Instituto de Matemáticas

Universidad de Valladolid

Jornada de Doctorandos en Matemáticas de la UVa 2018

Betriz Molina Samper: "Espacios foliados Newton no-degenerados y explosiones"

9:40-10:30

We introduce the concept of Newton non-degenerate foliated spaces and we prove that they are exactly those that have a combinatorial reduction of singularities (toric type). We do it through the Newton polyhedra system of the foliated space.

Iacopo P. Longo: "Comparison methods and propagation of stability properties for Carathéodory compartmental systems"

10:30-11:00

Due to their weak assumptions on regularity, non-autonomous ordinary differential equations (ODEs) and functional differential equations (FDEs) of Carathéodory type can be succesfully applied to model a wide range of real phenomena. Particularly, the talk will show how to model non-autonomous, non-linear compartmental systems and infer stability results of the associated mean age system. Additionally, we outline the abstract version of these results, giving sufficient conditions to prove the existence of a pullback attractor for any Carathéodory system with suitable features. Finally we also show how to "propagate" such pullback attractor if a continuous skew product semiflow can be defined.

11:00-11:30 **Pausa Café**

Yolanda Larriba González: "Statistical framework to analyse rhythmicity in chronobiology"

11:30-12:00

This work presents a novel statistical framework to analyse periodic data in chronobiology. The research has been motivated from problems arising in the analysis of data from phenomena that exhibited temporal rhythmic patterns in oscillatory systems (e.g. circadian clock, cell-cycle). The contributions of the work are twofold. First, a methodology is developed based on a circular signal plus error model that is defined using order restrictions. This mathematical formulation of rhythmicity is simple, easily interpretable and very flexible, with the latter property derived from the non-parametric formulation of the signal. Second, using methods based on Order Restricted Inference (ORI), we address various commonly encountered rhythmicity-related problems in practice. Specifically, we develop methodology for detecting rhythmicity in oscillatory systems, especially when times associated with samples are not available. This is a practical problem in a variety of applications, such as when samples are obtained from human biopsies. The proposed methodology is computationally efficient and broadly applicable to address a wide range of questions related to oscillatory systems.

12:00-12:30

Marina Agulló Antolín: "A parametric registration model for warped distributions with Wasserstein's distance"

We consider a parametric deformation model for distributions. More precisely, we assume we observe J samples of random variables which are warped from an unknown distribution template. We tackle the problem of estimating the individual deformation parameters. For this, we construct a registering criterion based on the 2-Wasserstein distance to quantify the alignment of the distributions.

12:30-13:00

Hristo Inouzhe Valdés: "Meta-analysis of clustering procedures based on k-barycenters in the Wasserstein space."

Cluster analysis addresses the detection of data grouping in data sets. Within this, too vague, description, model-based clustering aims to find particularly shaped groupings -clusters- according to specified distributions. In this setting, the clusters provided by the method are described by probability (often Gaussian) distributions, that can be considered as elements of an abstract space. Particular interest has been deserved by the L2 Wasserstein distance, leading to a rich set-up for developing statistical concepts in a parallel way to those known on Euclidean spaces. This is the case of the k-barycenters, the abstract version of k-means, by large the widest used method in clustering problems, recently introduced in the Wasserstein space even in a robust version. We focus on the application of the (trimmed) Wasserstein k-barycenters to some of the fundamental problems present in cluster analysis. This includes parallelization or stabilization of procedures …

13:00-13:30

Paula Gordaliza Pastor: "Obtaining fairness using optimal transport theory"

Statistical algorithms are usually helping in making decisions in many aspects of our lives. But, how do we know if these algorithms are biased and commit unfair discrimination of a particular group of people, typically a minority? \textit{Fairness} is generally studied in a probabilistic framework where it is assumed that there exists a protected variable, whose use as an input of the algorithm may imply discrimination. There are different definitions of Fairness in the literature. In this paper we focus on two of them which are called Disparate Impact (DI) and Balanced Error Rate (BER). Both are based on the outcome of the algorithm across the different groups determined by the protected variable. The relationship between these two notions is also studied. The goals of this paper are to detect when a binary classification rule lacks fairness and to try to fight against the potential discrimination attributable to it. This can be done by modifying either the classifiers or the data itself. Our work falls into the second category and modifies the input data using optimal transport theory.

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