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## LIBRJMCMC: AN OPEN-SOURCE GENERIC C++ LIBRARY FOR STOCHASTIC OPTIMIZATION

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Abstract. The librmcmc is an open source C++ library that solves optimization problems using a stochastic framework. The library is primarily intended for but not limited to research purposes in computer vision, photogrammetry and remote sensing, as it has initially been developed in the context of extracting building footprints from digital elevation models using a marked point process of rectangles. It has been designed to be both highly modular and extensible, and have computational times comparable to a code specifically designed for a particular application, thanks to the powerful paradigms of metaprogramming and generic programming. The proposed stochastic optimization is built on the coupling of a stochastic Reversible-Jump Markov Chain Monte Carlo (RJMCMC) sampler and a simulated annealing relaxation. This framework allows, with theoretical guarantees, the optimization of an unrestricted objective function without requiring any initial solution.

The modularity of our library allows the processing of any kind of input data, whether they are 1D signals (e.g. LiDAR or SAR waveforms), 2D images, 3D point clouds... The library user has just to define a few modules describing its domain specific context: the encoding of a configuration (e.g. its object type in a marked point process context), reversible jump kernels (e.g. birth, death, modifications...), the optimized energies (e.g. data and regularization terms) and the probabilized search space given by the reference process. Similar to this extensibility in the application domain, concepts are clearly and orthogonally separated such that it is straightforward to customize the convergence test, the temperature schedule, or to add visitors enabling visual feedback during the optimization. The library offers dedicated modules for marked point processes, allowing the user to optimize a Maximum A Posteriori (MAP) criterion with an image data term energy on a marked point process of rectangles.

[Conference Paper](#) (PDF, 1777 KB)

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