



Statistical inference for random T-tessellations models. Application to agricultural landscape modeling

Katarzyna Adamczyk-Chauvat¹ · Mouna Kassa² · Julien Papaix³ · Kiên Kiêu¹ ·
Radu S. Stoica⁴

Received: 4 February 2022 / Revised: 2 November 2023 / Accepted: 8 November 2023 /

Published online: 5 April 2024

© The Institute of Statistical Mathematics, Tokyo 2024

Abstract

The Gibbsian T-tessellation models allow the representation of a wide range of spatial patterns. This paper proposes an integrated approach for statistical inference. Model parameters are estimated via Monte Carlo maximum likelihood. The simulations needed for likelihood computation are produced using an adapted Metropolis-Hastings-Green dynamics. In order to reduce the computational costs, a pseudolikelihood estimate is derived and then used for the initialization of the likelihood optimization. Model assessment is based on global envelope tests applied to the set of functional statistics of tessellation. Finally, a real data application is presented. This application analyzes three French agricultural landscapes. The Gibbs T-tessellation models simultaneously provide a morphological and statistical characterization of these data.

Keywords Gibbsian T-tessellation · Monte Carlo Maximum Likelihood estimation · Pseudolikelihood · Global envelope test · Agricultural landscape

Kiên Kiêu died on 27.02.2017 after an earlier version of this paper had been prepared. The remaining authors take full responsibility for the present version.

✉ Katarzyna Adamczyk-Chauvat
Katarzyna.Adamczyk@inrae.fr

¹ Université Paris-Saclay, INRAE, MaIAGE, 78350 Jouy-en-Josas, France

² INSA, 35700 Rennes, France

³ INRAE, BioSP, 84914 Avignon, France

⁴ Université de Lorraine, CNRS, Institut Elie Cartan de Lorraine, Inria, F-54000 Nancy, France