THE UNIVERSITY OF CHICAGO

Department of Statistics

DISSERTATION PRESENTATION AND DEFENSE

RISHIDEEP ROY

Department of Statistics
The University of Chicago

Extreme Values of Log-Correlated Gaussian Fields

WEDNESDAY, July 6, 2016, at 10:00 AM

Jones 304, 5747 S. Ellis Avenue

ABSTRACT

In this thesis we discuss extremes of log-correlated Gaussian processes on integer lattices. The first four chapters show that the centered maximum of a sequence of log-correlated Gaussian fields with mild assumptions in any fixed dimension converges in distribution. The final chapter is on the behavior of a typical vertex of a branching random walk (BRW) when placed against a hard wall.

Chapter 1 introduces log-correlated Gaussian processes on the integer lattice and talks about previous related works. We make a few assumptions about the correlation structure, firstly about the form which is sufficient to prove tightness. Next we make further assumptions about convergence of covariances in a suitable sense for convergence in distribution and discuss examples which show that for logarithmically correlated fields, these additional structural assumptions of the type we make are needed for convergence of the centered maximum.

The second chapter deals with expectation of the maxima and its tightness after recentering. This is achieved by approximating the process in the sense of covariance comparison by other known Gaussian processes whose similar properties have been proved previously. We also provide an upper bound on the left tail as a complimentary result.

Chapter 3 covers the topic of robustness of log-correlated Gaussian fields. We observe no change in distribution of the maxima, except for shifting of mean, on perturbation at microscopic and macroscopic levels by Gaussian variables. We also study the locations of near-peaks of the field.

Chapter 4 is mainly based on the proof the convergence in distribution of the recentered maxima of the log-correlated Gaussian field. We identify the limit as a randomly shifted Gumbel distribution, and characterize the random shift as the limit in distribution of a sequence of random variables, reminiscent of the derivative martingale in the theory of BRW and Gaussian chaos. We also discuss applications of the main convergence theorem.

Chapter 5 talks about the behavior of the BRW on a d-ary tree when pressed against a hard wall. To this end, the field is approximated by a new Gaussian field switching sign BRW, and left tail estimates on this field gives our desired result.

For information about building access for persons with disabilities, please contact Laura Rigazzi at 773.702-0541 or send an email to lrigazzi@galton.uchicago.edu. If you wish to subscribe to our email list, please visit the following web site: https://lists.uchicago.edu/web/arc/statseminars.