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Title: Spatial statistics & R: our recent developments

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Many environmental, socio-economic and other data can be studied as stochastic point processes where events are represented by points (geographical coordinates) and marks (attributes) within a confined geographical region. Frequently, such events exhibit scaling behavior indicating clustering of their spatial/temporal patterns. In this regard, spatial statistical methods are used to discover patterns in their spatial association (spatial clustering). Thus, clustering analysis can reveal information about the patterns of the underlying process and their relationship with the phenomenon under study.

The present paper presents some clustering measures of point pattern analysis for estimating the degree of clustering of spatial point patterns such as the box-counting fractal dimension, the generalized Rényi dimensions and the Morisita index. This study aims at analyzing the spatial variability of forest fires which is a very complex process as a result of an intermixture of human, topographic, meteorological and vegetation factors. The considered database consisted on 2,402 georeferenced forest fires ignition-points occurring from 1969 to 2008 in Canton Ticino. This canton is located in the Southern Swiss Alps and it is the most fire-prone region in Switzerland.

To compute these measures of clustering in a complex-shape region as is the case of the Swiss Alps, the concept of validity domain is applied to constrain the spatial dimensionality of the phenomenon on the mapping space. The validity domains are regions of interest related to the phenomenon under study and are crucial for predictions. Within the validity domain is possible to generate spatial randomly distributed events which structure properties are well known. These properties can be compared to the real phenomena and the deviation between these measures can quantify the clustering of the original data. These simulations within validity domains allowed as well avoiding performing statistical tests to claim for statistical significance.

Computations were carried out using R free software for statistical computing. It is a free software environment integrating facilities for data manipulation, calculation and graphical display. The spatial point pattern analyses considered in the present study were completely developed by the author.