

Letter to the Editor

Comment on “On the Metropolis-Hastings Acceptance Probability to Add or Drop a Quantitative Trait Locus in Markov Chain Monte Carlo-Based Bayesian Analyses”

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AS Jean-Luc Jannink and Rohan L. Fernando (JANNINK and FERNANDO 2004) nicely illustrated, when applying Markov chain Monte Carlo methods in a form where the dimension [the number of quantitative trait loci (QTL)] is not fixed, it can sometimes be hard to establish the correct form of the acceptance ratio for the proposals that are made. Therefore, as a safety precaution, the correct performance of the sampler should be checked also (under the prior model) without data.

We recently learned that Patrick Gaffney (GAFFNEY 2001) in his Ph.D. thesis had made essentially the same observation as Jannink and Fernando, correcting our mistake in SILLANPÄÄ and ARJAS (1998). Somewhat earlier VOGL and XU (2000) had expressed similar kinds of thoughts. As GAFFNEY (2001) explained, the acceptance ratio given in our article would correspond to an analysis, where an accelerated truncated Poisson prior (with a square term in the denominator) was assumed for the number of QTL, instead of an “ordinary” truncated Poisson distribution as stated in the article. The former distribution gives bigger prior weights to smaller numbers of QTL and smaller weights to larger numbers. In our view the published analyses, where the authors have used the same acceptance ratio as in SILLANPÄÄ and ARJAS (1998), should be interpreted as corresponding to an accelerated truncated Poisson prior distribution, rather than saying that they should be completely omitted, which was the view expressed by Jannink and Fernando.

The terms “ordered” and “unordered” were in JANNINK and FERNANDO (2004) taken to mean, as we believe, the opposite from their standard meaning in mathematics. Thus their derivation of the correct expression of the acceptance ratio, which they say corresponds to considering the QTL as an unordered set of points, is in our view actually indexing them according to their ordered positions. The derivation in SILLAN-

PÄÄ and ARJAS (1998) was based on considering unordered QTL and the expression

$$\frac{\lambda}{(N_{\text{qtl}}^{(t-1)} + 1)^2} = \frac{\lambda}{(N_{\text{qtl}}^{(t-1)} + 1)}$$

(the Poisson prior ratio)

$$\times \frac{1}{(N_{\text{qtl}}^{(t-1)} + 1)}$$

(the proposal probability ratio of selecting a particular QTL

for a delete step and selecting a QTL for an add step)

$$\times 1$$

(the ratio of two uniform proposal densities)

(p. 1387) was wrong since the proposal probability of selecting a QTL for an “add” step should be $1/(N_{\text{qtl}}^{(t-1)} + 1)$ instead of 1. This is the probability of selecting the coordinate (in the unordered parameterization) that contains the parameters of the new QTL among the $(N_{\text{qtl}}^{(t-1)} + 1)$ possibilities. This contribution cancels against the contribution from selecting a particular QTL in a “delete” step. The acceptance ratio will naturally have the same expression as was established (in our view, for ordered QTL) by JANNINK and FERNANDO (2004).

LITERATURE CITED

- GAFFNEY, P. J., 2001 An efficient reversible jump Markov chain Monte Carlo approach to detect multiple loci and their effects in inbred crosses. Ph.D. Thesis, Department of Statistics, University of Wisconsin, Madison, WI.
- JANNINK, J.-L., and R. L. FERNANDO, 2004 On the Metropolis-Hastings acceptance probability to add or drop a quantitative trait locus in Markov chain Monte Carlo-based Bayesian analyses. *Genetics* **166**: 641–643.
- SILLANPÄÄ, M. J., and E. ARJAS, 1998 Bayesian mapping of multiple quantitative trait loci from incomplete inbred line cross data. *Genetics* **148**: 1373–1388.
- VOGL, C., and S. XU, 2000 Multipoint mapping of viability and segregation distorting loci using molecular markers. *Genetics* **155**: 1439–1447.

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