Statistical and Numerical techniques for Spatial Functional Data Analysis

Laura Sangalli*
Laboratory for Modeling and Scientific Computing MOX
Dipartimento di Matematica, Politecnico di Milano

Abstract

I will present a novel class of models for the accurate estimation of surfaces and spatial fields, that merges advanced statistical methodology with numerical analysis 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. The models are able to efficiently deal with data distributed over irregularly shaped domains, including Riemannian manifold domains, only few methods existing in literature for this type of data structures. Moreover, they can incorporate problem-specific priori information about the spatial structure of the phenomenon under study, with a very flexible modeling of space variation, allowing naturally for anisotropy and non-stationarity.

The models have a generalized additive framework with a regularizing term involving a differential quantity of the surface of spatial field to be estimated. The estimators have good inferential properties; moreover, thanks to the use of numerical analysis techniques, they are computationally highly efficient. The method is illustrated in various applied contexts, including data coming from eco-dopplers, three-dimensional angiographies and computational fluid dynamics simulations.

The seminar is based on joint work with Laura Azzimonti, Bree Ettinger, Fabio Nobile, Simona Perotto, Jim Ramsay, Piercesare Secchi.

This line of research is developed within the FIRB2008 Futuro in Ricerca research project SNAPLE (http://mox.polimi.it/users/sangalli/firbSNAPLE.html).

*url: http://mox.polimi.it/~sangalli/