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ESTIMATING THE VARIANCE OF THE MAXIMUM PSEUDO-LIKELIHOOD ESTIMATOR

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Abstract

The use of the pseudo-likelihood estimator for Gibbs-Markov random field models has a distinct advantage over more conventional approaches mainly due to its computational efficiency. Indeed, the maximum pseudo-likelihood estimator (MPLE) is often used as the Monte Carlo parameter in Markov chain Monte Carlo (MCMC) simulations. The MPLE itself has some very nice estimation properties, though its variance is still undiscovered. In this paper, the moving-block bootstrap is employed to estimate the variance of the MPLE in the Ising model.

KEY WORDS: parameter estimation, Gibbs random fields, Markov random fields, parametric bootstrap, moving-block bootstrap, subsampling

1 Introduction

Gibbs-Markov random fields (GMRFs) are statistical models used to study the spatial relationships among data taken on a grid. Although these models were developed around the turn of the century in physics as models for particle interactions (Gibbs, 1902), it has only been within the past fifteen years or so that they have been seriously considered by statisticians and other scientists as models for spatially related data. The form of the distribution used in practice is fairly simple:

$$P(X_\Lambda = x_\Lambda) = \frac{\exp\{\boldsymbol{\theta} \cdot \boldsymbol{Y}(x_\Lambda)\}}{Z}, \tag{1}$$