Department of Decision Sciences

Statistics Seminar

Spatial Regression with differential regularization

Laura Sangalli
Politecnico di Milano

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12:30pm Room 3-E4-SR03 Via Rontgen 1 Milano

Abstract

Spatial regression with differential regularization is a novel class of models for the accurate estimation of surfaces and spatial fields, that merges advanced statistical methodology with scientific computing techniques. Thanks to the combination of potentialities from these two scientific areas, the proposed class of models has important advantages with respect to classical techniques used in spatial data analysis. Spatial regression with differential regularization is able to efficiently deal with data distributed over irregularly shaped domains, with complex boundaries, strong concavities and interior holes. Moreover, it can comply with specific conditions at the boundaries of the domain, which is fundamental in many applications to obtain meaningful estimates. The proposed models can also deal with data distributed over Riemannian manifold domains, only few methods existing in literature for this type of data structures. Moreover, spatial regression with differential regularization has the capacity to incorporate problem-specific priori information about the spatial structure of the phenomenon under study, with a very flexible modeling of space variation that allows naturally for anisotropy and non-stationarity. Space-varying covariate information is also included in the models via a semiparametric framework. The estimators have a penalized regression form, they are linear in the observed data values, and have good inferential properties. The use of numerical analysis techniques, and specifically of finite elements, makes the models computationally very efficient. The method is illustrated in various applied contexts, including data coming from eco-dopplers and computational fluid dynamics simulations.
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Via Röntgen 1 - 20136Milano

Tel. 02 5836.5632
Fax 02 5836.5630