Stochastic modelling and statistical analysis: a Symposium in honour of Julian Besag FRS

Goldney Hall, University of Bristol, 2 April 2011

09.00 Registration, with tea and coffee

09.30 **Peter Diggle** (Lancaster) *A short history of spatial statistics*

I will give an informal survey of the historical development of spatial statistical methods and applications.

Apart from a connection with early (18th century) work in geometrical probability, many of the important developments in spatial statistics have been made in response to scientific needs in a range of disciplines, including agriculture, geology, image analysis and epidemiology.

Methodological development accelerated during the 1970's, two of the most important of these being the papers read to the Royal Statistical Society by Julian Besag in 1974, and by Brian Ripley in 1977.

Since the 1970's, spatial statistical methods have developed from their earlier standing as a rather specialised research area to become an integral part of modern statistical methodology. Throughout his career, Julian Besag was at the forefront of this development, making profound contributions to theory, methodology and substantive applications.

10.15 **Leo Held** (Zurich) *Bayesian age-period-cohort analysis*

Julian Besag's methodological contributions to spatial epidemiology are well known. Perhaps less known is that he also contributed to the statistical analysis of temporal trends in registry data through Bayesian age-period-cohort modelling (Besag, Green, Higdon, Mengersen, Statistical Science, 1995). In this talk I will review the approach proposed in that paper and illustrate how integrated nested Laplace approximations (INLA) rather than MCMC can be used for routine application of the methodology. I will then discuss some extensions of the methodology, such as the analysis of multiple outcomes (Riebler and Held, Biostatistics, 2009) and the integration of covariate information.

This is joint work with Andrea Riebler

http://www.biostat.uzh.ch/aboutus/people/held.html

11.00 Tea and coffee

11.30 **Stephen Duffy** (Wolfson Institute of Preventive Medicine) *Radiological density in mammography: statistical issues*

Breast density is defined as the quantification of the bright lucent areas on a mammogram (breast X-ray). High levels of breast density are associated with increased risk of breast cancer. Density is an unusually useful risk factor for breast cancer because it has a high attributable fraction and is alterable by treatment or lifestyle [1]. Its exploitation in prevention and control of the disease is complicated by its negative confounding with other breast cancer risk factors and unresolved issues in its measurement. In this presentation, we review some of these issues and briefly mention approaches to the measurement problems by Stanberry and Besag.

Cuzick J, Warwick J, Pinney E, Warren RML, Duffy SW. Effect of tamoxifen on breast density in women at increased risk of breast cancer. J. Natl. Cancer Inst. 96 (8): 621-628, 2004

http://www.wolfson.qmul.ac.uk/ccp/staff/profile/duffy_s.html

12.15 Buffet lunch

13.30 **Christian Robert** (Paris-Dauphine) *MCMC, looking back at 40 years*

We attempt to trace the history and development of Markov chain Monte Carlo (MCMC) from its early inception in the late 1940's through its use today. We see how the earlier stages of Monte Carlo (MC, not MCMC) research have led to the algorithms currently in use. More importantly, we see how the development of this methodology has not only changed our solutions to problems, but has changed the way we think about problems.

A Short History of Markov Chain Monte Carlo: Subjective Recollections from Incomplete Data, with George Casella, Statistical Science, to appear.
http://www.e-publications.org/ims/submission/index.php/STS/user/submissionFile/8754?confirm=b91ec51d

http://www.ceremade.dauphine.fr/~xian/

14.15 **Jesper Møller** (Aalborg) *Inference for spatial point processes: Julian Besag's contributions and related work*

A spatial point process is a stochastic model for spatial point pattern data. The talk provides a brief introduction to spatial point process modelling and inference. The focus is on Julian Besag's work in this connection and his great influence on related work:

1. the L-function which is a functional summary statistic for describing departures from complete spatial randomness, e.g. clustering or regularity;
2. local specifications for Markov random fields and the relation to Markov point processes;
3. how spatial point processes can be approximated by lattice processes, and thereby pseudo-likelihood functions for parametric models of spatial point processes can be defined;
4. Markov chain Monte Carlo algorithms.

http://www.people.math.aau.dk/~jm

15.00 **Debashis Mondal** (Chicago) *Continuum limits of Markov random fields and spatial statistics*

In this talk, I will discuss my work with Julian on one of the scaling limits of lattice-based Gaussian Markov random fields, namely, the de Wijs process that originates in the famous work of Georges Matheron on gold mines in South Africa. I will show how this continuum limit connection holds out further possibilities to fit a wide range of new continuum models by using Markov random fields. To this end, I will draw two examples. The first one involves a crop experiment in which I will demonstrate how the continuum limit approach can provide a better statistical model. The second one will be an application from geographic epidemiology. Here, I will consider Cox processes driven by the exponential functional of the de Wijs process.

Besag, J. and Mondal, D. (2005). First-order intrinsic autoregressions and the de Wijs process. Biometrika, 92, 909--920.

http://www.stat.uchicago.edu/faculty/mondal.shtml

15.45 **Peter Green** (Bristol) *Concluding remarks*

Tea and coffee