NONPARAMETRIC ANALYSIS OF EARTHQUAKE POINT-PROCESS DATA

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Motivated by multivariate data on epicentres of earthquakes, we suggest nonparametric methods for analysis of point-process data. Our methods are based partly on nonparametric intensity estimation, and involve techniques for dimension reduction and for mapping the trajectory of temporal evolution of high-intensity clusters. They include ways of improving statistical performance by data sharpening, i.e. data pre-processing before substitution into a conventional nonparametric estimator. We argue that the 'true' intensity function is often best modelled as a surface with infinite poles or pole lines, and so conventional methods for bandwidth choice can be inappropriate. The relative severity of a cluster of events may be characterised in terms of the rate of asymptotic approach to a pole. The rate is directly connected to the correlation dimension of the point process, and may be estimated nonparametrically or semiparametrically.

AMS subject classifications: Primary 62G05, 62G07; Secondary 63M30.
Keywords and phrases: Bandwidth, bias reduction, correlation dimension, data sharpening, density estimation, epicentre, geophysics, intensity, Japan, Kanto, kernel methods, magnitude, pole, regular variation, smoothing.

1 Introduction

An earthquake-process dataset may often be interpreted as a realisation of a 5-dimensional point process, where the first three, spatial components denote latitude, longitude and depth below the earth's surface, the fourth represents time, and the fifth is a measure of 'magnitude', for example on the Richter scale. Goals of analysis can be very wide-ranging. At one level they may be purely descriptive, perhaps summarising features of the dataset. In this regard, some form of dimension reduction is often critical, putting the information on five dimensions into a form that is more readily accessible and interpretable. At another level the goals may be exploratory, suggesting directions for future analysis, or they may be more explicit and detailed, perhaps with the aim of elucidating properties of subterranean features that played a role in generating the data.

[1] Supported by the Australian Research Council.