Report on the doctoral thesis

Daniela Flimmel: Asymptotic inference for stochastic geometry models

The thesis is rather extensive, it contains a detailed introduction over models used in stochastic geometry (Chapter 1) and an overview of asymptotic results based on the Malliavin-Stein method (Chapter 2). The new results of the author are contained in Chapters 3 and 4.

In Chapter 3, a weighted Voronoi tessellation of a stationary independently marked point process is introduced (containing also the Laguerre tessellations), some estimators of geometric characteristics of the typical cell based on minus sampling are proposed, and their properties are studied: asymptotic unbiasedness, asymptotic variances and central limit theorems. Some necessary assumptions guaranteeing weak dependencies of characteristics of far away cells are imposed. These results are based on a common paper with Z. Pawlas and J. Yukich.

In Chapter 4, a planar stationary cylinder process is studied. Here the "naive" estimator of the volume fraction of its union set (volume fraction in an expanding window) is studied and its asymptotic variance and central limit theorem are obtained. Here the Poissonianity is not assumed (in contrast to results known from the literature), but instead, some strong mixing conditions (expressed by means of cumulant measures) are imposed. These results are based on a common paper with L. Heinrich.

Both results are of interest and follow main research areas in recent stochastic geometry. There are certainly open questions motivating further research in this direction. The results are presented in a clear way, the authors made an effort to explain them clearly, and the proofs seem to be correct and sane.

I find rather unusual the large extent of the thesis. In fact, the contents of Chapter 2 is not connected directly with the main new results, and it is technically very demanding. Nevertheless, I understand that the author wanted to present an overview on this research direction since she considers it important and promising. In this sense, the thesis can be considered as a kind of survey which might be also valuable and I appreciate that the author does not see only her own results but tries to understand also other related results and compare them.

Summarizing, I consider the thesis to be very well written, of high mathematical quality, with new result of importance in stochastic geometry, and with inspiring questions for further research. I am sure that the author has proved her ability of doing independent scientific research.

I would like to ask the author the following questions:

(1) Can one relax the assumption of independent marks in the models with weighted Voronoi tessellations? Can you obtain some results if the marks depend on the point configuration?
(2) Did you consider also other characteristics of the planar cylinder process, as e.g. the number of holes?

Beside of these, I have a couple of minor remarks and questions:

- In Definition 1.24, don't you need some assumption of measurability of the function f?
- In the definition of the Wasserstein distance (Definition 2.5), I guess you should consider only *bounded* 1-Lipschitz functions? Also, the derivative need not exist everywhere, and the definition should be formally adapted to this.
- Definition 2.6 (Stein's equation): an absolutely continuous function need not have derivative at all points, so you cannot probably require (2.11) for all x. Also, in Theorems 2.2 and 2.3, the use of $\|f'\|$ is not correct.
- On pages 52–53, I find the definition of $L^q_\eta(\mathbb{P})$ a bit confusing, a set of functions of a given r.v. η. Probably one can work with $L^q(P_\eta)$ instead.
- Definition 3.1: The radius of stabilization R_x is a *deterministic* function of the point configuration μ?
- Definition 3.4: W should by probably replaced with B here?

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Jan Rataj
Faculty of Mathematics and Physics, Charles University
Sokolovská 83, 186 75 Praha 8, Czech Republic
rataj@karlin.mff.cuni.cz