Spatio-Temporal Linear Network Point Processes for GPS Data Analysis

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This work aims at analyzing the spatio-temporal intensity in the distribution of stop locations of cruise passengers during their visit at the destination. Data are collected through the integration of GPS tracking technology and questionnaire-based survey on a sample of cruise passengers visiting the city of Palermo (Italy), and they are used to identify the main determinants which characterize cruise passengers' stop locations pattern.

The spatio-temporal distribution of visitors' stops is analysed by mean of the theory of stochastic point processes occurring on linear networks, in order to consider the street configuration of the city and the location of the main attractions. First, an inhomogeneous Poisson point process model is proposed, with a separable parametric spatio-temporal first-order intensity. The spatial interaction among stop points on the given network is considered, by fitting a Gibbs point process model with mixed effects for the purely spatial component. This allows to study first-order and second-order properties of the point pattern, accounting both for the spatio-temporal clustering and interaction, and for the spatio-temporal scale at which they operate. Secondly, due to the strong degree of clustering in the data, a more complex model is proposed, by fitting a spatio-temporal Log-Gaussian Cox Process to the point process on the linear network, addressing the problem of the choice of the most appropriate distance metric.

The proposed methodology allows considering the linear network determined by the street configuration of the destination under analysis, as well as the temporal component. The results show an influence of the distance from the main attractions, and potential interactions among cruise passengers in stop configuration. The proposed approach represents both improvements from the methodological perspective, related to the modelling of spatio-temporal point process on a linear network, and from the applied perspective, given that a better knowledge of the determinants of spatial intensity of visitors' stop locations in urban contexts may orient destination management policy.