PHD POSITION IN STATISTICAL ECOLOGY

- Recruitment grade: Master Student (i.e. with MSc-degree)
- Location: Anglet, France
- Duration: 36 months, starting December 2020
- Deadline: 5th November 2020
- Gross Salary Range: 1768 euros + 110 euros (32 hours/years teaching) / month

Context and aims

Almost every area of human endeavour has been impacted in the past few decades by new forms of data. An immediate example is 'big data'. In addition to a greater volume of data from traditional sources, there are also many more sources of potentially useful data. For example, traditional observational data can be more easily acquired using new technology, and can be complemented by new digital data acquired by sensors such as satellites, wearables and automatic monitoring devices. Complex data can also include 'systems data' which require a fusion of data sources to comprehensively describe a complicated process.

Bayesian computational statistics offers an appealing framework for modelling and analysis of all of these forms of complex data. For example, models that encourage sparsity and adaptive sampling can help to address the problem of big data; informative priors can be employed to support little data; and Bayesian networks are an effective way of describing complicated systems.

An area of application that is of strong interest to the E2S-UPPA consortium is in ecology and environmental sciences.

Despite the intense international interest in statistical modelling of complex data, and of improved modelling of ecological and environmental data, there are still substantial gaps in both the statistical theory and methods and their application in this field.

These gaps motive the current Phd proposal: to create new knowledge in Bayesian statistics to address problems in ecology and environmental sciences that involve complex data.

The outputs of this research will benefit not only the fields of Bayesian statistics and environmental sciences, but will also translate to other areas of statistics and applied sciences.

Application

Coral reef ecosystems are on a global long-term decline trajectory. Under the combined effects of bleaching followed by partial or total destruction of the coral skeletons, sedimentation and algae covering, the structure of coral colonies will be strongly modified in the coming years and decades (patchiness flattening, smoothing). Research has aimed to anticipate and mitigate the degradation of coral reef systems, in particular by promoting the growth of coral on engineered structures or developing new hybrids through assisted evolution. The related modifications of the reef biotic structure and colony coverage are expected to strongly affect the life cycle of many species and the physical functioning of coral reefs, which shelter the inner shore from ocean forcings. From a biological point of view, knowledge of the structure of reef colonies has been traditionally obtained from local identification of the involved species. The coverage, density and geometrical structure of a coral reef is expected to be related to the health of the reef ecosystem. For instance, negative/positive relationships have been observed between structural complexity and algal cover/amount of living corals. Another important issue is that the coral colony properties (density, porosity, height, etc) govern the friction parameters introduced into circulation and wave numerical models.

The comprehensive characterization of coral colonies at large scale are now and will remain out of reach with local in-situ measurements. This becomes even more problematic when trying to monitor the long-term evolution over time, under the combined effects of global change and increased human pressure. The most promising prospect is the use of remote imagery, either aerial (planes, drones) or from satellite, to identify, discriminate, classify and survey the coverage and spatial structure of reef colonies. A major challenge is to develop automated processing of images, to allow a systematic and dynamic characterization of reef habitats at large scale and over time. The present PhD project aims to identify, test, compare and optimize the best tools for tackling the remote reef identification challenge.

The first task of the PhD student will be to perform a comprehensive state of the art, in order to select the highest potential tools amongst the wide variety of potential approaches (machine learning, rupture detection, random forest, etc).

The second part of the work will be to apply/compare/optimize the tools on the Sentinel satellite data recovered on a selected study site, the Maupiti Island in French Polynesia (already monitored in other projects).

The third part of the work will be to extend the best selected methods to other image sources and study sites, in order to evaluate and to adapt the tools for general applications.

The overall outcomes of the project can be applied on a wide range of other applications, including the coral reef characterization from in-situ imagery, but also the survey of forests, deserts, ice covers, etc.

Funding

This Phd position is funded by the project E2S-UPPA (Energy Environment Solutions) whom core scientific domain focuses on Environment and Energy to meet challenges related to the energy transition, geo-resources, aquatic habitats and the environmental effects of natural and anthropogenic changes (https://e2s-uppa.eu/en/index.html).

Supervision and Contact

Supervisory team: Distinguished Professor Kerrie Mengersen (k.mengersen@qut.edu.au) at QUT and International Guest Chair at UPPA, Associate Professor Damien Sous (damien.sous@univ-pau.fr) and Professor Benoit Liquet (benoit.liquet@univ-pau.fr) at the LMA : Laboratory of Mathematics and its Applications, UMR CNRS 5142 (https://lma-umr5142.univ-pau.fr/fr/index.html) on the campus of Anglet (64600) France.

The LMA is one of the lab of the University of Pau and the Pays de l'Adour (UPPA), I-site laureate with its project E2S-UPPA.

For additional information and proposal, please contact: Pr Benoit Liquet, Tel: + 33 6 95 46 10 61 Email: benoit.liquet@univ-pau.fr

Student skills required

The applicants should have a MSc-degree with double competence in ecology and statistics (or comparable skills), have experience with programming, good communication skills and interest in working in a cross-disciplinary team. Sound experience with Bayesian statistics, hierarchical modelling, quantile mapping and curve fitting and multivariate spatio-temporal analysis is seeked. It is an advantage, but it is not required, to have an experience with cross-disciplinary research.

Salary

The salary of the successful candidate will be based on level chart for teaching and research personnel in the salary system of French universities. The salary will be 1878 euros/month (gross salary), including allowance for 32 hours teaching per year.

Applications and deadline

Please submit your application by email to benoit.liquet@univ-pau.fr. Please attach the following documents as a single pdf file: motivational letter (max 1 page), CV (max 2 pages). Include also contact information of two persons who can provide a reference letter based on request.

The deadline for submitting the application is 5 November 2020.