2nd KERMES Workshop

Madrid, ETSIST – UPM (Campus Sur)

Invited Talks (26 Feb. 2019, 10:00 – 13:30), A3005

Dino Sejdinovic (University of Oxford)

Learning on Aggregate Outputs with Kernels

While a typical supervised learning framework assumes that the inputs and the outputs are measured at the same levels of granularity, many applications, including global mapping of disease, only have access to outputs at a much coarser level than that of the inputs. Aggregation of outputs makes generalization to new inputs much more difficult. We consider an approach to this problem based on variational learning with a model of output aggregation and Gaussian processes, where aggregation leads to intractability of the standard evidence lower bounds. We propose new bounds and tractable approximations, leading to improved prediction accuracy and scalability to large datasets, while explicitly taking uncertainty into account. We develop a framework which extends to several types of likelihoods, including the Poisson model for aggregated count data. We apply our framework to a challenging and important problem, the fine-scale spatial modelling of malaria incidences.

Gustau Camps-Valls (Universidad de Valencia)

Machine Learning in Earth Observation Data Analysis

In this talk, several approaches developed in the last years to tackle specific problems in remote sensing data analysis will be presented, in particular upon developments on: 1) image classification by exploiting the spatial and temporal data structures with deep recurrent networks; 2) bio-geo-physical parameter retrieval with advanced Gaussian processes that can predict several variables simultaneously and fuse heterogeneous multisensory data while providing credible confidence intervals for the estimates; 3) nonlinear methods to decompose Earth data cubes in spatially-explicit and temporary-resolved modes of variability that summarize the information content of the data and allow for identifying relations with physical processes; 4) new machine learning models that respect Physics; and 5) exploitation of Google Earth Engine to develop data assimilation to fuse multiresolution data and estimate/spatialize variables.

Javier González (Amazon Research Cambridge)

Gaussian processes and the common ground of decision making under uncertainty

In this talk we will discuss the common ground of several decision making methods under uncertainty and the role that Gaussian processes play in these approaches. In this context, recent advances in Bayesian optimization, Active learning, and Bayesian quadrature will be discussed as well as a general recipe to develop and efficiently implement new approaches.

Poster Session (26 Feb. 2019, 15:00 – 17:00)

Hall of the Student's Cafetería

o Miguel López and Rafael Molina, "Deep Gaussian Processes for histological image classification"

o José A. Padrón Hidalgo, Valero Laparra and Gustau Camps-Valls, "Kernel Anomalous Change Detection for Remote Sensing Imagery"

o Daniel Svendsen, Luca Martino and Gustau Camps-Valls, "Automatic emulation with Gaussian Processes"

o Adrián Pérez-Suay and Gustau Camps-Valls, "Fair Kernel Learning"

o José Adsuara, Adrián Pérez, María Piles, Anna Mateo, Jordi Muñoz and Gustau Camps, "Distribution Regression for Crop Yield Prediction"

o Gonzalo Mateo and Luis Gómez, "Cloud detection from space with kernels"

o Joaquín Martínez-Minaya, David Conesa, Haakon Bakka and Maria Grazia Pennino, "Dealing with physical barriers in bottlenose dolphin (Tursiops truncatus) distribution"

o Carlos Villacampa-Calvo and Daniel Hernández Lobato, "Alpha Divergence Minimization in Multi-Class Gaussian Process Classification"

o Carlos Villacampa-Calvo, Gonzalo Hernández-Muñoz, Daniel Hernández Lobato, "Approximate Inference in Deep Gaussian Processes by Minimizing Alpha Divergences"

o David Luengo, Manuel Campos and Gustau Camps-Valls, "Gaussian Process Latent Force Models for the Missing Data Problem in Geoscience"

o David Meltzer and David Luengo, "A Clustering Approach to Construct Multi-Scale Overcomplete Dictionaries for ECG Modeling"

o Simón Roca-Sotelo and Jerónimo Arenas-García, "Unveiling the semantic structure of text documents using paragraph-aware Topic Models"