Excursion and contour uncertainty regions for latent Gaussian models

Dr David Bolin/ Mathematical Statistics/ Lund University

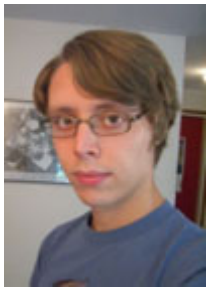

Photo: LTH, Lund University

Abstract

An interesting statistical problem is to find regions where some studied process exceeds a certain level. Estimating these regions so that the probability for exceeding the level jointly in the entire set is some predefined value is a difficult problem that occurs in several areas of applications ranging from brain imaging to astrophysics. In this work, we propose a method for solving this problem, and the related problem of finding uncertainty regions for contour curves, for latent Gaussian models. The method is based on using a parametric family for the excursion sets in combination with integrated nested Laplace approximations and an importance sampling-based algorithm for estimating joint probabilities. The accuracy of the method is investigated using simulated data and two environmental applications are presented. In the first, areas where the air pollution in the Piemonte region in northern Italy exceeds the daily limit value, set
by the European Union for human health protection, are estimated. In the second, regions in the African Sahel that experienced an increase in vegetation after the drought period in the early 1980s are estimated.

Thesis

"Models and Methods for Random Fields in Spatial Statistics"