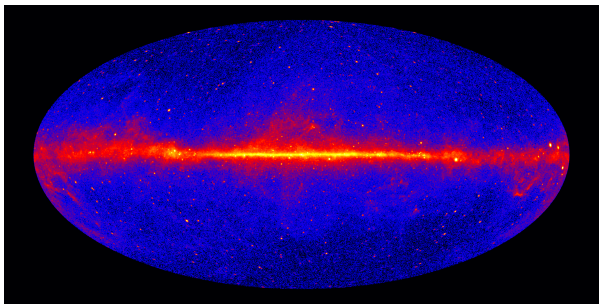
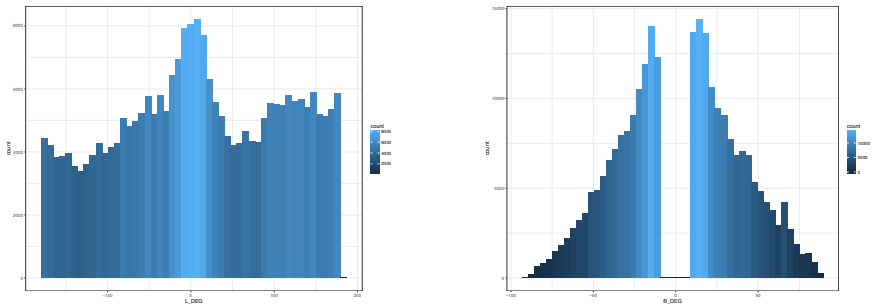
The Fermi LAT Data



http://fermi.gsfc.nasa.gov/

- We consider photons from the *extra-galactic space* (blue region in the map) with a minimal detected energy of $10 GeV$.
- We abandon the approach proposed in *Mattox et al. (1996)* and we extend the model of *Jones et al. (2015)* to simultaneously estimate the number of sources in the Fermi LAT γ-ray count map and their coordinates, separating their signals from the intensive background contamination that characterizes our data.

A parametric model for the *Isotropic γ-ray background*



- Two possible classes of events are considered:
  1. *extra-galactic sources* $\Longrightarrow$ *King's PSF*
  2. *Isotropic γ-ray background* $\Longrightarrow$?
- The background contamination is not uniform at all.
- We approach to this problem modelling the background through a parametric distribution.

Bayesian mixture modelling and results

	Known Sources	*Unknown Groups*
Sim.1	105	65
Sim.2	108	62
Sim.3	108	62
Sim.4	105	65

Table 1: Four different runs of the Reversible Jump MCMC algorithm with 10,000 iterations.

- The bayesian mixture modelling permits to:
  1. deal with uncertainty about photons' origins;
  2. automatically select the number of sources taking into account the presence of the background;
  3. add a priori knowledge into the model (already known sources, intensities of the events,...).